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The introduction of written examinations: some historical perspectives

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Abstract
In this paper the 10 questions on one of the first externally-set, written mathematics test in the United States of America are given, and the political circumstances surrounding the use of that test by the Massachusetts State Board of Education, in 1845, described. The Secretary of the Board at the time was Horace Mann, and the arguments put forward by Mann in favour of the use of externally-set, written tests by schools are analysed and critiqued. It is argued that although Mann believed that the arithmetic test that the Board used was of a high standard, in fact it was seriously unreliable and invalid. We also argue that the use of the test set an unfortunate precedent because Mann used it as a key weapon in his political jostle with the Boston schoolmasters. The paper also comments on the effects of the use of externally-set, written tests on schools in the United Kingdom between 1838 and 1888. We argue that, whenever such instruments are used as high-stakes tests, the intended, implemented, and attained curricula of schools are likely to change in educationally significant ways, and we question whether such changes are likely to improve learning and teaching in schools. Towards the end of the paper a similar question is raised with respect to the “No Child Left Behind” (NCLB) legislation that has, since its introduction in 2002, affected schooling in all parts of the United States of America. The paper closes with some observations on the role of examinations in Brunei Darussalam.

Introduction: missing elements in the history of mathematics curricula

In this paper we argue that events which took place in the United States of America (USA) and in the United Kingdom (UK) during the period 1837-1888 proved to be fundamentally important in shaping the intended, implemented and attained mathematics curricula in all schools, and at all levels, in those two nations. We shall argue that during this period mathematics curricula in the UK and in USA changed in fundamental ways, and that in 2007 mathematics curricula still resemble curricula put into place during that earlier
period. In fact, present-day mathematics curricula around the world, including in Brunei Darussalam, continue to bear the stamp of these events.

Mathematics educators (see, e.g., Bidwell & Clason, 1970) do not seem to have noticed the extent and force of the changes between 1837 and 1888 because these changes occurred across the curriculum, and not just for mathematics. Yet, the effects on school mathematics were profound. As far as we know, no previous writer on curriculum history, from any nation, has placed the events to which we shall refer in the foreground as a cause of change to mathematics curriculum and teaching methods.

It is beyond the scope of this paper to elaborate our arguments in full. Our emphasis will be on the contributions of Horace Mann – perhaps America’s most famous educator – to school reform, and in particular on the immediate and long-term effects of Mann’s introduction of written examinations into the American school education.

Horace Mann’s challenge to American school education, 1837-1848

Horace Mann, before his appointment as the secretary of the Massachusetts board of education

In the United States, the driving force behind school reform during the period under review was Horace Mann, who was foundation Secretary of the Massachusetts State Board of Education between 1837 and 1848. Neither the Board nor its secretary had any powers of compulsion – the Board’s work being to report on school practices, to expose defects and to make recommendations for action to the legislature. Mann maximised his effectiveness as Secretary of the Board by producing powerful annual reports that called for the upgrading of all aspects of common schools, as opposed to privately-owned schools. His reform initiatives were directed at changing fundamentally what happened in all aspects of schooling, rather than what transpired during lessons in particular subject areas, or in particular schools.

Mann was born into a poor family in 1796, in Franklin, a rural town in Massachusetts (Edwards 1958; there have been many biographies of Mann, but in this paper details of Mann’s life are taken from this reference). He obtained his early education in a small local public school and, following the early death of his father worked hard to earn enough money doing farm duties, in order to support his mother and his siblings. He was ambitious, and longed for a higher education. While still working on the family farm, he took advantage of an opportunity to learn Greek and Latin from an itinerant schoolmaster, and mathematics at a nearby academy. Subsequently, he studied classics at Brown University between 1816 and 1818, and after he graduated he became an itinerant schoolmaster while studying Law. After being admitted to the Bar in 1823, Mann turned to politics. He was a member of the Massachusetts House of Representatives for six years, and the State Senate for three years. In 1837 the Board of Education was created, and Mann was a surprise appointment as Secretary.

Horace Mann’s major contributions to the history of US school education

In the United States of America Horace Mann is remembered as the person who took up the challenge of bringing respect to “common” or “public” schools so that they would be regarded by all as natural training grounds for those who intended to enter any of the major
professions. His vision for US public schools was summarised on the first page of his twelfth and final Report to the Massachusetts School Board (State of Massachusetts, 1848):

Our [common] schools, far more than they have done, may supply the presidents and professors of colleges, and the superintendents of public instruction, all over the land; and send, not only to our sister states, but across the Atlantic, the men of practical science to superintend the construction of great works of art (pp. 1).

Mann’s efforts to upgrade the level of education provided in the common schools are well documented in numerous texts on the history of American education. Here, special attention is drawn to four major contributions that had obvious and long-term effects on the intended, implemented, and attained curricula of US schools. These contributions were:

1. His work in establishing the first state US normal schools (i.e., “teacher-training colleges”);
2. His use of data gathered on an expedition to Europe to make it clear that the modes of conduct and outputs of US schools ought to be realistically compared with those of schools in various parts of Europe;
3. His introduction of grade-level schools and a standardised “intended curricula” in schools across Massachusetts; and
4. His introduction, in 1845, of Board-controlled, externally-set written tests for assessing the work done by pupils and teachers in common schools in Massachusetts.

In this paper brief comment, only, will be made on the first three of these contributions, for they have been dealt with in some detail elsewhere (see, e.g., Massachusetts School Board, 1848). We shall focus on the importance, especially for school mathematics, of the fourth of the above-named contributions – specifically, the introduction of Board-controlled, externally-set written tests for assessing the work done by pupils and teachers in public schools in Massachusetts – and our emphasis will be on the long-term effects of this innovation on the intended, implemented and attained mathematics curricula, not only in Massachusetts, but more widely in school systems across the United States.

The introduction of normal schools
Mann’s best-known achievement for education is undoubtedly his success in persuading the Massachusetts legislature to establish the first state-supported “teachers colleges” (or “normal schools”) in the United States. As a result of Mann’s insistence, Massachusetts established the Lexington (later “Framlingham”) Normal School in 1839. Soon after that, the Barre (later “Westfield”) and Bridgewater Normal Schools were established in Massachusetts.

We believe that the questions of how the operation of the normal school should be funded, who should teach the teachers to teach in the normal schools, what and how they should teach prospective teachers, and how any training given in the normal schools might adequately be assessed, were never carefully thought through by Mann. Mann believed that a great gain in the quality of instruction and therefore in the learning of common school students would be the inevitable result of the introduction of normal schools. We intend, in
a future publication, to document an argument that throughout the period 1839-1900, the mathematics programs in normal schools did not generate graduates who had been well prepared for the important work of improving the teaching and learning of mathematics in the common schools. That was because the mathematics instructors in the normal schools were, too often, themselves not strong mathematically, and sometimes they were not aware of developments in mathematics curricula and teaching methods. They tended to support popular “recitation” methods of teaching without being aware of limitations of these methods.

Mann naïvely believed that the “best” practising teachers in the common schools should become instructors in the normal schools. The early normal schools were poorly funded, with over-worked “principals” doing most of the teaching. If the meagre funds permitted the employment of other instructors, these were usually part-time and, too often, barely knew their curriculum content. Later, when normal schools became large enough to support curriculum-related departments, heads of these departments were rarely specialists in the content knowledge dealt with by their departments. Often, for example, heads of mathematics departments did not hold college qualifications in mathematics. In addition, the teaching methods they advocated were, in too many cases, of questionable value.

**Mann’s efforts to introduce grade-based classes, and to standardise State curricula and textbooks** Mann was also successful in persuading the Massachusetts legislature to adopt the policy of grouping, whenever feasible, pupils into grades based mainly on age and academic achievement. He insisted on the development of uniform grade-based curricula and the adoption of State-prescribed textbooks in common schools. This development, which also occurred in other states around the same time, would prove to have a profound effect on what content (e.g., in mathematics) would be taught in the schools.

**Horace Mann and the Boston schoolmasters, and the advent of written examinations** Mann spent much of 1843 visiting schools in Ireland, England, Scotland, Germany, France, and other European nations (Edwards, 1958). He found much to admire in the education systems he examined, and on his return to the United States immediately set out to implement changes based on what he had observed. He had been particularly impressed with the concept of externally-set written examinations recently introduced in England and in Germany, and on his return he became the principal advocate for the introduction of such examinations into the common schools of Massachusetts.

This emphasis on the importance of pupil, teacher and school assessment by externally-set written examinations, based on standardised curricula and prescribed textbooks, was destined to change principles and practices of school education profoundly. Indeed, as a result of pressures directly associated with the new examination regime, the intended, implemented, and attained curricula of all schools in Massachusetts, and in other states, would change dramatically. In particular, the introduction of graded classes, standardised curricula, prescribed textbooks, and externally-set written examinations generated a rapid and amazing transformation of school mathematics within a period of 25 years. The copybook era would finish, and a “control-by-examinations” era would begin.

Before proceeding further we would wish to emphasize that we are not suggesting that Horace Mann was the first to introduce external written examination into North American education settings. The first written examinations in the American education system were
not those used by the Boston Committee and Horace Mann in 1845. In 1844 The Common School Journal of the State of Pennsylvania (Vol 1, number 1) included copy of written examinations (including arithmetic and algebra examinations) used for the selection of new Pennsylvania public school teachers. The examinations are narrow but elementary in scope, and suggest that they were aimed at recent university graduates looking for temporary employment as teachers. For example, one of the questions on the 1844 Arithmetic examination for prospective Pennsylvania teachers was the following:

A merchant sold flour at $11 per barrel, by which he cleared 3/8 of the money, but afterwards raised the price to $13.50 per barrel. What did he clear, at that price, on each $100 laid out? (The Common School Journal of the State of Pennsylvania, 1844, pp. 15).

The arithmetic examination was only one in a battery of written examinations required of prospective teachers – other papers were set in Algebra, History of the United States, Geography, Grammar, and Theory of Teaching. Presumably, these examinations took place in 1843. We do not know if this was the first time written examinations in mathematics had been set in the United States. Interestingly, the teachers were not selected solely on the basis of their scores on the written tests. While they were doing the tests, they were called forward, person by person, and “interviewed.” The idea was to assess their suitability for teaching, from the point of view of personality, through this “interview.”

Evaluating school learning, and teaching in North American schools, before 1845

Assessment by committee

In order that readers might appreciate the extent of the change, it will be useful to describe how the work of pupils, teachers and schools was evaluated before the introduction of written examinations. It is likely that before the 1840s, written examinations were not used in American schools, with the quality of student learning being assessed by what we shall call the “committee system.” At the end of each term (which usually comprised about 10 weeks), a small local committee, often presided over by a local clergyman, would attend a school and, in front of as many parents and friends as wished to attend, proceed to address questions to individual students. The students would, one after the other, stand, and a committee-man would ask each student a question. The student was expected to answer the question without help but, in practice, the teacher, who was nervously standing next to the committee, would often rephrase a question in order that it might be better understood by a student.

After one member of the committee had asked students questions on one subject (e.g., arithmetic), another member of the committee would proceed to ask questions on another subject (e.g., grammar, or history, or geography, or Bible knowledge, etc.). The committee assessment procedure is well captured in Figure 1, which is taken from Edwards (1958). After the students had finished answering the questions, the teacher was usually expected to make a brief statement about what had been achieved at the school during the term. If a parent dared, he or she might then ask the teacher a question, and then choral work by the children, followed by afternoon tea or supper, would bring the event to its conclusion.
Everything was usually conducted in a very polite way, but that did not prevent local politics from sometimes intruding (see State of Massachusetts, 1848).

While the question-answer sessions were proceeding, the parents and friends who were present would quietly examine written work, and drawings, etc., that had been done by the students during the term. Of special interest among the artefacts inspected by parents and friends who were present were the students’ ciphering books. The heyday of the ciphering book era was about 1800: before then, paper was too scarce, and expensive, to permit too much emphasis on the production of such texts. After 1850, the ciphering book tradition declined, rapidly, as a result of assessment of arithmetic being carried out increasingly through written examinations.

Figure 1 Committee assessment (from Edwards, 1958, pp. 51)

At the height of the ciphering book era it was likely that most parents and friends who attended the special end-of-term occasions, and even many members of the examining committee, could not follow the arithmetic that was presented in the ciphering books. For that reason, teachers were more interested in form than substance, and they aimed to make sure that the penmanship, neatness, and calligraphy in the ciphering books would be of as high a quality as possible. Because of that, it was often the case that the teachers themselves, during the term, devoted much time to ruling the pages in the students’ ciphering books, and to writing in the headings (often using elaborate calligraphy). What
was important, from the teachers’ perspective, was that the pages of the ciphering books would look as beautiful as possible. What was written in the books, other than the elaborate headings, had usually been carefully copied from the teacher’s own ciphering book, or from a ciphering book produced some years before by an “outstanding” student. Discipline in the schools was harsh, and in many accounts of these early schools (e.g., in Dickens’ *Great Expectations*) incidents are reported in which students were thrashed because the appearance of copied work was “not good enough.”

**Horace Mann’s (1845) criticisms of the system of assessment by committee, and his claims for externally-set Written examinations**

Mann had experienced the committee system of assessment when he himself had been a student, and later a teacher, in common schools. He drew attention to five weaknesses of the system:

1. Different questions were asked of different students, and since the questions were not all of the same difficulty, a strong student might give an incorrect answer to a difficult question, and a weak student a correct answer to an easy question. Since relatively few questions were asked of individual students, the question-answer procedure did not reliably assess the quality of a student’s learning.

2. The committee-system utilised local identities on the committee, and local politics were likely to intrude, with a committee-man asking difficult questions to students from families he did not like, and easy questions to students from families he liked. Whether this in fact occurred was beside the point, because a parent’s *perception* that questions were “biased,” whether or not that was indeed the case, was likely to inflame local animosities.

3. Teachers often interrupted during the testing process “to clarify the meaning of questions.” These clarifications could result in the teachers significantly reducing the intended difficulty of a question.

4. The *validity* of questions was often questionable because examiners were not always expert in the subject(s) they examined. This resulted, sometimes, in faulty assessments being made of student learning by examiners who knew less about a subject than the teacher.

5. The committee-system was based on the assumption that only those present at the time of the “examination” needed to be well acquainted with the results. Rarely were full and accurate *reports* of the results of the assessments produced, and the evaluation of students, teachers, and schools, was often based on hearsay rather than facts. (Mann, 1845, pp. 20)

Following his critique of the workings and validity of the committee system, Mann (1845) claimed that the system of examining schools by means of externally-set, written examinations was much better than examinations carried out orally, by committees, because:

1. For any subject, all students in a particular grade, at different schools, would answer the same set of questions.
2. A common measuring stick was thereby created, and assessment of the learning of individual students, and of the work of the teacher, became much more accurate and reliable.

3. If the written tests were administered by disinterested visitors, it became much more difficult for teachers to interfere in the examination process in educationally significant ways.

4. The written tests, themselves, could be constructed, and assessed, by subject experts.

5. Full, accurate reports on results could be easily made available to all interested parties. (pp. 21)

Mann’s arguments were presented in an explosive political climate in which his work as Secretary of the Massachusetts Board was under attack by a group of “Boston schoolmasters” (see Caldwell & Courtis, 1925; Mann 1845). From 1845 to 1848 there were numerous attacks and counter attacks from Mann and the schoolmasters. In 1845, Mann arranged for members of his Board of Education to test students in Boston schools using a battery of written tests prepared by his Board. These tests, which had not been seen by the schoolmasters, were administered by members of the Board, who rushed from one school to another administering the examinations to students at different schools. The schoolmasters subsequently claimed that the examinations were woefully invalid, in the sense that questions did not bear a strong relationship with what they had taught their students.

Mann claimed that the examinations had been designed for the “top” eighth-grade students in the schools (sometimes called the “brag students”). There were 8343 students enrolled in the 19 schools that were asked to do the examinations, and altogether only 308 students were tested. Since these were the “brag students,” Mann and his committee believed that most students should have been able to answer correctly the questions on each paper, with a reasonable proportion of the students being able to cope with even the most difficult questions.

The questions comprising the first externally-set US written arithmetic examination

The Arithmetic paper comprised 10 questions, all shown in Table 1, which also shows the number (out of 308) of students who responded correctly, and the corresponding percentages, for each question. The questions and associated data are reproduced from Caldwell and Courtis, 1925.

<table>
<thead>
<tr>
<th>Question</th>
<th>Number of Correct Responses (n = 308)</th>
<th>% Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How much is 1/3 of 9 hours and 18 minutes?</td>
<td>288</td>
<td>93.5%</td>
</tr>
<tr>
<td>2. What part of 100 acres is 63 acres, 2 roods and 7 rods?</td>
<td>282</td>
<td>91.6%</td>
</tr>
<tr>
<td>3. What is the quotient of one ten thousandth divided by ten thousand?</td>
<td>170</td>
<td>55.2%</td>
</tr>
<tr>
<td>Express the answer in decimal and vulgar fractions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. A stationer sold quills at 10s 6d per thousand, by which he cleared</td>
<td>9</td>
<td>2.9%</td>
</tr>
</tbody>
</table>
1/3 of the price – but, the quills growing scarce, he raised the price to 12s per thousand. What percent would he clear by the latter price?

5. Suppose A owes me $100 due at the end of 3 months and $100 due at the end of 9 months, and he agrees to give me a note for $200 payment at such a time that its present worth shall be the same as the sum of the present value of the two first-mentioned notes. How long after the date must the note be made payable?

6. A man has a square piece of ground which contains one quarter of one acre and a quarter on which are trees which will make wood enough for a pile around on the inside of the bounds of the land 3 feet high and 4 feet wide. How many cords of wood are there?

7. A sold goods for $1 500 to be paid for one half in six months and one half in 9 months. What is the present worth of the goods, interest being at 7 per cent?

8. A merchant in New York where interest is 7 per cent gives his note dated at Boston, where interest is 6 per cent for $5 000 payable at the Merchants Bank, Boston, on demand. Thirty days after the date of the note, demand is made. A year after demand, $200 is paid on the note. What sum remains at the end of two years from the date of the note?

9. What is the square root of 5/9 of 4/5 of 4/7 of 7/9?

10. The city of Boston has 120 000 inhabitants, half males, and its property liable to taxation is one hundred millions. It levies a poll of 2/3 of a dollar each of one half of its male population. It taxes income to the amount of $50 000, and its whole tax is $770 000. What should a man pay whose taxable property amounts to $190 000?

From the data shown in Table 1 it is clear that most of the 308 students found Questions 1 and 2 relatively easy, but Questions 4, 5, 6, 8 and 10 almost impossibly difficult. Questions 3, 7 and 9 proved to be moderately difficult for the students.

One might be impressed by the performance of the 308 students on Questions 1 and 2, especially Question 2. So far as Questions 4, 5, 6, 8 and 10 are concerned, one might say that the level of language was inappropriate, and complexity unreasonable for eighth-grade students. Depending on one’s perspective, and on what the students had actually been taught before they took this test, it could be argued that this first externally-set Arithmetic test used in US schools was technically of a poor standard. Indeed, one might have considerable sympathy for the students, teacher, and school communities whose work was evaluated by such an unreliable and invalid instrument.

But Mann, as Secretary of the Massachusetts Board of Education, had the ability to present an opposite point of view, and to do this with all the backing and status consistent with his position. Mann (1845) said of his system of external examinations:

We call it novel, because although such a plan of examination is common in Europe, and has been partially adopted in some places in this country, yet we have seen nothing, on this side of the Atlantic, so thorough, and complete, and embracing, in one view, so large a number of schools, as the Boston committees’ reports. We venture to predict that the mode of examination by printed questions and written answers will constitute a new era in the history of our schools. There is
a variety of reasons which give it a decided superiority over all other methods (pp. 238).

Mann put his own twist on the data and on the subsequent reports by the examiners:

The astounding character of the results themselves … all these and other considerations, combine to give an extraordinary degree of importance to these reports. The high character of the committee who conducted the examination, at once thorough and perfectly fair and impartial, the labour and care expended in reducing the results to a tabular form, so that the common eye can compare them, and determine at a glance the relative standing of each school … (pp. 237-238).

Not surprisingly, Mann’s forthright assertions exacerbated the bitterness that had developed between Mann and the Boston schoolmasters throughout the 1840s. Mann made it clear that he believed that the students’ performances on the written tests had resulted from poor teaching. He accused the teachers of being bound to teaching from textbooks, and maintained that most of them were not sufficiently competent to elaborate meaningfully points made by textbook authors. According to Mann (1845):

[Textbooks] are books containing texts. These texts the teacher is to expound. Each one of them should be the foundation of a discourse, or a series of discourses. This is teaching.

Hearing recitations from a book is not teaching. It has no claim to be called by this dignified and expressive name. It is the exposition of the principle contained in the book; showing its connection with life, with action, with duty; making it the nucleus around which to gather all related facts and all collateral principles – it is this, and this only, which can appropriately be called teaching.

Now the method of examination lately adopted by the Boston School Committee, settles the questions definitely, on what kind or quality of instruction has been given by the masters, as it does measure what amount or extent of proficiency has been made by the pupils. …

A pupil may faithfully commit the whole of one of our grammars to memory, and yet know nothing more of the science of English grammar, than a parrot (pp. 241).

The tone was aggressive. For Mann (1845), where children of ordinary abilities had been continuously and for some time under instruction by the same teacher, any deficiencies were “not to be laid to their charge, but to that of their instructors” (pp. 242). He admitted, however, that the case was different “with regard to children who attend school irregularly, or for short periods only, [for in] such cases, it would be unjust to hold the instructor responsible for their deficiencies” (p. 242).

We would argue that the arithmetic test used by the committee was so inferior in quality that virtually nothing could be legitimately inferred from the data it generated. It seemed that Mann did not anticipate major difficulties and weaknesses that might be associated with large-scale adoption of an external-test regime aimed at measuring student learning, teaching performance, and school quality. Questions like: Would it be possible,
each year, to create high quality external tests, for increasingly large numbers of students, that would accurately assess student learning, and teaching performance? Would such a development result in good teachers feeling compelled to leave the profession? Would curricula need to be prescribed that were so rigidly defined that good teachers would not be able to meet the needs of individual students? Furthermore, Mann (1845) naïvely assumed that externally-set tests would be able to measure accurately the competency and sufficiency of the teaching which the pupils had received.

Mann did not seem to anticipate the following six possible weaknesses of evaluation regimes based on data from externally-set written tests linked to tightly defined “external” curricula:

1. External examiners might not have sufficient familiarity with school contexts or average student capacities to be in a position to create valid test instruments.
2. Teachers may feel forced to “teach to the test,” which may lead to cramming procedures inducing lack of understanding among students.
3. External examiners might use inappropriate language in test questions.
4. School teachers and principals might feel tempted to adopt dubious practices to maximise results.
5. It could be difficult for examiners who did not know precisely what students had been taught to develop questions for externally-set written tests that would be likely to measure higher-level education objectives.
6. Student confidence – an important but extremely fragile characteristic in school education – might easily be destroyed by poor examination results resulting from invalid and/or extremely difficult tests set by over-zealous external examiners.

Observations on the effects of written examinations in the United Kingdom, 1838-1888

It was mentioned earlier in this paper that Horace Mann had had his attention drawn to potential advantages of externally-set written examination during his visit to the United Kingdom and Europe in 1843. In fact, the first externally-set written examinations in England were held in 1838. Fifty years later, in November 1888, the English periodical Nineteenth Century devoted 45 pages to a powerful “protest” against the “the sacrifice of education to examination” (1888, pp. 617-645). Fourteen of the 45 pages comprised solely of the names of well-known educationists who supported the protest. The educationists complained about false educational values which had arisen from the increasingly heavy emphasis on examinations, and maintained that this had resulted in a “stifling uniformity in education.” They also expressed their dissatisfaction with a system that had gradually resulted in many teachers feeling compelled to “teach to the test.”

The Nineteenth Century article claimed that, as a result of the introduction of written examinations, “serious monetary considerations” had come to “throw their shadow over all educational work” (pp. 618-619). Professor Max Müller, the distinguished Oxford University anthropologist and literary scholar, commented that “many years ago we wanted to have examinations for the sake of schools and universities: we now seem to have schools and universities simply and solely for the sake of examinations” (The Sacrifice of
Education to Examination, 1888, pp. 638). Professor Frederic Harrison likewise protested against a state of affairs by which “teachers, examiners, crammers, and students, all have to take their place in the vast examining machine which, like the Prussian military system, grinds out a uniform pattern” (pp. 646).

Although Horace Mann had been quick to recognise the large potential of European-style externally-set external examinations for significantly and quickly influencing the operation of schools, he failed to take adequate account of the maxim that in education it is well to reflect carefully on possible consequences of planned policy initiatives before acting. It could be argued that experiences with written examinations since 1845 raise the possibility that Mann, as Secretary of the Massachusetts Board of Education, moved to apply the new concept – in the examinations in Boston in 1845 – too quickly. As a result, poor examinations were set, and students and teachers were harshly judged on data generated by inadequate and unscientific evaluation instruments. Indeed, one might conclude that, from the outset in the United States, externally-set, written examinations were used primarily for personal and political gain, and did not improve school education.

The end of the ciphering tradition

In school arithmetic, the old ciphering book tradition (see Clements & Ellerton, 2006), in which students copied the wording and solutions to arithmetic tasks from a “master” ciphering book (or, in some cases, from a textbook) was associated with inactive teaching processes and passive student involvement in learning. However, that tradition was maintained for many years because it became part of the committee system by which the learning of students and the work of teachers were evaluated. Between 1837 and 1888 the situation did not improve in England or in the United States when the committee system of assessment was mandated, and the quality of student learning was assessed by externally-set, written examination papers. By this system a teacher’s future employment prospects, as well as the reputation of a school, were affected by the results.

We (Ellerton and Clements) have collected over 100 arithmetic ciphering books, dated between 1702 and 1880. Most of the books were generated by North American school children between 1750 and 1870, with the majority between 1800 and 1850. It would seem to be the case that, after 1850, the ciphering tradition quickly disappeared in the United States and was replaced by a new assessment tradition in which the quest for results on externally-set examinations controlled the intended, implemented and attained curriculum. No longer were ciphering books inspected for their neatness, as had been the case when students and teachers had been evaluated by school committees and by those parents present at end-of-term evaluation occasions. There was no longer any compelling need for students to produce ciphering books featuring beautiful penmanship. Changes in high-stakes assessment procedures can, and usually do, have a large impact on what happens in school classrooms.
Fast forward 150 years: the “No Child Left Behind Legislation” and its immediate effects

In 2002, President George Bush, in the United States, signed a Federal Law called “No Child Left Behind” (which is often referred to, simply, as NCLB). Supporters of this legislation claimed that NCLB is based on an “outcome-based education” (OBE) or “standards-based” approach to school education by which intended curricula are clearly stated in behavioural terms, teachers are expected to take account of individual student needs as they assist their students to achieve the intended outcomes, and assessment is criterion-referenced in the sense that each question should relate directly to the intended outcomes. But the NCLB program is heavily dependent on results of high-stakes, externally-set, written examinations that are taken by all students. The rhetoric is that the main purpose of these examinations is to monitor the progress of students, especially in relation to outcomes in a state’s language and mathematics programs, but the real agenda encompasses much more than that. Schools at which students fail to make adequate progress can be put on “probation,” and ultimately closed. Principals and teachers in schools where students are deemed not to be making adequate progress can be transferred, and even dismissed. “Failing” schools can be (and have been) closed, with students being transferred to other schools in which better “value-adding” practices are apparently followed.

It would not be sensible to attempt to provide a carefully documented account of the arguments for and against NCLB here. It suffices to say that the NCLB legislation has induced within US school communities a large emphasis on “teaching to the test,” and that reactions of school communities to the requirements of NCLB have sometimes induced behaviour verging on paranoia. Since these externally-set written tests are mainly of the multiple-choice variety, students are being taught how to guess answers “intelligently.” There are allegations of student, teacher, and school cheating. Reading and mathematics have been accorded more and more curriculum time in many schools. Weeks and weeks of school time are being dedicated to doing nothing more than preparing students for “the test.” Admittedly, performances on NCLB-required externally-set standardised tests do seem to be improving, and it is claimed that there is definite evidence that African-American and Hispanic students are performing better than ever before.

In the 1840s in Massachusetts, Horace Mann’s introduction of externally-set, state-wide written examinations quickly made a difference to intended, implemented and attained aspects of school curricula, and a similar story has been true in regard to NCLB – only this time the influence has been in school communities right across the United States. In a few subjects (particularly English and mathematics) US teachers are teaching more content, often in different ways, but in other subjects, less content is being taught because less time is available. For many teachers and principals, the main aim now is to maximise student performance on the forthcoming “test.” Although, on average, some students are doing marginally better on multiple-choice tests of English and mathematics, the question arises whether these students are understanding the content better and remembering more of what they are “learning.” In the field of mathematics, many US students are still not learning mathematics well. We have gathered much data in secondary schools in Illinois, a mid-west US state, and have found that after examinations many (indeed, most) students forget much of what they memorised for these examinations.
And what about the situation in Brunei Darussalam (the country in which this paper is being published)? Both of us (Ellerton and Clements) have worked at Universiti Brunei Darussalam, and are aware that in both primary and secondary schools in Brunei there is a strong examination orientation among students, teachers, principals and curriculum and education policy officers. Yet, the performance of Bruneian students on O- and A-level examinations – still created in the United Kingdom by the University of Cambridge Local Examination Syndicate – has not improved much (if at all) over the past 25 years. We would ask: What is the point of cramming for an examination, and then forgetting almost everything that you crammed, almost immediately?

Horace Mann drew attention to the potential advantages of externally-set written examinations, but he was not aware of the destructive powers of the educational beast he unleashed.

References


The Sacrifice of Education to Examination (1888). Nineteenth Century 141, 617-662.
A time when scientifically developed mathematics curricula held sway in the United States of America: 1900-1950

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ABSTRACT: Most official school mathematics curriculum documents, in most countries, call for curricula to be relevant to the immediate and future needs and interests of students. They also want their nation’s curricula, and teaching and assessment practices, to be in line with findings of the best contemporary education research. Thus, for example, in Brunei Darussalam, official documents make it clear that curricula and school programs are expected to be consistent with Islamic teachings, and there is a determination in the Ministry of Education that curricula should be in line with contemporary education research. In this paper, theories of education that came to be widely accepted in the United States between 1900 and 1950 will be described. This was a period when numerous attempts were made to develop and implement school mathematics programs that not only incorporated the findings of the best recent education theory and research, but were also socially transformative and likely to improve student learning. It will be argued that historians have agreed that U.S. education reformers during the period 1900-1950 did not achieve their lofty goals, and the reforms did not tend to enhance student learning. Indeed, it was the Sputnik-induced belief, especially among politicians, that a new regime was desperately needed that precipitated the “New Math” movement in the United States in the late 1950s and throughout much of the 1960s. Ironically, that movement has also been deemed, by education historians, to have failed. Towards the end of the paper, questions for curriculum reformers and education researchers and discipline experts in Brunei Darussalam are raised, and briefly discussed.

In this paper we shall first look at the forces that influenced change in the teaching and learning of mathematics in U.S. schools during the period 1900-1950. We shall then draw lessons for those charged with the responsibility of developing, implementing, and evaluating education policy. In the early years of the twentieth century, U.S. public school administrators and policymakers broke with an extraordinarily powerful tradition that expressed itself in heavy emphasis on rule-bound grammar, ciphering, and copybook writing, usually backed by harsh discipline (Monroe, 1908). At that time all aspects of schooling were “placed on the
table” for consideration. In such times of educational ferment, there is a danger that the pendulum might swing too far, and valuable traditions might be lost. Shortly before the Second World War, Clark, Otis and Hatton (1939) applied the pendulum metaphor to U.S. school mathematics in the following way:

A curriculum-conscious generation of educators of all ranks have rightly been addressing themselves to a re-examination and re-evaluation of what is proper and suitable to teach in our schools. The results have been salutary, but as is to be expected in times of rapid change and new enthusiasms, the pendulum has in many instances swung too far. It is the authors’ belief that with respect to mathematics in primary grades there is for us in our present stage of research and experiment (shall we even say “uncertainty”?) a middle ground between the two extremes of the now outmoded formalism of an overburdened curriculum and the unestablished freedom of wholly incidental learning (pp. v-vi).

We shall argue that, although the different groups were by no means agreed on the best way to improve the nation’s schools, they all agreed that the nation was facing an important “education for all” challenge.

Schooling and the challenge of “Education for All”

At the beginning of the twentieth century American politicians and those responsible for formal education systems faced an unprecedented “education for all” challenge. In 1890, some 30 percent of a population of 63 million lived in cities; in 1920, over 50 percent of the population of 106 million lived in cities; and in 1950, 66 percent of a population of 151 million lived in cities (Cremin, 1976). By 1900, almost every child in the nation would attend a school for at least three years, and almost half of the nation’s children would proceed to at least Grade 8. Increasing proportions of children would proceed into high school (Rugg, 1900). As Cremin (1964) pointed out, during the 1930s secondary school enrolments rose from 4.8 million in 1929-1930 to 7.1 million in 1939-1940. Thorndike et al. (1924), on drawing attention to the rapid growth in the number of U.S. school students, at all levels, commented: that nothing like it had “ever occurred before in the world’s history” (pp. 3). Be that as it may, in 1950 only 34 percent of the American population 25 years or older had completed at least four years of high school (Cremin, 1989).

Alfred Binet (1899), a French psychologist, argued for the existence of a general mental ability that could be measured by having students respond to carefully selected and graded tasks. He devised an intelligence quotient (IQ) scale that could, he said, identify students who might be in need of special forms of education (Kilpatrick, 1992). Here was what many teachers of mathematics wanted to hear: “scientific” support for streaming students, and teaching secondary mathematics to only a minority of students. Thorndike et al. (1924) applied this idea arguing that, because of mental ability considerations, between 50 and 60 percent of students entering secondary schools would not be capable of learning algebra.

The rapid move toward graded classes in urban schools challenged the romanticised “little red schoolhouse” traditions by which many students received their formal education
in ungraded classes in small and often remote schools. Textbook authors were now expected to match content to the average intelligence of pupils in the grades for which their texts were written. The period also witnessed an increasing determination among educators to provide relevant classroom experiences to all students – including those from families in which parents had had little experience with graded schools, with children with disabilities, and with children who did not speak English as their mother tongue. School environments and traditions were changing and, from a mathematics education perspective, urgent answers were needed for new questions such as: “What mathematics should we teach to the masses, should we teach the same mathematics to all children attending the same school, how much mathematics should prospective teachers of mathematics know before they will be in the position to become effective full-time teachers of the subject, and how should we assess the quality of mathematics teaching and learning?”.

In the first half of the twentieth century there were many remarkable developments in U.S. school mathematics. Kilpatrick (1992) has identified four of the most important of these developments:

1. The development of individualised, mastery programs in which behavioral objectives and mastery criteria were set, associated instructional programs and test (mastery) instruments developed, and teachers encouraged to allow students to proceed “at their own pace”.

2. The development of so-called research-based arithmetic curricula, in which curriculum developers (and associated textbook authors) claimed that the sequencing of content was based on research into what pupils were capable of learning at different ages and in different grades. Many curriculum developers and textbook authors liked to use expressions such as “scientifically developed curriculum,” “research-based curricula,” etc.

3. The rise of progressivism, with its emphasis on the need for school arithmetic to be problem- or project- or theme-based, and immediately relevant and interesting to the lives of all pupils. There was an accompanying belief that all students should be actively engaged in the learning process.

4. The development of school mathematics programs that were based on the fundamental objective of assisting students to gain meaningful understanding of content. Of course, almost all authors claimed that their texts would help children “understand,” but for some authors this was absolutely fundamental.

We shall now look at each of these developments. Necessarily, the treatments will be brief.

**Individualisation: Frederick Burk, Carleton Washburne and the Winnetka Plan**

*The move towards individualised instruction in school mathematics*

In 1912, Frederick Burk, President of the San Francisco State Normal School, employed a military metaphor to criticise what he called the “class system” and “lock-step schooling”:

> The class system has been modelled upon the military system. It is constructed upon the assumption that a group of minds can be marshalled and controlled in
growth in exactly the same manner that a military officer marshalls and directs the bodily movements of a company of soldiers. In solid unbreakable phalanx the class is supposed to move through the grades, keeping in locked step. This locked step is set by the “average” pupil – an algebraic myth born of inanimate figures and an addled pedagogy. …

The class system does permanent violence to all types of pupils.

(1) It does injury to the rapid and quick-thinking students, because these must shackle their stride to keep pace with the rate of the mythical average. They do so, usually at the price of interest in their work. Their energy is directed into illegitimate activities with the result that in the intermediate grades a large portion of them fall into the class of uninterested, inattentive, rebellious, and unmanageable pupils.

(2) The class system does a greater injury to the large number who make progress slower than the rate of the mythical average pupil. Necessarily, they are carried off their feet by the momentum of the mass. They struggle along, with greater or less pretense, but eventually they are discovered and put back into the next lower class … By setting the pace of a mathematical average, education for nearly one half the class is made impossible. They are foredoomed to failure before they begin. … This policy is, of course, as inhuman as it is stupid.

Could any system be more stupid in its assumptions, more impossible in its conditions, and more juggernautic in its operations? Every one of its premises is palpably false; every one of its requirements is impossible and every one of its effects is inefficient and brutal (Burk, 1935, pp. 24).

The Winnetka Plan

In May 1919, 29-year-old Carleton Washburne, a disciple of Burk, became Superintendent of the Winnetka schools system, in Northern Illinois. He persuaded the 40 teachers in the Winnetka schools to attempt to individualise teaching and learning, and met with the teachers in small groups, every two weeks. At group meetings, teachers were encouraged to discuss their problems in teaching the various subjects. They responded enthusiastically (see Washburne, 1925, 1927, 1938). These meetings continued for 24 years. In the meetings, research was planned, instruments developed, results discussed, procedures modified. According to Washburne (1963), “democracy, and what was later called ‘group process’ were fully effective” (pp. 17). According to Washburne, not only did learners proceed at different rates, but also the same child proceeded at different rates in different subjects and, even within the same subject, at different rates for different topics. Each child was to be administered criterion-based pre-teaching tests to determine what goals that child needed to pursue within particular topics. Once the child had completed related instructional materials post-teaching mastery tests were administered to determine which goals the child had, and had not, reached.

Washburne’s intention, at the outset of the Winnetka Plan, was that the elementary level in Winnetka’s elementary schools be divided into two parts. At least half were to be devoted to common “essentials”, and from one-third to one-half to group work or social-creative activities stemming from social studies, literature, art, music, and dramatics. Student involvement in the latter group of subjects was to be marked by discussion, projects work, and report writing. According to Washburne (1963), the widespread interest
in the Winnetka Plan stemmed in no small measure from its being seen as providing an answer to the incessant and mounting allegations levelled at Progressive educators for neglecting the essentials.

Forty-four years after the Winnetka Plan was first conceived, Washburne (1963) recollected that he challenged his teachers to specify precisely what arithmetic they wanted their students to know at the end of each year. The teachers quickly decided that in the past they had wanted their pupils to learn too much. Washburne insisted that objectives be stated behaviorally – i.e., in terms of intended student behaviours – and that each objective should represent an achievable outcome. Together the teachers created the Winnetka maxim: “A year’s work in a subject is what the slowest, normal, diligent child can accomplish in a year”. Agreement was reached on the following principle, which, Washburne (1963) maintained, was “discovered by the teachers themselves.”

Children below normal intelligence should not be pushed beyond their ability – let them successfully complete as much of the year’s work as comes within their ability. Children above normal ability should not be held back, but encouraged to do as much more than a year’s work as they can. Children who were not diligent would be penalised by slower progress, but their interest and consequent effort, should be stimulated by the teacher (pp. 23).

The idea that every student should be allowed the time he or she needed to master carefully specified learning objectives that were suited to that student’s present level of development would become known, in the 1960s, as “mastery learning” (Block, 1971).

Although Washburne's self-paced program was promoted as individualised instruction, critics claimed that the only factor individualised was the rate of correct items completed and time of testing to certify achievement. Other problems with the Winnetka Plan were raised by William H. Kilpatrick (1925) and other progressive educators, who questioned the division of the curriculum into two disconnected and unequal parts, and the designation as the common essentials those subjects that most readily conformed to mechanistic self-instruction exercises and objective items.

**Research-based curricula and pedagogy**

During the first half of the twentieth century there arose many university-based colleges of education in which highly qualified educationists conducted research aimed at improving the teaching and learning in schools. There was an undoubted smugness about this new breed of university educators, who regarded themselves as fundamentally important in the push towards a strong scientific basis for school education. Many scholars argued that the training of teachers for U.S. schools, and the work of schools, would inevitably improve because of the new scientific scholarship available in education schools in universities like Stanford, Columbia and Chicago. Their view was that the old normal schools could not “compete with the universities, either in securing men of first-rate ability as teachers, or in equipment comparable to those found in the higher institutions of learning” (Sandiford, 1913, pp. 517). In 1918, for example, W. S. Monroe, Professor of Education and “Director of the Bureau of Educational Research” at the University of
Illinois, claimed he had developed an entirely new series of instruments for estimating teaching efficiency and the quality of student learning. These were in the form of new standardised diagnostic tests for students, and accompanying standard scores and score charts (Monroe, 1918).

This smugness among the university educators was also well illustrated in numerous statements made by Edward Lee Thorndike – whose connectionist ideas and research provided a strong basis for early behaviorist research in relation to the teaching and learning of school mathematics (Kilpatrick, 1992). In 1900, for example, Thorndike – who was based at Teachers College, Columbia University – wrote in his preface to his *Arithmetic Book One* (a textbook for elementary school children):

> These books apply the principles discovered by the psychology of learning, by experimental education, and by the observation of successful school practice, to the teaching of arithmetic. Consequently they differ from past practice (Thorndike, 1900, pp. v).

Thorndike (1900) asserted, confidently:

> The formation and persistence of useful habits is not left to be a chance result of indiscriminate drill and review. Every habit is formed so as to give the maximum of aid to and the minimum of interference with others. Other things being equal, no habit is formed that must later be broken; two or three habits are not formed where one will do as well; each is formed as nearly as possible in the way in which it is required to function; each is kept alive and healthy by being made to cooperate in the formation of other and higher habits in the arithmetical hierarchy. If a pupil carries through the projects in computing and problem-solving of these three books under competent supervision, he will have abundant practice for the arithmetical insight, knowledge, and skill that the elementary school is expected to provide (pp. vi).

Thorndike was promising a new era for school mathematics.

Harold O. Rugg and John R. Clark (1919) – who were faculty members at Columbia University – stated at the beginning of their *Fundamentals of High School Mathematics* that their intensive investigations over five years had established that the traditional course of study in high school mathematics needed “to be completely reconstructed” (pp. iii). What was needed, they said, was a course of study based on a clear-cut program, and “a real psychology of how children learn mathematics” (pp. iii). “The slate needed to be wiped clean,” they maintained, and a new course organised which contained no material that could not be defended “either on the basis of social worth or upon the probability of relatively worthwhile thought power” (pp. iii).
Progressivism, and problem- or project- or theme-based school mathematics programs

Not everyone was convinced that scientific experimentation would provide the key for the development of schools consistent with an “education for all” environment. John Dewey, for example, believed that a new type of school, which fundamentally changed the goals and modes of operation of schools, was needed.

Almost every school arithmetic or mathematics textbook published in the United States between 1900 and 1950 had a statement in the preface indicating that the authors had referred to contexts that were immediately relevant and of interest to learners. This tendency, coupled with the desire of many educators for students to be actively engaged in the learning process, came to be associated with the terms “progressive education,” or “progressivism.” Even the most severe critics of the progressive movement acknowledged that the desire to make curricula relevant and interesting was always a positive feature of progressivism. However, Arthur Bestor (1956), Professor of History at the University of Illinois, would argue that “progressive education became regressive education when it turned away from intellectual education, when the method came to be regarded as more important than what was being learnt” (pp. 143). Bestor (1956) continued:

Into the vacuum rushed the pedagogical experts, the curriculum doctors, the integrators, the life-adjustors – the specialists in know-how rather than knowledge. Out of their overflowing minds they offered to furnish ready-made a philosophy to guide the entire educational system. Scientists and scholars might supply little facts to fill up the blanks, but the great schemata were to be devised by the curriculum engineers alone (pp. 143).

Bestor was extremely critical of the tendency for “courses in the teaching of specific subjects – mathematics, history, English, and the like – to be mainly in the hands of educationists, not mathematicians, or historians or scholars in the field of English language and literature” (p. 160-161). He did recognise that John Dewey, for many the high priest of progressivism, was a genuine philosopher, but said it was “one of the great ironies of history that John Dewey, the disbeliever in absolutes and the apostle of open-mindedness should be the central figure in those strange rites – at once the worshipped deity and the sacrificial lamb” (pp. 250-251).

Dewey and problem-based curricula
In 1916 Dewey made it abundantly clear that he was strongly opposed to the kind of school education found in most traditional classrooms. He wrote:

Just as the biologist can take a bone or two and reconstruct the whole animal, so, if we put before the mind’s eye the ordinary schoolroom, with its rows of ugly desks placed in geometrical order, crowded together so that there shall be little moving room as possible, desks almost all of the same size, with just space enough to hold books, pencils, and paper, and add a table, some chairs, and bare walls, and possibly a few pictures, we can reconstruct the only educational activity that can possibly go on in such a place. It is all made for “listening” – because simply
studying lessons out of a book is only another kind of listening: it marks the dependency of one mind upon the other. The attitude of listening means, comparatively, passivity; absorption; that there are certain ready-made materials which are there, which have been prepared by the school superintendent, the board, the teacher, and of which the child is to take in as much as possible in the least possible time. There is very little place in the traditional classroom for the child to work. The workshop, the laboratory, the materials, the tools, with which the child may construct, create, and actively enquire, and even the requisite space, have been for the most part lacking (Dewey, 1916, pp. 56).

This statement was nothing short of a manifesto. Traditional classrooms, where children merely listened (or read), needed to be replaced by school spaces in which children actively conceptualised, theorised, and solved problems. Dewey called for problem-based school environments that facilitated mental and physical action by learners. In the course of solving problems, children would learn to behave in much the same way as scientists – they would make conjectures, work out how to test them, test them, reach conclusions, and consider whether a new “experiment” was needed.

Dewey (1916) complained as much about uniformity of curriculum as he did about uniformity of physical structures in traditional classrooms. He may have argued, in his later years, that there had been excesses in the progressive movement, but it needs to be recognised that he had called for a revolution in school curricula, and teaching and learning methods. Consider, for example, his clarion call for child-centred, as opposed to teacher-centred, classrooms:

Now the change which is coming into our education is a shifting of the centre of gravity. It is a change, a revolution, not unlike that introduced by Copernicus when the astronomical centre shifted from the earth to the sun. In this case the child becomes the sun about which the appliances of education revolve; he is the centre about which they are organised. (Dewey, 1916, pp. 57)

In Experience and Education Dewey (1938), insisted that, in order to learn efficiently, learners needed to engage in rich problem-based learning experiences in which they would recognise a problem or difficulty, would gather data for the purpose of resolving the dilemma, and would make conjectures about what might happen if they implemented their strategies for solving the problem. Then, having tried to solve the problem, they would evaluate whether the tentative theory that they had developed was, indeed, appropriate (Good, 1969). Dewey was not keen on presenting data to the learner around which a problem might be identified; rather, the student should gather, analyse and interpret data in order to solve problems that were “niggling” him or her. In the process of solving a problem, a learner would, Dewey (1910) argued, acquire knowledge and problem-solving insights that he or she could apply to solving increasingly complex, but related, problems. This was an early statement of what some psychologists – Jean Piaget, for example – would, later in the twentieth century, call “cognitive dissonance” (Brubacher, 1966).
Project-based and theme-based curricula

Between 1895 and 1906 Charles and Frank McMurry prepared, and had published, separate volumes on special methods in the Reading of English Classics, Primary Reading and Oral Work with Stories, Geography, History, Elementary Science, Arithmetic, Language, and Manual Arts, as well as two volumes that provided an overview of how the curriculum might be “correlated.” For the sixth grade, the McMurrys’ course of study included the following:

History: Causes of the French and Indian War. Desire of France and England to secure the fur trade; differences in religion, etc.

Geography: Valley of St Lawrence, the Great Lakes, Ohio River, Nova Scotia and New Brunswick, Lake Champlain and Lake George, pineries of West and North, fisheries on coast.

Science: Fur-bearng animals – beaver, otter, mink, bear, buffalo, raccoon. Also deer and moose.

Arithmetic: Relative size of the lakes, expressed decimally; of the states in the once disputed territory; relative worth of various kinds of furs, and so forth (Quoted in De Garmo, 1895, pp. 128 –129).

This “integrated” curriculum position was regarded as extreme by many teachers and teacher educators, who were not prepared to contemplate the possibility of a child’s arithmetic education being so narrow, in the sense that it would be confined to tasks associated with the relative size of lakes and states, and the worth of various kinds of furs for one whole year.

William H. Kilpatrick developed a variant of the integrated theme-based curriculum approach, and of Dewey’s problem-based approach, which he called the “project method” (Kilpatrick, 1925). This method, which had been successfully used in German and Russian schools, was based on curriculum units in which it was intended that students would become engaged in purposeful activity where the dominating purpose fixed the aim of the action, guided its process, and generated among students an inner motivation. In other words, the aim with the project method was to structure the learning environment and the curriculum so that students felt ownership over what they were doing. Kilpatrick (1925) maintained that if learners felt they owned what they learning then there would be a much greater chance than in traditional school classrooms that they would learn related knowledge and concepts, and would also develop problem-solving strategies. They would also be likely to learn to love and appreciate what they were doing. The teacher’s task, in a project method classroom, was to show a genuine enthusiasm for what was being done, for that could become contagious. This contagion would apply to the arts as well as the sciences, and subjects like arithmetic would be better studied within an overall theme-based approach, then a curriculum in which units were rigidly separated into traditional subjects.
Meaningful learning

During the period under review almost every writer of mathematics curriculum statements and school mathematics textbooks in the United States claimed that the primary aim of school mathematics was the development of mathematical insight, understanding, and meaning, and some added that this was more important “than speed and mechanical skill” (Buswell, Brownell & John, 1943, pp. v). William Brownell, of Duke University, is the name most frequently associated with a “meaningful mathematics” thrust of the 1930s and 1940s. For Brownell, the most important goal of school mathematics classes was for learners to learn important mathematics, with understanding. Towards the close of his career Brownell (1949) would contrast the effects of learning mathematics by drill with learning mathematics for meaning in the following way:

Look at this nonsense: “Golsi brando strexit lufter krinka,” and read it aloud. What does it mean? Read it again. What does it mean now? Obviously it means nothing except the sounds you make. Suppose you were to read this nonsense sentence over and over again, thirty times a day. How many days would you require to learn its meaning? What would be the effect of the drill? You would pronounce the sounds with greater facility and speed, but that is all, unless you force some kind of meaning, by some artificial method, into the syllables.

Suppose that the child has no clear meaning of the numbers 4, 5, and 9. His teacher presents the combination 4 + 5 and tells him that the sum is 9. The child repeats the combination “4 and 5 are 9” over and over again as drill period follows drill period. If drill is continued for weeks, will the combination mean anything more than a group of sounds? The effect of drill on the combination will be precisely the same as the effect of drill on the nonsense syllables “Golsi brando strexit lufter krinka.” That is, the effect will be the same, except for certain complications. The child is required to learn not one nonsense sentence, but hundreds of nonsense number combinations. He may become greatly confused (as who would not?) and give incorrect answers as frequently as the correct ones. Eventually, he may become discouraged, stop trying, and develop an unwholesome attitude towards arithmetic. Or he may discover for himself, or adopt from a schoolmate, some means of dealing with the combinations which enables him to hold them in mind (pp. 134).

Brownell went on to say that if the child had been able to develop sound concepts of numbers and number combinations, then 4 + 5 = 9 is no longer like a nonsense rhyme. Teaching for meaning will ultimately save time, and result in pupils being able to relate what they learn to what they already know, or to apply what they learn to solve new problems.

Between 1935 and 1949 Brownell carried out a series of high quality research studies that generated results that supported his theory of meaningful learning (see Kilpatrick, 1992). Brownell emphasised the importance of making sure a child learned mathematical relationships. If these were embodied in real-life contexts, then that was an advantage; but the primary aim was for the child to acquire meaning, for meaningful relationships could be invoked in many real-life contexts, not just one. Brownell’s research also pointed to the
conclusion that it was unwise to expect mathematical concepts to be learnt with a problem-based, or project-based, or thematic approach to school mathematics in which arithmetic was not a definite part of the curriculum, for the organisation of concepts normally developed by learners who experience school arithmetic as a definite subject was more likely to be meaningful in the sense that it would be related to other mathematical concepts (Brownell, 1935).

**What were the effects on learning of all this experimentation?**

In 1932 a Commission on the Relation of School and College of the Progressive Education Association commenced an Eight-Year-Study into the college achievements of 1475 students who would enter college between 1936 and 1939 after having attended “progressive schools” at which there had been “curricular experiments.” The colleges had agreed to accept the students without demanding the normal “guarantees” of success in certain subjects. Data were collected on the college performances of these students, and each was compared with performances of a “control” student who had entered the college from a “non-progressive” school and had the normally required prerequisites. Matching of experimental and control students took account of “sex, age, race, scholastic aptitude scores, home and community background interests, and probable future” (Aikin, 1941, pp. 112). The researchers concluded that the “experimental” students, as a group and as individuals, tended to have done better at college. It was reported that the experimental school group:

1. Earned a slightly higher grade average.
2. Earned higher grade averages in all subject fields except foreign language.
3. Specialised in the same subject fields as did the comparison students.
4. Did not differ from the comparison group in the number of times they were placed on probation.
5. Received slightly more academic honors in each year.
6. Were more often judged to possess a high degree of intellectual curiosity and drive.
7. Were more often judged to be precise, systematic, and objective in their thinking.

(Aikin, 1941, pp. 110-111)

This would seem to have provided strong evidence that, at worst, the progressive approaches represented by the 30 experimental schools had not damaged the academic potential of its students. At best, it would seem that the analysis suggested that the experimental students had been advantaged by their school education.

This study challenged bodies such as the Illinois Section of Mathematical Association of America (ISMAA), which believed that the traditional approach to the teaching and learning of mathematics was far superior to the experimental approaches. In an article published in the November 1953 issue of the *American Mathematical Monthly*, ISMAA maintained that the Eight-Year-Study had serious design weaknesses, and in its reports there were many serious statistical flaws “which render[ed] its conclusions of little value.” The criticisms were not accepted by those who conducted the study (see Bestor, 1956, pp. 342-344, for a discussion of this controversy).
The main point that should be made here is that the ordinary parent, or school administrator, was left in a hopeless position. Who were they to believe – those who had conducted the experiment, or the highly qualified mathematicians and statisticians in ISMAA? The interesting fact was that no experimental data were available to show whether American school students, as a whole, performed better in 1900 than they did in 1950. Similarly, there were no data available to show whether American students learnt mathematics better than students of the same age in English schools, or in Russian schools, or in Japanese schools, etc.

Little wonder, then, when on October 4, 1957, the Russian space satellite, Sputnik, was launched, it was argued that Russia had beaten the United States in the space race because of the stronger science and mathematics courses in Soviet schools. It was not surprising that politicians, military personnel and academicians (especially scientists and mathematicians) attributed what they regarded as the sorry state of education in U.S. schools to the “excesses” of the progressive movement. What was needed, these critics stridently proclaimed, was a stronger curriculum, one in which school subjects were defined by those who knew the subjects best: that is to say, new physics courses and texts needed be developed by top-class Physicists, and mathematics courses by the best academic mathematicians in the best universities. Furthermore, stronger college entrance examinations, controlled by top subject experts, were needed.

And so it came to be that America entered upon what would become known as the “New Math” period, an era when school mathematics curriculum developments would be led by academicians in universities, with large-scale science and mathematics curriculum development projects being heavily funded by the National Science Foundation (see Clements, 2003; Payne, 2003).

Democracy, multifarious voices, and the effects of education policy confusion
Between 1900 and 1950, school boards throughout the United States exercised their democratic freedoms by proceeding along education pathways that they believed would lead to the best forms of education for “all” children in all schools within their systems. This paper has shown that, with respect to school mathematics at least, numerous theoretical positions were adopted, and many of these positions were bolstered by research data collected, analysed, and reported by well qualified education researchers and theorists.

For much of the time, however, the experts in the subject disciplines were less consulted about school education matters than they would have liked. This engendered considerable angst among the subject discipline experts who believed their “superior knowledge of the content” made them the best qualified group to define curricula (Bestor, 1955; Cairns, 1953). The stage was set for volatile curriculum confrontation of the highest order. All that was needed was a political situation to arise in which the mathematicians and other subject specialists would be given a strong voice to enable them to be heard, and listened to. The mathematicians were ready to tell the nation that what had transpired in the schools during the period 1900-1950 had been anti-educational, in the sense that students often were made busy in “activity math,” or “progressive math,” but did not really learn genuine mathematics, and were not being adequately prepared for college study in mathematics, or for coping with the mathematical demands of everyday life. The historian Arthur Bestor (1955) expressed the burning resentment of the academicians in The Restoration of Learning, published in 1955. Bestor argued that educational administrators...
were “not collaborators in, but rather victims of ... the interlocking directorate of professional educationists” (pp. xi). Bestor claimed that, for example, most mathematics teachers supported the conservative viewpoint which looked to professional mathematicians rather than to mathematics educators for advice on what was needed in school mathematics.

The Soviet launching of Sputnik in 1957 ignited the simmering politico-curriculum controversy. The professional mathematicians’ arguments were heard, and accepted, at the highest levels. The mathematicians and the scientists in the universities were given their opportunity, through large national Research Foundation Funding, to develop school curricula that took advantage of changes in mathematics over the past century. This, the mathematicians, believed would result in a stronger and more successful “mathematics for all” thrust than at any previous time in the nation’s history.

Interestingly, the “New Math” programs that were developed in the late 1950s and in the 1960s were not supported by all professional mathematicians. The professional mathematicians disagreed among themselves as to what was needed (Clements, 2003). By the 1970s the New Math developments would be regarded, by many mathematicians, teachers, parents, and even students, as having failed the nation.

All of this raises two questions that are crucially important at the beginning of the twenty-first century. First, how can we ever know that education policy within a nation is succeeding? And second, what are the most important criteria for evaluating education programs?

Some reflections on possible implications for school mathematics in Brunei Darussalam

For more than a decade both authors of this paper have been interested – both as insiders and, more recently, as outsiders – in the quality and progress of school mathematics in Brunei Darussalam. Although we have felt privileged to be involved, we have sensed a lack of common purpose within and between important stakeholders about what should be happening, at both theoretical and practical levels in school mathematics.

Certainly, the Ministry of Education has acted responsibly in developing and implementing policies aimed at maximising the quality of mathematics learning in the schools. Mathematicians within the Mathematics Department at Universiti Brunei Darussalam (UBD) have worked hard in assisting the Ministry with mathematics competitions, in training very capable students for Mathematics Olympiads, and in providing leadership in the Brunei Mathematics Society. Mathematics educators within the Sultan Hassanal Bolkiah Institute of Education have worked hard at preparing young teachers to teach in relational ways in schools, at supervising Master of Education research studies in mathematics education, and in assisting in major projects such as the Active Mathematics in Classrooms (AMIC) Project, and the development of the Jerudong Park mathematics trails. Teachers in schools have done their best to prepare their students as well as possible for the Ministry’s end-of-Grade 6 and end-of-Grade 9 examinations, and in preparing senior secondary students for the English O-level, N-level, and A-level examinations. They have also created mathematics clubs in their schools, and contributed to Ministry groups that were formed to advise Ministry officials on school mathematics.
However, not unlike the situation in the United States between 1900 and 1950, discussed in this paper, stakeholders in school mathematics in Brunei Darussalam have not always moved in the same direction. One important lesson of this paper is that unless there can be a shared vision and agreed strategies within and between the major stakeholders, and unless a coordinated thrust is developed that is accepted and owned by all stakeholders, too many important decisions are likely to be made in response to the “politics of the moment.” Influence and power are likely to reside in the group(s) that have most influence at that time. Jumping from one initiative to another, depending on the political wind that is blowing at the moment, is unlikely to generate effective long-term improvement. One reason why New Math “failed” in the United States was that school teachers felt it had been thrust upon them by people who did not really understand their classroom conditions. Can we learn an important lesson from the past – and plan to work together to improve the quality of mathematics learning and teaching, at all levels, in the schools of Brunei Darussalam?

References


Factors affecting Form 4 students’ level of knowledge of solving quadratic equations

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Abstract
The purpose of this study is to investigate the factors affecting the knowledge of 187 Form 4 students on the topic of solving quadratic equations at two secondary government schools in Belait district of Negara Brunei Darussalam. Solving quadratic equations is one of the sub-topics taught in O-level Mathematics Syllabus D subject. This is part of a larger study where investigations in this study will also look into other factors such as students’ confidence that might affect or influence the students’ achievement in solving quadratic equations.

A multiple perspective research design was used. Two instruments were used to collect data which included the Solving quadratic equations test (QE TEST) and Solving quadratic equations Confidence questionnaire. Qualitative and quantitative data were collected from six vantage points. In this paper data from only two vantage points; pre- and post-teaching pencil-and-paper test performance scores and post-teaching student confidence scores are reported and analysed. From the stepwise multiple regression analysis it was shown that the component of Solving Quadratic Equation using formula was the highest overall contribution to the students’ achievement of solving quadratic equation. This indicates the students successfully using the quadratic formula to solve the quadratic equations appropriately.

One-way ANOVA analysis produced the results that there were significant differences in the post-test mean total scores existing between the different confidence levels of students. From the results of the correlational analysis it was reported that the students’ confidence levels correlated significantly with their achievement scores obtained on the performance test.

Introduction

Solving Quadratic equations is one of the sub-topics in Solutions of equations and inequalities and is taught in Mathematics Syllabus D. Four upper secondary, Forms 4 and 5, students were taught according to the O-level mathematics courses of the University of Cambridge Local Examination Syndicate (UCLES), and the algebra components of these courses are carefully defined and examined.
Table 1 gives a summary of the BGCE O-level (October/November) Mathematics Syllabus D results of all the candidates in Brunei for the last five years (Jabatan Peperiksaan, 2006).

It is of interest to find out if the poor performance in BGCE O-Level Mathematics D was due to the lack of understanding in certain topic in Mathematics D such as solving quadratic equations and the use of quadratic equations in solving other related questions.

Recent studies by Noridah (1999) and Radiah (1998) have generated data suggesting that algebra components of the O-level curricula are especially problematic for many students in Form 4, 5 and 6 in secondary schools in Brunei Darussalam. This finding has significantly shaped the thinking of the researcher. It was also an interest to the researcher in confirming or disconfirming the findings done in the previous studies (see, e.g., Lim, 2000; Noridah, 1999; Radiah, 1998) on students’ performance in the component of algebra-solving quadratic equations. It was expected that the data from the study would provide a check on the amount and quality of students’ knowledge in solving quadratic equations. Part of the investigations in the study would also look into other factors that might affect or influence the students’ achievement in solving quadratic equations.

**Table 1** The BGCE O-Level (October/November) mathematics D results from 2001 to 2005

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Candidates</th>
<th>Distinction</th>
<th>Credit</th>
<th>Pass</th>
<th>Total no. of O-Level passes</th>
<th>Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Grade A (%)</td>
<td>Grade B (%)</td>
<td>Grade C (%)</td>
<td>Grades D-E(%)</td>
<td>Grades A-C(%)</td>
</tr>
<tr>
<td>2001</td>
<td>3863</td>
<td>5.15</td>
<td>10.15</td>
<td>15.20</td>
<td>30.42</td>
<td>30.49</td>
</tr>
<tr>
<td>2002</td>
<td>3934</td>
<td>5.80</td>
<td>11.46</td>
<td>14.67</td>
<td>29.36</td>
<td>31.93</td>
</tr>
<tr>
<td>2003</td>
<td>3946</td>
<td>5.58</td>
<td>9.20</td>
<td>13.40</td>
<td>31.60</td>
<td>28.18</td>
</tr>
<tr>
<td>2004</td>
<td>4165</td>
<td>5.71</td>
<td>11.72</td>
<td>13.64</td>
<td>30.71</td>
<td>31.07</td>
</tr>
<tr>
<td>2005</td>
<td>4288</td>
<td>4.71</td>
<td>10.98</td>
<td>15.56</td>
<td>32.0</td>
<td>31.25</td>
</tr>
</tbody>
</table>

**Background of the study**

This paper reports on an aspect of an investigation on students’ knowledge and achievement of a core component of algebra in solving quadratic equations from two Form 4 O level government secondary schools in Belait District during the 2006 school year. Four intact classes from each school were selected. Both schools were located in the same area and their students were from the same urban background. A qualitative and
quantitative research methodology will be used. Both schools, school A and school B, which were involved in the study, are all secondary (lower and upper) government schools.

**Literature review**

*Learning of algebra*

In some countries, however, not all secondary students study algebra, and of those that do, many study it for one year only. One such country is the United States of America, but there are many U.S. politicians and educators who are unhappy about that (see, e.g., Moses, 2000).

In Brunei Darussalam, there have been many research studies carried out into the teaching and learning of algebra in schools. Clements (1999a) provided evidence from his observations on the teaching of algebra in Brunei Darussalam that students are taught to solve equation mechanically, and many fail to realize that the numerical answers that they will obtain if substituted into the original equations. Lim (2000) who studied on the teaching and learning of algebraic equations and factorization in O level mathematics reported that most students did not really like algebra and they did not enjoy algebra classes. The confidence data revealed that when the students were attempting algebra questions, even questions of a kind that had been dealt with in earlier years, most of them were not sure whether answers they gave were right or wrong. He also concluded from the evidence of pre-test on Algebra that many of the students who do well on the PMB mathematics examination do not seem to have grasped even the most elementary aspects of algebra. Also, through his findings, it shows that the traditional drill and practice method of teaching and learning, and the “examination-oriented” organization of schooling, are not generating the quality of student understanding, and the level of performance in examinations, that are desired. Radiah’s (1998) study of the performance of 327 Form 4 students in 9 Secondary schools in Brunei Darussalam strongly suggested that there is a problem with the teaching and learning of algebra in secondary schools of Brunei Darussalam.

Thomas and Tall (2001) distinguished, among other things, between “algebra as generalised arithmetic” and “manipulation algebra”, and commented that students who completed secondary education were usually able to substitute values correctly for variables in expressions and equations, and were able to interpret variables in symbolic and graphical contexts. However, student thinking in such contexts appeared to be dominated by a need to achieve procedural mastery, and usually there was no guarantee that relational understanding was achieved.

Stacey, Chick and Kendal’s (2004) landmark volume on *The Future of the Teaching and Learning of Algebra* provided commentary from scholars from numerous countries on many aspects of algebra education, but no attention was given to the cognitive challenges faced by students trying to solve quadratic equations.

Although many researchers (e.g., Warren & Pierce, 2004) have found that the concept of a variable is central to algebra, the lack of an adequate research base with respect to the teaching and learning of quadratic equations has meant that peculiarities associated with variables in quadratic equations, and in particular with the effects of these on student learning, have remained hidden. Vaiyatavutjamai (2004) stated that the best discussion of
the teaching and learning quadratic equations is the U.K. report on the teaching of algebra in schools originally written between 1929 and 1933 by a Committee of the Mathematical Association (1962).

**Attitudes towards mathematics**
Studies have shown that promoting positive attitudes towards mathematics become an important objective in teaching mathematics. The term attitudes have included various types such as self-concept, confidence in mathematics, anxiety in mathematics and enjoyment in mathematics (Klum, 1980; Reys, 1980 & 1984; Leder, 1987; Khoo & Veloo, 1990).

Alrwais (2000) examined the relationship among the factors students’ attitude toward learning mathematics, students’ mathematical creativity and students’ school grades and their effect on achievement in mathematics. He found out that the best predictor was the students’ attitude toward learning mathematics. McLeod (1992) noted that students’ attitudes play a central role in mathematics achievement. Khoo and Veloo (1996) stated that a positive correlation between mathematics achievement and the affective variables, beliefs and attitudes. Findings from their study, students with a high level of mathematics self-concept, enjoyment of mathematics and confidence in learning mathematics but with a low level of mathematics anxiety tend to have a high level of mathematics achievement.

Fadzil (1998) found that there was a positive correlation between achievement and confidence in learning mathematics, followed by enjoyment in learning mathematics, perceptions on the importance of mathematics and interest in mathematics.

**Research questions**

It is hoped that the study would answer the following research questions:

1. Did the new knowledge acquired by the students after the lessons on solving quadratic equations in Form 4 influence the students’ achievement in solving quadratic equations?
2. Is there any relationship between the Form 4 students’ confidence in answering questions on solving quadratic equations and the overall new knowledge acquired by the students after the lessons in solving quadratic equations?

**Methodology**

**Research design**
A multiple perspectives research design was employed in this exploratory study. A combination of qualitative and quantitative methods was used in collection of data. The quantitative data were collected using achievement test (QE TEST) and Confidence Questionnaire. The qualitative approach involved interviews with students of the selected schools and retrieval of official documents. The researcher had interviewed six students consisted of two students who were low achievers, two students who were medium achievers and two who were high achievers. All the post-performance data on the
achievement tests were needed in order to determine the range of marks so as to categorise the students into high, medium and low levels of achievement based on the whole sample.

The sample of students in the study
The data of this research was collected from two secondary schools in Belait district that would be involved in the study. The students from these schools were presently studying in Form 4 and learning the O-level Mathematics D subject. The total number of students in the sample is 187 students. Four intact classes from each school were selected. The two schools were selected to contribute to the sample of students in the study as both schools were located in the same area and their students were from same urban background.

Instrumentation of the study
One of the instruments, Solving Quadratic Equations Test (QE TEST) was the achievement test comprising of 18 questions. Another instrument in the form of “Likert Scales”, Quadratic equations Confidence Scale was attached to the achievement test.

Solving Quadratic Equations Test (QE TEST). This test consisted of 18 pencil-and-paper questions covered the different types of method in solving quadratic equations having the last two questions consisting of problem solving questions, as outlined in Table 2. Based on the various types of questions structures, the researcher could get an insight of how the students managed to solve the quadratic equations.

Solving Quadratic Equations Confidence Scale. The scales, in the form of “Likert scales”, were designed to measure the students’ confidence in answering questions on the Solving Quadratic Equations Test (QE TEST). The maximum and minimum possible scores for the Solving Quadratic equations Confidence Scale were 135 and 27 respectively.

Table 2  Methods of solving quadratic equations in Solving Quadratic Equations TEST (QE TEST)

<table>
<thead>
<tr>
<th>Methods</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null factor</td>
<td>1 and 2</td>
</tr>
<tr>
<td>Simple factorisation and Null factor</td>
<td>3 and 4</td>
</tr>
<tr>
<td>Square root method</td>
<td>5 and 6</td>
</tr>
<tr>
<td>Factorisation and Null factor</td>
<td>7, 8, 9 and 10</td>
</tr>
<tr>
<td>Expansion, Factorisation and Null Factor</td>
<td>11, 12 and 13</td>
</tr>
<tr>
<td>Quadratic Formula</td>
<td>14, 15 and 16</td>
</tr>
<tr>
<td>Problem Solving</td>
<td>17 and 18</td>
</tr>
</tbody>
</table>

Solving Quadratic Equations Confidence Scale is similar to the scales used by Lizawati (2004), Zurina (2003), Khoo (2001) and Lim (2000). After a student responded to a question on Solving Quadratic equations Test (QE TEST), he/she is required to indicate the level of confidence he/she has in his/her answered by putting a tick in one of the five columns. The five columns have headings “I’m certain I’m right,” “I’m think I’m right,” “I’ve got a 50-50 chance of being right,” “I think I’m wrong” and “I’m certain I’m wrong.”
A response of “I'm certain I’m right,” was allocated a score of 5, “I’m think I’m right,” was allocated a score of 4, “I’ve got a 50-50 chance of being right,” was scored as 3, “I think I’m wrong” a score of 2 and “I’m certain I’m wrong” a score of 1.

Results and discussions

Research Question 1: Did the new knowledge acquired by the students after the lessons on solving quadratic equations in Form 4 influence the students’ achievement in solving quadratic equations?

Using the stepwise multiple regression analysis would be able to generate the answer to the first research question. In stepwise multiple regressions, the independent variables as predictors (prediction variables) are entered one step at a time to pick out the best predictor that makes a useful contribution to the overall prediction. For this study, the analysis would indicate which knowledge components significantly predict the overall gain of knowledge (achievement of Solving Quadratic Equations) of the Form 4 students.

The inter-correlations between of knowledge of solving quadratic equations variables and the post-test scores variable are given in Table 3. The students’ overall post-test mean total scores on each knowledge component were also given. It can be seen that the components correlate with each other and with the post-test total scores at $p < .05$ level.

Entries in Table 4 list the results summary of the stepwise multiple regression analysis. The students’ scores on solving quadratic equations using formula knowledge component which accounted for 57.9 percent of the variance in the post-test total scores, entered the equation first. This component of knowledge was highly significant, as indicated by the significant $F$ change – value.

The second prediction variable entered was the knowledge on solving quadratic equations using factorization and null factor (K4) which contributed 25.8 percent. The knowledge on Problem solving (K7) contributed 5.8 percent, whereas the knowledge on solving quadratic equations using Simple factorization and Null factor (K2) contributed 5.0 percent. The component knowledge on solving quadratic equations using expansion, factorization and null factor (K5) contributed 3.1%, the knowledge on solving quadratic equations using null factor (K1) contributed 1.8% and the knowledge on solving quadratic equations using Square root method contributed 0.6 percent. Although their contributions are low, they are highly significant.

From the results obtained, it shows that the combination of all the components of new knowledge affected the Form 4 students’ achievement of solving quadratic equations. It also included that the component solving quadratic equations using formula (K6) was the highest predictor to the overall new knowledge and achievement of solving quadratic equations of the students in the study. This indicates the students successfully using the quadratic formula to solve the quadratic equations appropriately.

The ability to factorize and solve by equating each of these factors to zero was successfully used by some of the pupils, solving quadratic equations using factorization and null factor (K4) which contributed 25.8 percent of the variance. The other knowledge components were not really significant, each contributing less than 6 percent. Since the marks obtained by the students in this study were so low generally and since the two
significant knowledge skills are both procedural, it showed that little understandings is implied. Through the results, students in this study couldn’t do the test very well, and resorted to using the quadratic formula method for solving quadratic equations with which they had some limited success. A few of the pupils could factorize, and could solve the appropriate questions this way. This revealed the students in this study lack of understanding or breadth of knowledge gained in solving quadratic equations.

Table 3  Means, standard deviations and inter-correlations between the components of knowledge of Solving Quadratic Equations variables and the total post-test scores variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>K1</th>
<th>K2</th>
<th>K3</th>
<th>K4</th>
<th>K5</th>
<th>K6</th>
<th>K7</th>
<th>Post-test Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.57</td>
<td>1.562</td>
</tr>
<tr>
<td>2</td>
<td>.585</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.89</td>
<td>1.307</td>
</tr>
<tr>
<td>3</td>
<td>.275</td>
<td>.331</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.65</td>
<td>.882</td>
</tr>
<tr>
<td>4</td>
<td>.408</td>
<td>.449</td>
<td>.384</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.70</td>
<td>2.384</td>
</tr>
<tr>
<td>5</td>
<td>.277</td>
<td>.353</td>
<td>.432</td>
<td>.656</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.48</td>
<td>2.067</td>
</tr>
<tr>
<td>6</td>
<td>.318</td>
<td>.262</td>
<td>-.028</td>
<td>.358</td>
<td>.196</td>
<td>-</td>
<td>-</td>
<td>2.65</td>
<td>3.916</td>
</tr>
<tr>
<td>7</td>
<td>.175</td>
<td>.169</td>
<td>.022</td>
<td>.207</td>
<td>.156</td>
<td>.537</td>
<td>-</td>
<td>1.20</td>
<td>2.554</td>
</tr>
</tbody>
</table>

Note: Correlation is significant at the 0.05 level. K1- Solving quadratic equations using null factor; K2- Solving quadratic equations using simple factorisation and null factor; K3- Solving quadratic equations using square root method; K4- Solving quadratic equations using factorisation and null factor; K5- Solving quadratic equations using expansion, factorisation and null factor; K6- Solving quadratic equations using quadratic formula; K7- Problem solving.
### Table 4  Stepwise multiple regression analysis to predict post-test total scores

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Knowledge Entered</th>
<th>Combination Knowledge</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F Change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K6</td>
<td>K6</td>
<td>.579</td>
<td>.579</td>
<td>254.393</td>
<td>.000</td>
</tr>
<tr>
<td>2</td>
<td>K4</td>
<td>K6 &amp; K4</td>
<td>.837</td>
<td>.258</td>
<td>292.551</td>
<td>.000</td>
</tr>
<tr>
<td>3</td>
<td>K7</td>
<td>K6, K4 &amp; K7</td>
<td>.895</td>
<td>.058</td>
<td>100.843</td>
<td>.000</td>
</tr>
<tr>
<td>4</td>
<td>K2</td>
<td>K6, K4, K7 &amp; K2</td>
<td>.945</td>
<td>.050</td>
<td>163.380</td>
<td>.000</td>
</tr>
<tr>
<td>5</td>
<td>K5</td>
<td>K6, K4, K7, K2 &amp; K5</td>
<td>.976</td>
<td>.031</td>
<td>232.608</td>
<td>.000</td>
</tr>
<tr>
<td>6</td>
<td>K1</td>
<td>K6, K4, K7, K2, K5 &amp; K1</td>
<td>.994</td>
<td>.018</td>
<td>538.800</td>
<td>.000</td>
</tr>
<tr>
<td>7</td>
<td>K3</td>
<td>K6, K4, K7, K2, K5, K1 &amp; K3</td>
<td>1.000</td>
<td>.006</td>
<td>19092.433</td>
<td>.000</td>
</tr>
</tbody>
</table>

*Note:* K1- Solving quadratic equations using null factor; K2- Solving quadratic equations using simple factorisation and null factor; K3- Solving quadratic equations using square root method; K4- Solving quadratic equations using factorisation and null factor; K5- Solving quadratic equations using expansion, factorisation and null factor; K6- Solving quadratic equations using quadratic formula; K7- Problem solving. The mean difference is significant at the .05 level.

Research Question 2: Is there any relationship between the Form 4 students’ confidence in answering questions on solving quadratic equations and the overall new knowledge acquired by the students after the lessons in solving quadratic equations?

Confidence levels of the students were measured in the form of post-teaching mean score on Confidence Questionnaire which associated with the Solving quadratic equations test (QE TEST). Data collected from the administration of the Confidence Questionnaire were used to answer the second research question.

**Confidence Questionnaires Data and Students’ Acquired Overall New Knowledge**

Data generated from the confidence questionnaires. The students were invited to respond to the Confidence Questionnaires during the administration of the Solving Quadratic Equations test (QE TEST). The total scores of each individual student on the questionnaire were obtained. The three percentiles, the lower quartile (25%), median (50%) and the upper quartile of distribution (75%), were determined (using the SPSS
package) based on the total scores of the Confidence Questionnaires for the whole sample. The students were then classified into high, medium and low confidence level students.

Based on the percentiles of the whole sample, the high confidence students scored equal to or above 63 marks on the total scores of the Confidence Questionnaire. The range of marks used to classify the medium confidence students was above 42 marks to below 63 marks. The low confidence students achieved scores of 42 marks and less. Entries in Table 10 provide the statistics of the total scores for the Confidence Questionnaire.

Results in Table 5 indicate that about 26 percent of the students in the study had high confidence level in answering the performance test. Approximately 49 percent had medium confidence level and about 26 percent of the sample of students had low confidence. Overall, the medium confidence students (49%) were the majority group in the study followed by the low and high confidence students (26% for both low and high confidence group).

### Table 5 Total mean score of the confidence questionnaires of the sample

<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
<th>Confidence Questionnaires Mean Score</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Confidence Students</td>
<td>48 (25.7%)</td>
<td>76.02</td>
<td>10.340</td>
</tr>
<tr>
<td>Medium Confidence Students</td>
<td>91 (48.7%)</td>
<td>52.53</td>
<td>5.890</td>
</tr>
<tr>
<td>Low Confidence Students</td>
<td>48 (25.7%)</td>
<td>33.58</td>
<td>5.649</td>
</tr>
<tr>
<td>Total</td>
<td>187</td>
<td>53.70</td>
<td>16.898</td>
</tr>
</tbody>
</table>

Discussion on the Results and Analysis (one-way ANOVA) of the Confidence Questionnaire Data

One-way analysis of variance (ANOVA) was used to compare the high, medium and low confidence students with their performance on the post-test that tested the different components of knowledge and overall knowledge gained. Any significant results of one-way ANOVA were subjected to Scheffé multiple comparison test to determine the significant differences between the three groups. For reference, the statistics of the mean scores on the post-test of each category of confidence levels of students were previously given in Table 5.

Entries in Table 6 provide the results of the Scheffé test that determined between which groups significant differences in their mean post-test total score occurred.
According to these mean difference data (see Table 6), the high confidence students’ post test mean total scores differed significantly from that of the medium confidence students by 6.097 marks and the low confidence students by 9.104 marks. A significant mean difference was also seen between the post-test mean total scores of the medium confidence students and the low confidence students by 3.007 marks. From these data, the high confidence students scored significantly higher in the post test compared to the medium and low confidence students.

All the results above indicate that the high confidence students had higher acquisition level of overall new knowledge on solving quadratic equations compared to the medium and low confidence students.

Table 6  Scheffé Test Multiple Comparisons Results of the Students According to their Different Confidence Levels on the Post-test Total Scores

<table>
<thead>
<tr>
<th>Students’ Confidence level (I) Vs</th>
<th>Students’ Confidence level (J)</th>
<th>Mean Difference (I – J)</th>
<th>Standard Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Medium</td>
<td>6.097*</td>
<td>1.628</td>
<td>.001</td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td>9.104*</td>
<td>1.863</td>
<td>.000</td>
</tr>
<tr>
<td>Medium</td>
<td>Low</td>
<td>3.007</td>
<td>1.628</td>
<td>.184</td>
</tr>
</tbody>
</table>

Note: * The mean difference is significant at the .05 level.

References


Formative assessment in scientific investigation

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Abstract
Recent studies on assessment show that the learning of students is generally enhanced in classrooms where teachers put heavy premium on formative assessment in making judgments about teaching and learning. This study, in particular, demonstrates how a performance-based assessment as a form of formative assessment has enriched science investigations and provided the teacher with useful information on how students design a controlled experiment, carry out the experiment, record results and use them to draw out conclusions. As a formative assessment, performance-based assessment tasks with rubrics conveyed a message to students about the knowledge and performance that are valued in a particular lesson. The rubrics, on the other hand, helped the teacher analyse and describe the students' responses to complex tasks and determine the students' levels of proficiency. The assessment designed in this study was primarily geared towards exploring the scientific investigation and inquiry skills and conceptual understandings that 30 students brought in a lesson on electromagnetism. The information about what the students were learning and not learning were revealed from this assessment and an early intervention was provided to encourage and assist students reach the goals of instruction.

The nature of scientific investigations

A scientific investigation is a process by which scientists collect data and endeavor to construct an accurate solution to a problem. It is very much akin to the scientific method. It follows the steps of the scientific method, such as the following as enumerated by Wudka (1998):

1. Observation and description of a phenomenon or group of phenomena
2. Formulation of a hypothesis to explain the phenomena
3. Use of the hypothesis to make predictions
4. Performance of experiments to test the predictions

The process of observation is important in a scientific investigation. A good scientist is observant and notices happenings in the world around him/her and he/she becomes curious about what is happening. The scientist then raises a question about what he/she sees going on.

The scientist formulates a tentative answer to the question. This tentative answer or solution to a problem is called hypothesis. Hypotheses should be testable by
experimentation. An experiment is conducted to check if the hypothesis is correct or if the predicted results are obtained. Hypotheses must be tested in a controlled manner.

A well tested, verified hypothesis is a theory. It is a generalization based on many observations and experiments that explains how processes or events are thought to occur (Carter, 1996). Theories may be modified as new information is gained.

In any science classroom the heart of inquiry-based instruction is scientific investigation. Inquiry consists of making observations, posing questions, proposing answers, explanations and predictions, planning investigations, using tools to gather, analyze and interpret data, and communicating results (Roehri and Luft, 2004). The implementation of inquiry lessons by science teachers is mandated by the National Science Education Standards (NRC, 2000). The Standards insist on a level of science literacy that goes well beyond simple science knowledge to science conceptual understanding and application of that knowledge. Inquiry is the avenue to attain understanding and concept application. In fact, it is a significant category that the National Science Education Standards (NSES) identified and described extensively; it is treated not only as a means of teaching and learning, but also as a content field (NRC, 2000).

**How teacher candidates perform in scientific investigations**

At the School of Education in the University of Guam, college students working towards the completion of a teaching degree in elementary education have to take a methodology course in science after having satisfied the content requirements of science in the general education program. These students take the science methods course on the last semester prior to student teaching. At this stage of their teacher preparation, they are no longer called students but teacher candidates.

The teacher candidates in the science methods course are provided with content and practicum activities. Performing several scientific investigations that are needed to develop the skill of inquiry constitute a part of the practicum activities. The development of inquiry skills in teacher candidates is emphasized in two teaching standards of NSES. Teaching Standard A requires teachers of science to plan an inquiry-based science program for their students. Teaching Standard B asks teachers to focus and support inquiries while interacting with students, and model the skills of scientific inquiry that characterize science.

**Assessment of the skill of inquiry in a scientific investigation**

To determine the initial performance level of the 30 teacher candidates in performing scientific investigations, they were asked to do the following tasks after discussing concepts relating to magnets and the different ways of making artificial magnets.

1. Construct an electromagnet.
2. Find out how to improve the magnetic field strength of the electromagnet.
3. Formulate hypotheses.
4. Write a procedure to test the chosen hypothesis.
5. Carry out the procedure through an experiment.
6. Record the observations made.
7. Make a conclusion (to support or reject the hypothesis).

The rubrics below were used to assess performance of each of the tasks above. Rubrics are scoring schemes that contain qualitative descriptions of performance criteria (Robin, T. and Simon, M., 2004). There are numerical equivalents assigned to each level of performance described by the rubric to allow for statistical computations. For each task the level of performance is designated by letters with the following descriptors and numerical equivalents:

<table>
<thead>
<tr>
<th>Letter</th>
<th>Descriptor</th>
<th>Numerical Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Very Good</td>
<td>(4 points)</td>
</tr>
<tr>
<td>B</td>
<td>Good</td>
<td>(3 points)</td>
</tr>
<tr>
<td>C</td>
<td>Fair</td>
<td>(2 points)</td>
</tr>
<tr>
<td>D</td>
<td>Needs Improvement</td>
<td>(1 point)</td>
</tr>
</tbody>
</table>

The rubrics for assessing performance in scientific investigation

I. Constructing Science Device/Tool
   A. Materials for the device/tool are properly set up; resulting product works perfectly well.
   B. Materials for the device/tool are properly set up; resulting product sometimes works well but at other times it fails.
   C. There are some flaws in the set up; resulting product does not work.
   D. Set up is wrong; product is defective.

II. Problem Posing
    A. Problem is stated very clearly.
    B. Problem is somewhat clearly stated.
    C. Problem is not clearly stated.
    D. There is no statement of the problem or problem stated is not correct.

III. Formulating Hypothesis
     A. Hypothesis shows well-developed conceptual understanding.
     B. Hypothesis shows acceptable conceptual understanding.
     C. Hypothesis shows very limited conceptual understanding.
     D. Hypothesis shows no conceptual understanding at all.

IV. Designing an Experiment
    A. Materials are appropriate and complete; procedure is organized; two or more observation questions are provided and are all correctly stated.
    B. Materials are appropriate; procedure has few errors; only one observation question is correctly stated.
C. Some materials are missing; procedure has some errors; only one observation question is provided
D. Most of the materials are missing; procedure is disorganized; no observation question is given

V. Carrying out the Experiment
A. Procedure is carried out very well, observation table is provided, observations questions are answered well and conclusion is stated correctly.
B. Procedure is carried out well, observation table is not provided but questions are answered well and conclusion is stated correctly.
C. Some steps of the procedure were missed, observation table is not provided, observation questions are not answered properly; conclusion is stated arbitrarily.
D. Procedure is erroneous, observation table is not provided, observations are not clearly stated, conclusion is not correct.

Performance results of the teacher candidates

The performance results are graphed for each of the task that the teacher candidates carried out. The first graph shows the candidates’ skills in constructing an electromagnet with given materials, such as two batteries, copper wire, big nail to act as core, tape, sand paper, a box of pins.

![Figure 1](candidates_performance_construction.png)

**Figure 1** Candidates’ performance in construction activity (Task 1)

Figure 1 shows that 67% of the candidates were able to construct an electromagnet that worked perfectly well, thus getting an ‘A’ for this task. Only 23% of them had some flaws with a ‘B’ grade. The common flaw was improper removal of the insulation at both ends of the copper wire that were connected to the batteries. A few of the candidates (10%) did not remove the insulation from the wire resulting to failure of the electromagnet to attract
the pins. This group of candidates who got ‘C’ displayed lack of full understanding of conductors and insulators in the study of electricity. This knowledge deficiency resulted to the candidates’ inability to solve a problem by applying the concept that should have been fully understood prior to the study of the current topic, which is electromagnetism.

Figure 2 below shows the graph of the candidates’ performance in scientific investigation. It describes the performance in three tasks – problem posing, formulating hypothesis, and designing an experimental procedure to test the hypothesis.

The candidates performed very well the task of problem posing (Task 2). A very substantial number of them (93%) obtained a grade of ‘A’. Their problem statements were clearly stated and unambiguous. About 7% of the candidates obtained a ‘B’ grade where the problems stated were quite clear but somehow clouded by some unnecessary descriptors. Some examples are: How can we make a powerful electromagnet that can attract more than 10 pins? How can we make the magnet that is run by electricity work better? Can our electromagnet increase its capability to lift metallic objects? If so, in what way?

The candidates’ performance of Task 3 is an area of concern. The formulation of hypotheses by 60% of the candidates in the C and D categories revealed inadequacies in understanding certain concepts. About 27% of the candidates associated battery size with voltage (The bigger the battery the higher is the voltage. Thus, a B battery which is bigger than a triple A battery is considered to be more powerful and therefore can attract more pins when used to set up an electromagnet). It is true that batteries of different sizes may be of the same voltage, but they produce different magnitudes of current which has an effect in this experiment. Their responses were given a grade of ‘D’. Limited understanding was demonstrated by 33% of the candidates who obtained a grade of ‘C’. They hypothesized that increasing the number of batteries, doubling the core, and varying the length of the wire would make their electromagnets work better. Their hypotheses lacked the specifics of battery type, size of core, and kind of wire. Acceptable
understanding, which was demonstrated by 17% of the candidates who obtained a grade of ‘B’, included manipulating such variables as size of a similar core and number of coils. Full understanding of the factor that is allowed to vary and the effects of its manipulation were exhibited by 23% of the candidates who got ‘A’. Their hypotheses carried brief explanations of predicted outcomes when the variable would be manipulated.

Another area of concern is the candidates’ skill in controlling variables in Task 4. This is manifested in the candidates’ design of the experimental procedure. Nearly 50% of the candidates had incomplete procedure citing only the first set of steps. The repetition of certain steps in the first part to be used in manipulating the variable for the second part was always overlooked. The use of exactly the same conditions for both parts of the experiment, except for the variable that is manipulated, was consistently neglected in the design. The common examples are:

- increasing the number of batteries from 2 in the first part of the experiment to 4 in the second part with no mention of the same battery type,
- changing the size of wire from thin in the first part of the experiment to thick wire in the second part without stating the use of the same kind of wire,
- changing battery voltage without observing sameness of battery type,
- using a small-sized core and a big-sized core to find out any difference, but no reference to the use of the same kind of core.

Moreover, the materials listed by these candidates were inadequate. They were not specific enough to determine whether batteries, wires and cores were of the same kind for use in both the experimental and control set-ups. Most of their observation questions were not intended for observation purposes.

The intervention and its impact on performance of inquiry skills

The rubrics for Tasks 2-4 with corresponding assessment of performance were given back to the candidates for them to determine what need to be done before doing the experiment. They were grouped to discuss their hypotheses and the correct way of testing them. After revising their work, they discussed it with the teacher. From the discussion with the teacher the candidates were able to see clearly the importance of stating correct and well described hypotheses, controlling variables in an experiment and the need to use appropriate materials and correct, well organized procedure to ensure success. These are the targets in the rubrics they need to achieve to get an ‘A’. The rubrics conveyed a message to each candidate about the kinds of knowledge and performance that are valued in a particular lesson.

The rubric for Task 5 was distributed to the candidates to provide guidance on how they should carry out the experiment. This rubric on assessing performance of the inquiry skills of experimenting, observing, and making conclusion was discussed by the teacher with the candidates and the following points were highlighted in the discussion:

- The steps in the revised procedure should be strictly followed.
• Observations should be noted down immediately. Observation data may later be transferred to a data table.
• Answers to the revised observation questions should be direct to the point.
• Statements of conclusion should be comprehensive.

The intervention before experimentation was intended to encourage and assist teacher candidates reach the goals of scientific investigation. It proved helpful in improving their performance of Task 5. The graph below attests to this fact.

![Figure 3](image)

**Figure 3** Candidates’ performance of the inquiry skill of experimentation

The positive results for this group of teacher candidates may be expected with a similar group of teacher candidates. However, a control group is necessary to make a statement that is generalisable to a wider population sample.

**Concluding statements**

The assessment results pertaining to hypothesis formulation and controlling variables indicate the inadequacy in pre-requisite knowledge and skills by a substantial number of candidates. If not intervened prior to experimentation, the results would be disastrous. For teachers to successfully carry out inquiry lessons and scientific investigations in the classroom, more emphasis on the following is needed:

• The building of a “deep and highly structured content knowledge base” for teacher candidates (Gess-Newsome, 1999). In addition to an understanding of content, teacher candidates should also have some understanding of the relationships between evidence and theory. This involves the use of reliable empirical data to support claims (Watson, R., Swain, J. and McRobbie, C. (2004). Empirical data are collected during
experimentation. If the experimental procedure is correctly designed, reliable data can easily be obtained.

- The use of rubrics for assessing skill performance. Rubrics in formative assessments provide a picture of skill development for teacher candidates (Ferrer, 2004). They convey a message about the kinds of knowledge and performance that are valued in a particular lesson. Duschl (2000) strongly advocates the development of the skill of scientific inquiry. He said, “How this skill is carried out should be one of the central aims of science education”. The development of this skill should be assessed and made known to students of science to guide their own learning.

- The use of scientific knowledge in practical situations to solve problems and inquiry processes to arrive at important generalizations. Engaging teacher candidates in active and extended scientific inquiry is very important. They have to be taught scientific concepts and their applications through inquiry much like their students who will need to learn science through scientific investigation (Peters, 1998).

References


Attitudes towards economics: a case study of Brunei secondary school students

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Abstract
There has been a drop in the number of students taking Economics in secondary schools in Brunei Darussalam. This is a matter of concern because for a developing country like Brunei Darussalam a good Economics and business-educated population can help contribute positively towards economic development and progress. This study explores the possible factors that could influence these attitudes amongst secondary school students toward Economics subject. The study is based upon both quantitative and qualitative data and involves all government secondary schools that teach Economics as a subject at upper secondary level. The study adapted one established instrument that were nationally normed in the United States, to measure students’ attitudes toward Economics subject: ‘Attitudes Toward Economics’ (ATE). Another instrument ‘Factors Influencing Attitudes’ (FIA) was developed based on the literature review done and was pilot tested for reliability. Attitudes toward Economics subject were classified into three categories: (1) Enjoyment; (2) Usefulness; and (3) Difficulty of the subject. Factors Influencing Attitudes were categorized into: (1) Nature of Economics; (2) Competition from Other Subjects; (3) Class Environment; (4) Teaching Methods; (5) Teachers Supports; (6) Resources; (7) Parents Supports; (8) Friends Supports; and (9) Students Efforts. The results provide useful insight into the current decreasing trends in the number of students choosing and taking Economics as their option subject. This information would be very valuable to teachers and appropriate authorities to develop strategies in the classroom and in planning policies to attract and encourage secondary school students to take up Economics subject.

Introduction
The falling trend in the number of students taking the Economics subject in Brunei Darussalam Secondary schools is a matter of concern to educationists and policy makers as reported in a study done by Rosmawijah (2001), where the number of Brunei students taking Economics fell by 50 % from 1996 to 2000.

The drop in the number of students taking Economics is of concern especially in Brunei, because Economics, as well as other business related subjects, are seen as
important subjects especially for a developing country like Brunei. A nation familiar with economic principles will promote economic development and progress. A positive attitude towards Economics in students, not only improves their achievements and results, but also produces future generations who are more confident in business and the economic system of a country (Walstad, 1987). Furthermore, attitudes toward economics may be as important as economics understanding in influencing economic behaviour especially towards public issues (Soper & Walstad, 1983).

This is in line with the country’s aim of diversifying the economy as stated in the National Development Plan. A good business-educated population and one that is knowledgeable in Economics will ensure an expansion of trade and businesses that can reduce the burden of unemployment that the country is currently trying to overcome. The statistics given by the Brunei Darussalam Economic Council shows unemployment at 5.1% in 2000 (cited in Echo magazine, 2001). Reducing unemployment is an aim included in the 8th National Development Plan. Various recommendations and programmes were suggested and implemented such as building more vocational schools, upgrading the ITB and UBD courses, introducing the Apprentice Scheme and LiveWIRE programme. During the 13th UBD Convocation His Majesty had urged graduates to be less dependent on the government for jobs and suggested that they set up their own businesses. This shows the importance of investing in human resources. Therefore, based on this reasoning, a research on students’ attitudes towards Economics is necessary to gain insight into students’ decision for choosing a subject. Human resources must be developed as early as possible to fit into the current requirements of the country.

Aims of the study

This study looks at the current secondary economics students’ attitude towards Economics subject. The difference in attitude towards Economics subject between high, average and low achievers and between students’ gender is also being considered.

The study also looks at possible factors that might influence students’ attitudes toward Economics subject. Possible factors being considered are: ‘Nature of Economics’, ‘Competition from Other Subjects’, ‘Class Environments’, ‘Teaching Methods’, ‘Teachers’ Supports’, ‘Resources’, ‘Parents’ Supports’, ‘Friends’ Supports’ and ‘Students’ Efforts’. Information on these factors may be useful to teachers and school administrators as it will provide an understanding of the current Economics subject situation at secondary school level.

Literature review

At the international level a general decline was observed in the 1990’s (Siegfried & Round, 2001). In United States, enrollment trend increased in the 1980s after the introduction of compulsory Economics courses in certain states. However a survey showed only 44 % of high school graduates took Economics in 1994 (Walstad & Rebeck, 2000). In England, since 1989 the numbers of students taking A-Level Economics has fallen by over 50 % (Ashworth and Evans, 2001). The decline in interest in Economics starting from the mid
1980s in USA and in most Australian Universities in recent years was mentioned in the case study of Hodgkinson and Perera (1996). A study made by Clark and Davis (1992) found that only a small percentage of high school students showed significant gains in Economics knowledge and felt more favourably toward Economics after learning the subject.

A factor attributed to the falling number of students taking Economics at secondary level might be their attitudes towards the subject itself. According to Eagly and Chaiken (1993), “Attitude is a psychological tendency that is expressed by evaluating a particular entity with some degree of favour and disfavour.” (p.1). ‘Psychological tendency’ refers to people’s evaluative response either overt, covert, cognitive, affective or behavioural towards an entity. “Entity” refers to something concrete such as Economics textbooks or teachers or to abstract issues such as Economics concepts. Some Educational research that had focused on students’ attitudes towards Economics as their key variable to be analysed were Wetzel, Potter & O’Toole (1982); Soper & Walstad (1983: 1988); Hodglin (1984); Charkins, O’Toole & Wetzel (1985); Fizel & Johnson (1986); Walstad & Soper (1989) and Phipps & Clark (1993).

Furthermore, learning Economics content also improves students’ ability in social studies skills, such as problem-solving, decision-making and quantitative skills. It also suggests improvement in Language arts and Mathematics (Chizmar, McCarney, Halinski & Racich, 1985).

There are several studies done internationally on students’ attitudes towards Economics at secondary, college and university levels. Phipps and Clarks (1993) found out that the students’ attitude towards Economics subject has three dimensions, namely ‘enjoyment’, ‘usefulness’ and ‘difficulty’ of Economics.

With regards to students’ enjoyment of Economics subject, gender was one of the items mentioned. Being male was found to have some influence on students’ attitudes towards Economics subject (Walstad & Soper, 1982). Upon closer examination through factor analysis procedure, males seem to enjoy Economics more than females. However there were no significant gender difference in the perceived difficulty and usefulness of Economics (Phipps & Clark, 1993). Males learned more and got better scores on Test of Economics Literacy (TEL) than females. They also have more positive attitudes towards Economics subject than females (Walstad & Soper, 1989). Another study also found female students performed less well in Economics than in other subjects compared to male students (Jensen & Owen, 2001). In most studies males seemed to like or have more favourable attitudes towards Economics subject than female students (Walstad & Soper, 1989; Phipps & Clark, 1993).

Female Mathematics inferiority and their poor performance in Economics during high school was another cause suggested by Dynan and Rouse (1997), (cited in Jensen & Owen, 2001). They stressed the need to enroll more female Economics students in secondary school and more female Economics teachers to attract female students (Ashworth & Evans, 2001). Female students are more likely to take Economics if other female students are studying the subject too. Other factors found to influence decisions to study Economics were Mathematics ability, prior study of Economics, underachievement in Economics and certain classroom features or environments (Ashworth & Evans, 2001).

Interest in the subject matter is also a factor that can influence attitudes. Greater gain in economic understanding is likely to be made by those students who are interested in the
subject. The reasons for the students’ lack of interest in Economics are related to the difficulty of Economics subject and its relevance to students’ daily lives. Some gave the reason that Economics was too boring. These appear at an early part of the semester, suggesting that the attitude may have been formed at secondary schools or from general exposure in newspapers or on television (Hodgkinson & Perera, 1996).

Students’ perceived usefulness of Economics subject was another factor that could influence attitudes (Phipps & Clark, 1993). Academically better students might perceive quality and usefulness of Economics as lower relative to other subjects. Science subjects were considered to enhance their marketability for entering the college of their choice (Peterson, 1992).

Difficulty of the subject was another possible factor that could influence students’ attitudes toward Economics subject (Phipps & Clark, 1993). Exposure to Economics also does improve students’ attitudes toward Economics but has no effects on students’ attitudes toward economic issues (Walstad & Soper, 1989). Students who received Economics instruction viewed the subject as easier (Phipps & Clark, 1993). In terms of subject choice, the greater the comparative difficulty of Economics the greater is the likelihood that students will not choose to study Economics relative to Science and arts (Ashworth & Evans, 2001).

Factors that can influence attitudes

Factor analysis done showed that specific Economics instruction only affects students’ perceived difficulty of Economics but does not affect their enjoyment and usefulness of the subject (Phipps & Clark, 1993). Types of instruction were also found to influence students’ attitudes towards economic issues (Phipps & Clark, 1993).

Other researchers stated that Economics topics and methods of teaching are not appealing to female students. This has caused a decline in the number of female students taking Economics (Feiner & Roberts, 1995) (cited in Jensen & Owen, 2001). Some suggested that the teaching method and evaluation instruments favour male learning styles (Becker, 1997; 2000) (cited in Jensen & Owen, 2001). Others suggested that if done with appropriate methods and materials, studying Economics concepts, behaviour and process in classroom would enhanced motivation and interest in learning the subject (Chizmar, McCarney, Halinski & Racich, 1985).

Students in classrooms made up of middle and high income families had greater understanding of Economics and more positive attitudes towards Economics subject than students in classrooms consisting of low income families (Walstad & Soper, 1989). Some possible reasons mentioned were differences in parents’ occupation, educational attainment or the school funding level (Walstad & Soper, 1989). Teaching methods was one of the factors that could influence students’ attitudes towards Economics. In their research, lecturing was the most frequently used teaching method, followed by class discussion and group problem solving (Jensen & Owen, 2001). In a classroom situation there is only one teacher with one teaching style but many students with many learning styles. Thus the use of appropriate and a variety of teaching styles to cater for all types of learning styles is important for improvement in student’s understanding of Economics (Wetzel, Potter & O’Toole, 1982). Research has shown that
utilizing more class time to group problem solving does increase student’s perception of relevance (Jensen & Owen, 2001).

Problem-based learning in Economics is also viewed as an effective method in generating student interest and sustaining motivation in learning Economics. However the overall gain in the Economics subject knowledge was low compared to the traditional lecture and discussion methods (Mergendoller, Maxwell & Bellisimo, 2000). Other teaching methods recommended to improve teaching of Economics were the use of computers in teaching and case studies (Bach, Kelley & Allen, 1984).

The possibility of doing Economics research in secondary school can also be considered. Research findings can be submitted to enter international competitions. This provides an active learning environment to the students. Through research, students gain other skills such as public speaking, cooperative work, organization, working under pressure and the creation of multimedia presentation (Zaveri, Pedisich & Greene, 2000).

The pedagogical method used by instructors did matter in student learning outcomes but differed across different types of students. Overall, students prefer Economics classes that contain more discussion and less lecturing. Using a variety of techniques is the most successful strategy to increase student interest regardless of learning styles (Jensen & Owen, 2003).

A study examined how the characteristics and attitudes of students interact with the pedagogy and attributes of the teachers to influence students’ decision to study Economics in the second semester. They found that students who think Economics is relevant, who believe they understand Economics, and who expect higher grades, were likely to continue taking Economics in the second semester (Jensen & Owen, 2001).

Educators have long agreed that when parents get involved in education, children try harder and achieve more at school. Parents who help and encourage their children to learn at home and who help develop positive attitudes towards school and subjects will see personal growth and academic success of their children. Parental discussion with students about post high school plans was significant for students of majority race and middle income group when compared with the minority race and low income groups (Desimone, 1999). Positive relationship was also found between students’ achievement and high parental expectations for students from majority race and middle income group (Desimone, 1999). However parental help with students’ homework was associated negatively with achievement for students from all races and income levels. Homework monitoring causes negative outcomes as it decreases maturity growth or the development of independence and responsibility (Desimone, 1999).

Research in other school subjects has shown evidence to support the belief that favourable positive students’ attitudes towards any particular subject have some kind of relationship with the students’ academic achievements. Factors such as class environment, teachers’ personality and attributes, methods of teaching, parents’ involvement, interest in the subject and other subject related matters can influence students’ attitudes towards Economics subjects. It is the matter of knowing these attitudes affecting factors and controlling them to achieve a favourable students’ attitudes towards a subject matter such as Economics (Walstad, 1987).
Methodology

Sample
There are only eleven government secondary schools offering Economics in Brunei Darussalam. Nine of those were used in this study. Seven schools are in the Brunei Muara District and two are in Tutong District. A total of 14 Form Four classes were involved in the study. The total number of students was 123. There were 43 boys and 80 girls. The mean age of the students in the sample was 15.16 years and the standard deviation was 0.80 years.

The students were categorized based on their Form Three Penilai Menengah Bawah (PMB) examination grades results. In the PMB examination the grades given are 1 and 2 for distinction; 3, 4, 5, and 6 for credits; 7 and 8 for passes; and 9 for fail. For the purpose of this study, grades of six core subjects in the PMB were collected and added together to obtain an overall aggregate. The subjects are Malay language, English, Mathematics, Science, History and Geography.

Students were categorized according to the three groups. Those who got grades 1 to 3 in the six subjects or having total grades of the six subjects not exceeding grade 18 were grouped as ‘high achievers’. Those who received grades 4 to 5 in the six subjects or having total grades of the six subjects from grade 19 to grade 30 were grouped as ‘average achievers’ and those who got grades 6 to 8 or having total grades of the six subjects from grade 31 to grade 48 were grouped as ‘low achievers’. The result was 32 students were in the high achievers category, 72 in the average achievers category and 19 in the low achievers category, respectively. In all schools only above average ability students are allowed to take Economics subject. This is reflected in the smaller number of ‘Low Achievers’ group available in the study.

Data collection methods
The study used both questionnaire survey and interview methods. Students’ questionnaires were on students’ attitudes toward Economics subject and factors influencing students’ attitudes toward Economics subject. An open-ended questions section was also included in the questionnaire. These open-ended questions provided more information which was used to triangulate with the questionnaire data and the information gathered from the interviews. Semi structured group interviews were carried out with several Economics students.

The questionnaire has 2 sections. The first section is adapted from the ‘Survey on Economic Attitudes’ (SEA) developed by Soper and Walstad (1983). The SEA contains 28 statements and has 2 parts, the first 14 questions ‘Attitudes Toward Economics’ (ATE) measures students’ attitudes toward Economics as a subject. Soper and Walstad (1998) study proved the consistency of its validity and reliability with alpha value .88 for ATE.

The second section measures the possible factors that might influence students’ attitudes toward the Economics subject. These possible factors are derived from the literature review. The factors considered are: ‘Nature of Economics Subject’, ‘Competition from Other Subjects’, ‘Class Environment’, ‘Teaching Methods’, ‘Teachers’ Supports’, ‘Resources’, ‘Parents’ Supports’, ‘Friends’ Supports’ and ‘Students’ Efforts’.

Interviews were carried out in groups of 5 students per group. Interviews were conducted for about 30 minutes per group. The reliability of the questionnaire items were
measured using the Cronbach Alpha test. The reliability coefficient of Attitudes toward Economics (ATE) was 0.86 and Factors influencing attitudes (FIA) was 0.82.

In Attitudes towards Economics subject, factors analysis resulted in three domains, ‘Enjoyment of Economics subject’, ‘Usefulness of Economics subject’ and ‘Difficulty of Economics subject’. The names were adapted from research done by Phipps and Clark (1993). All question items matched to those three clusters or factors found in their study including those question items they found to be loading on multiple factors.

In factors influencing students’ attitudes toward Economics, the domains are ‘Nature of Economics’, ‘Competition from Other Subjects’, ‘Class Environment’, ‘Teaching Methods’, ‘Teachers’ Supports’, ‘Resources’, ‘Parents’ Supports’, ‘Friends’ Supports’ and ‘Students’ Efforts’. There were developed from the literature review done where these factors were mentioned.

Findings and discussions

The following are the findings regarding students’ attitude towards Economics as a subject as measured by the ‘ATE’ instrument. The domains being considered are ‘Enjoyment’, ‘Usefulness’ and ‘Difficulty’ of Economics subject. A mean score above 2.0 indicates a positive attitude towards the domain and a score below 2.0 indicates a negative attitudes.

Table 1  Means and standard deviations for economics students, achievers and gender on ‘Attitude Towards Economics’ instrument and domains

<table>
<thead>
<tr>
<th>Instrument &amp; Domains</th>
<th>Achievers</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Economics Students</td>
<td>High</td>
</tr>
<tr>
<td>Attitudes Toward Economics (ATE)</td>
<td>2.85 (0.43)</td>
<td>2.95 (0.41)</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>2.64 (0.50)</td>
<td>2.68 (0.47)</td>
</tr>
<tr>
<td>Usefulness</td>
<td>3.19 (0.49)</td>
<td>3.30 (0.53)</td>
</tr>
<tr>
<td>Difficulty</td>
<td>2.49 (0.63)</td>
<td>2.70 * (0.49)</td>
</tr>
</tbody>
</table>

- Economics Students (n=123), High Achievers (n=32), Average Achievers (n=72), Low Achievers (n=19).
- Boys (n=43) & Girls (n=80) * Sig. at 0.05 level
Table 1 show that all Economics students had highly positive attitude towards Economics as a subject with a mean score of 2.85 for the whole instrument ‘Attitudes Towards Economics’. Regarding the three domains, students had highly positive attitudes towards ‘Usefulness’ domain, with a mean of 3.19.

Individual statements show that, 96.8 % of the economics students agreed that studying Economics was not a waste of time. Furthermore, 91.1 % stated that Economics ideas were not dumb, 87 % agreed that Economics was not dull and 85.4 % stated that they do not hate Economics. While, 69.9 % stated that Economics was not one of their most dreaded subjects and 64.3 % stated that Economics was practical.

In the students’ interviews, when asked about the importance of Economics to students, most agreed that Economics subject was important in their daily life and useful for planning a business. Some stated that it was important for finding jobs while others said it was important as it was knowledge. A few have no ideas about its usefulness. Studies found group problem solving does show how Economics is relevant to daily life (Jensen & Owen, 2001). However problem-based learning only effective in generating interest and sustaining motivation and the gain in knowledge is more in the traditional lecture and discussion methods (Mergendoller, Maxwell & Bellisimo, 2000).

In the open-ended question analysis, when asked if they thought Economics was important, the majority, 98 students (79.7 %), stated Economics was important for them. Only 18 students (14.6%) stated it was not important. When asked for reasons, a total of 160 responses were gathered. Several students gave multiple responses. Those who stated Economics as being important gave reasons such as, for doing business 55 responses (34.4%), for finding jobs 40 responses (25 %) and for daily application and for understanding the economy, only 39 responses (24.4 %). Other positive responses were for higher marks or passes in examination, interested in learning Economics and to improve students’ English. Those students who did not think Economics was important gave reasons such as, not interested to learn it 7 responses (4.4%) and it was hard, difficult and not important as it was optional subject, 3 responses (1.9 %).

In the ‘Enjoyment’ domain, students had positive attitude with a mean of 2.64. Individual statements show that, 78.1 % of the economics students enjoyed Economics, 70.7 % are willing to attend an economist lecture. Around 66.7 % enjoyed reading Economics articles. However, only 30.1 % of the students sometimes read an unassigned Economics book. About 60.2 % of the students had used Economics concepts to analyse situations and had stated that Economics as one of their favourite subjects.

In the interview, when asked how they felt after learning Economics, some stated that Economics is interesting because it relates to life and business. Some find Economics of moderate difficulty. Others had interest at first but are no longer after learning it. Few stated that the lessons can be boring. For others, the interest grows as they learn more about Economics. This is similar to findings that exposure to Economics does improve students’ attitudes toward Economics (Walstad & Soper, 1989). They also tend to view the subject as easier (Phipps & Clark, 1993).

In the ‘Difficulty’ domain, students had slight positive attitude with a mean value of 2.49. Most viewed Economics not as a difficult subject. The individual statements show that 53.6 % found Economics easy to understand and 52 % agree that Economics is not a very difficult subject.
In the interview, when asked what they heard about Economics before they took the subject, some heard that Economics was difficult, challenging and complicated. They also heard that it was difficult to score high marks in Economics. Several had never heard of Economics before. However some heard that Economics was interesting and easy. Most heard that Economics was related to business, trade, shares and growth of a country.

When asked how they felt after learning Economics, most students found Economics to be difficult, complicated with difficult to understand Economics language, terms, graphs and diagrams. But some students found Economics graphs easy. Students had difficulty understanding most of the topics and admitted to their weakness in English language. Students found it hard to answer examinations and tests question that require application of Economics concepts. Some complained the time given for essay questions was not enough. Others mentioned that their teacher discouraged them from answering using their own words. However some students found Economics to be easy, moderate and interesting.

Overall we can see that most students viewed Economics as a subject about business and saw its usefulness in everyday life for making decisions and choices. The viewed it as an essential subject to be learnt to understand the world around, especially the economy and for future employment opportunities. Some students who were interested, chose the subject, which could be attributed to their understanding of concepts taught. However their interest declined after learning the subject. This might be caused by the difficulty to understand concepts taught. However there are indications that although students seemed to have weak command of English language, most students did enjoy and were interested in Economics subject. It also showed their willingness to improve their Economics knowledge.

High achievers had slightly more positive attitude towards Economics subject with mean of 2.95 for the whole 'Attitude Towards Economics' Instrument. Average and low achievers had means of 2.80 and 2.88 respectively.

At the individual domain, low achievers enjoy the subject more than the high and average achievers with means score of 2.74, 2.68 and 2.59 respectively. It might be due to more emphasis being given by teachers to these low achievers during lessons. This might explain the high positive attitudes low achievers students had towards 'Teaching Methods' domain in 'Factors Influencing Attitudes' Instrument.

In the 'Usefulness' domain, all three groups viewed Economics as a useful subject. However high achievers scored a higher mean of 3.30 on the 'usefulness of Economics' domain than the other two groups However' the differences in means on enjoyment and usefulness domains between achievers were not statistically significant.

Average achievers seemed to perceive Economics as more difficult than the high and low achievers with a mean of 2.38. Average achievers had the lowest positive attitude score in this domain. The differences in means on 'Difficulty' domain between achievers was significant at 0.05 level. This could be attributed to their average performance in Mathematics and English language. If students had good results in these subjects, it would help them in their understanding of Economics subject. But low achievers had more positive attitudes than average achievers. This might be due teacher emphasis to the low achievers as mentioned earlier. High achievers experienced the least difficulty of Economics subject, which might be because of their good command of English.

Overall, we can assume that all three achievers groups know the usefulness and enjoyed learning Economics subject. Improvement in the content presentation and teaching
methods is required to improve understanding and reduce difficulty of the Economics experienced by the majority average achievers.

In term of students’ gender and their attitudes towards Economics subject in the table above, we can assume that boys had slightly higher positive attitude towards Economics subject compared to girls with the overall mean values of 2.90 and 2.83 respectively. This is the same as in Walstad and Soper (1982); Walstad & Soper, (1989); and Phipps & Clark, (1993). However the difference in means was not statistically significant.

Upon a closer look at the individual domains, we can see that both boys and girls equally enjoyed learning Economics. Boys seemed to view Economics as more useful than girls, with means of 3.29 for boys and 3.14 for girls. Boys also seemed to find Economics much easier than the girls, with means of 2.52 and 2.47 respectively. However the difference in means for enjoyment, usefulness and difficulty were all not significant. This contradicts with the findings of (Phipps & Clark, 1993), where boys enjoyed Economics more than girls but no significant difference in term of difficulty and usefulness of Economics.

Overall, we can assume that there are slight differences in attitudes between boys and girls toward Economics subject. Boys tend to see the usefulness and experience less difficulty learning Economics. However both groups enjoyed learning it. Economics topics and methods of teaching might not be appealing to female students as found by Feiner and Roberts (1995) (cited in Jensen & Owen, 2001). Using appropriate teaching methods that help girls learn better might be necessary.

In conclusion, we can say that Economics students in the study had a positive attitude towards Economics subject, with a total mean of 2.85. Economics students seemed to enjoy the subject and know its usefulness. They also seemed to experience moderate difficulty of the subject. There were minor differences between high, average and low achievers in both enjoyment and usefulness of Economics subject. Only in terms of difficulty of Economics subject do these groups had a significant difference. Boys seemed to have slightly more positive attitude toward Economics subject than girls. Boys seemed to view Economics subject as useful and less difficult than the girls. However both boys and girls seemed to enjoy Economics subject equally. However the difference in means is not significant in all cases.

Table 2 shows the factors that influence the attitude of students towards Economics subject. All these factors have some degree of influence on students’ attitude towards Economics subject. The overall means was 2.61 for the whole ‘Factors Influencing Attitudes’ instrument.

In the individual factor domain, ‘Class Environment’ had the highest mean score of 2.90. Students seemed to have a strong positive attitude towards this ‘Class Environment’ domain. At the individual statement level, 88.6 % of Economics stated that their Economics class was not so noisy that they cannot hear the teacher and 89.4 % stated that there are not many students in their class. In the study, most Economics classes had small number of students. The number ranges from two to seventeen students per class as Economics was offered as an optional subject thus giving the students a range of other subjects to choose from. Furthermore, 69.9 % of the students feel comfortable during Economics class. While, 65.9 % stated that they can see clearly everything written on the whiteboard and 65.9 % disagreed that they cannot concentrate in class.
In the interview, when asked if they were satisfied after every Economics lesson, most stated feeling less satisfied because they could not understand the lesson. Some stated difficulty to concentrate in class because of distraction from friends. However some students felt satisfied some of the time.

‘Teachers’ Supports’ domain ranked second highest with a mean of 2.88. This could indicate that students were mostly dependent on their teacher for their success in Economics subject. Thus teachers’ knowledge of Economics and their ability to teach the subject plays an important role. At the individual statements, 91.1% of Economics students stated that their Economics teachers try hard to make the subject interesting, 89.5% stated that their Economics teachers always helped them with Economics exercises and 79.7% agreed that their teachers gave them helpful feedback on their progress. While, 70.7% stated that class explanation was clear and 50.4% stated that they always revised in class Economics concepts that they did not understand. This showed that teachers put in great effort to make the students understand the lessons. This however might also mean that students are too dependent on teachers.

In the students’ interviews, when asked whether they consulted their teachers if they had problems in understanding the Economics lesson, most students stated that they consulted their teachers. The teacher normally would explain again although some teachers had trouble in explaining it again. Students sometimes still did not understand even after the second explanation. Students also requested for extra classes. A few students blamed the teachers for their lack of understanding, stating that the notes given were difficult to understand. Students requested that the subject be made easy for them.

**Table 2** Means and standard deviations for economics students, achievers and gender on factors influencing attitude towards economics subject instrument and domains

<table>
<thead>
<tr>
<th>Instrument &amp; Domains</th>
<th>Achievers</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Economic Students</td>
<td>High</td>
</tr>
<tr>
<td>Factors Influencing Attitudes (FIA)</td>
<td>2.61 (0.25)</td>
<td>2.70 * (0.30)</td>
</tr>
<tr>
<td>Nature of Economics</td>
<td>2.70 (0.43)</td>
<td>2.84 * (0.39)</td>
</tr>
<tr>
<td>Competition from other subject</td>
<td>2.57 (0.54)</td>
<td>2.76 ** (0.51)</td>
</tr>
<tr>
<td>Class environment</td>
<td>2.90 (0.45)</td>
<td>3.06 (0.39)</td>
</tr>
<tr>
<td>Teaching method</td>
<td>2.56 (0.34)</td>
<td>2.53 (0.40)</td>
</tr>
</tbody>
</table>
In the Economics students’ open-ended questions analysis, when asked how the teacher could improve their understanding, most students agreed that giving adequate examples as the most helpful. 50 student responses stated that examples must be simple, interesting, local and mostly about current issues. 36 students stated that good and capable teachers were required. 18 students stated that doing exercises in class or at home after every topic and discussing the answer when doing corrections with the students really helped them to understand the topics better. Some students requested for simple questions. 16 students’ responses stating teachers should be more approachable and have a good personality. Teachers must have a clear voice, handwriting and need to ask appropriate questions to test their understanding. All these personality traits helped to make the lessons interesting to the students and reduce boredom in class. 15 students preferred teachers to provide them simple, good and useful notes. Students requested teachers written notes instead of printed notes from pages in certain Economics textbooks. This indicates that students mostly rely on the teachers’ notes for learning and understanding. This is to be expected as the textbooks were seldom used as the content was obsolete and lacked explanation.

Teachers who were knowledgeable in content could explain the complicated topics better. Teachers must also be resourceful in gathering Economics content and be creative in presenting them to the students. Teachers must also be sensitive to students’ needs so as to accommodate their pace of learning and understanding. The ability to simplify complex Economics language and words was an asset for teachers.

‘Students’ efforts’ ranked third with a mean of 2.74. ‘Students Efforts’ refers to their own initiative or efforts in improving their understanding of Economics. Students seemed to work hard to understand the subject. However, half of the items in the domain had lower positive means. Those are related to students’ reference to textbooks, buying extra Economics textbooks and practicing drawing Economics graphs and diagrams on their own. This is expected as few ‘O’ level Economics textbooks are available in the local shops. Furthermore the students had also indicated in the ‘Resources’ domain that Economics textbooks were hard to understand and were seldom used in class.
At the individual statements, 87% of the students always did their best when doing Economics exercises, 80.5% kept neat files of their Economics teachers’ handouts and notes, 73.2% liked to ask their teacher about Economics and 52% referred to Economics textbooks to understand Economics concepts. This shows that students put some effort in studying Economics. They knew that Economics was a tough subject. They organized their materials. They consulted teachers when they needed assistance.

However only 33.3% of the students had bought any extra Economics books. This is to be expected as there is a limited availability of ‘O’ level Economics books in the local book shops. 53.7% seldom practiced drawing Economics graphs and diagrams on their own. This might indicate students’ lack of understanding of Economics graphs and diagrams. Teaching styles were mentioned in the open-ended questions and interview as the students’ main concern in understanding Economics. If they understood the graphs and diagrams, it would in turn make it possible for the students to practice drawing and explaining it on their own. This shows that teachers should spend more time taking them through the graphs and diagrams in their Economics lessons.

In their interviews, when asked about their strategies to increase understanding of Economics, several students stated that they asked their teacher during and/or after the class. Some read from the teachers’ notes and even tried to make their own notes from the lessons and the Economics textbooks. They used dictionary to understand difficult words. They sometimes summarized the teachers’ notes. Others just listened to the explanation in class and they also studied on their own at home. Mind mapping was used by a few students. Students discussed amongst themselves when revising for examination. A few students admitted that they needed to improve their command of English. However, only a few students used the Economics textbooks. One student tried to listen to business news for current issues.

When asked whether they would continue to take Economics at ‘A’ level, a few stated that they would continue. Reasons given were that they liked to learn about business, they dreamt of setting up own business and wanted to pursue their future career. However most students would not take Economics at ‘A’ level because it was too difficult for them. It would be even more difficult at a higher level. Some students would take Economics if their coming ‘O’ level Economics result was good, if their Science subjects result was not good enough or if there were no other options. One student hoped that Economics subject would get easier. Some students were more interested in Science than in business. A few found Economics interesting.

‘Friends Supports’ also have a relatively high positive attitude with a mean of 2.71. This domain looks at students’ interaction with friends and the amount of support they gave each other. Students seemed to depend on their friends for help in understanding Economics. They like to discuss amongst their friends as indicated in the interviews. Friends also helped them when seeing the Economics teacher for further explanation.

At the individual statements level, 84.5% of the students like to discuss Economics with friends, 69.1% studied Economics together before an examination and test, 62.6% stated that they could always depend on friends to help in Economics and 59.4% always saw the Economics teacher with their friends if they had problems. This shows a high dependence on their friends’ help in learning Economics. However 53.6% stated that their friends seldom encouraged them to do their best in Economics exercises and 51.2% stated that their friends seldom reminded them about Economics homework.
In the students’ interview, when asked about friends’ encouragement, some students stated that their friends did encourage them to take Economics or at least try it but some friends warned them about it’s difficulty. Several students thought that some of their friends liked Economics only in the beginning. Several of their friends stated that the other optional subjects were much easier to learn and to score in examination. Students also mentioned about the Economics teachers’ strict marking of Economics papers.

Nature of Economics domain had a mean of 2.70, which indicates students’ highly positive attitude. This is supported by other findings that students’ exposure to Economics content improves their attitudes toward the subject (ATE) (Walstad & Soper, 1989).

On the individual statements, 68.3 % of students found larger concepts like government policies interesting and 78.1 % agreed that smaller concepts like division of labour are interesting. This shows that Economics students tend to like both the micro and macro aspects of Economics. Furthermore, 74.8 % understand more than half of the Economics concepts they have learned and 69.9 % found counting values in Economics not difficult. However 52.1 % found it hard to understand Economics graphs and 56.9 % had problem in understanding Economics language. This shows that the students who were weak in English language found it difficult to understand Economics concepts.

‘Competition from Other Subjects’ domain had a mean of 2.57. This could indicate that there were some students interested in Economics and the attractiveness of other subjects was not that strong. A likely reason might be that their actual exposure to the subject had created an interest and the desire to know more about the subject. The students’ perceived usefulness of the subject compared to Computer and Geography might be due to their understanding that Economics is all about business. In choosing a subject, the greater the comparative difficulty of Economics the more likely students will choose science and arts (Ashworth & Evans, 2001).

In the individual statement, 75.6 % of Economics students agreed that Economics is more useful than Computer studies, 59.3 % stated that Economics is more interesting than History and 52.8 % agreed that Economics is more relevant to life than Geography. However 50.4 % found Mathematics to be much easier than Economics, 61.8 % stated that that Economics is more difficult than English language and 69.1 % found that Science is more interesting than Economics. This is the same as Peterson (1992) study, where academically better students perceived the quality and usefulness of Economics are lower relative to other subjects especially science subjects, which were considered to enhance students’ marketability.

In the students’ ranking of Economics subject against other twelve subjects, 19 students (15.4 %) ranked Economics as their fifth favourite subject. 18 students (14.6 %) ranked Economics as their fourth favourite subject. Overall 52.8 % of the Economics students ranked Economics subject in their top five subjects.

In the interview, when asked why they chose Economics, some students stated that they chose Economics to avoid the other option subjects on offer. Others stated that they wanted to continue lower secondary Commerce and do business related subject, while some students took Economics because of their poor results in their lower secondary commerce. Some took Economics because they did not study Commerce in lower secondary and wanted to avoid Commercial Studies that was option with Economics. Some just decided to try Economics because it seemed interesting and was a new subject for them. One school makes Economics compulsory for one class. If given a choice, these
students might not have opted for Economics. However, some students regretted taking Economics.

‘Teaching Methods’ domain had a mean of 2.56, a relatively high positive students’ attitude. However the mean was third lowest after ‘Parents’ Supports’ and ‘Resources’. This could indicate that improvement in teaching methods is needed to increase students’ understanding of Economics. The more students understand the more they tend to like the subject (Walstad, 1987). Economics concepts are abstract in nature and require students’ hands-on experience of these concepts through demonstration, project work and research. The students’ low positive attitude towards the ‘Difficulty of Economics’ domain earlier might be attributed to the teaching methods used in class. Using appropriate teaching methods and materials for studying Economics concepts, behaviour and process in classroom would enhanced motivation and interest in learning the subject (Chizmar, McCarney, Halinski & Racich, 1985). Varieties in teaching styles will cater all types of learning styles thus improve student’s understanding of Economics (Wetzel, Potter & O’Toole, 1982)

At the individual statements, 85.4 % of Economics students agreed that teaching done involves discussion and giving local examples. However 72.3 % stated that Economics lessons are seldom being taught using a computer. The lack of computer usage in Economics lessons may be due to the limited availability of computers in schools. While, 60.9 % stated that they seldom do group work, 50.4 % stated that Economics concepts are seldom demonstrated in class and 64.2 % said that they are seldom given project work in Economics. This could be due to the fact that there are a lot of topics to be covered in a limited time and the students have only five to six periods a week for Economics.

In the interview, asked about class activities or teaching methods used by the teacher that helped improve their understanding of Economics, students indicated that they sometimes did group work in class. One student stated that demonstration of Economics concepts in class increased their understanding. Other mentioned the use of projector and laptop in class. Using examples especially local examples did increase students’ understanding. However some stated that because of too much explanation and too many examples given in class the teacher was not able to finish the lesson. Several teachers asked students to make their own notes from textbooks. Teachers also did use articles from newspapers in the lessons. Students also suggested doing school visits.

Unfortunately in some schools, some students reported that teachers just did normal traditional teaching. Teacher did not set group work but encouraged more class discussion. As a result some students were not satisfied most of the time as they did not understand the lesson fully. This is similar to the finding that lecturing was the most frequently used teaching method, followed by class discussion and group problem solving (Jensen & Owen, 2001).

In the open-ended questions analysis, when asked how the teachers could improve the students’ understanding of Economics, a total of 207 responses were gathered from students. 15 responses (7.2%) stated that class activities, such as projects, research, group work and presentations would increase their understanding of the Economics concepts. Any activities that engaged in discussion was seen as motivating and stimulating students’ thinking about the topics. Some 13 responses (6.3%) stated that computer and power point presentations and other various teaching aids did increase their understanding of Economics. Revision was seen as valuable items for some students, 12 responses (5.8%).
Extra classes and tuition were stated by 11 responses (5.3%). Some 8 responses (3.9%) requested that teachers become bilingual when teaching the lessons. But this is just a small percentage of the student sample. This is to be expected as Economics subject is usually given to high ability students in the schools. Some 7 responses (3.4%) stated that educational visits where they could see the Economics concepts at work was needed. Teachers could also try to demonstrate Economics concepts in class or relate concepts to daily situations. The least teachers could do was watch documentaries and discuss them with the students. All this would help to motivate and increase students’ curiosity and interest in the subject and make the lessons more interesting to them.

‘Parents’ Supports’ can be defined in terms of giving advice and encouragement to students, in providing relevant materials for learning, checking students’ school work and sending students to attend tuition and extra classes. In the ‘Parents’ Supports’ domain, students had slightly lower positive attitude with a mean of 2.38. This indicates moderate involvement of parents in their children’s Economics education. Most parents had little knowledge of Economics subject thus did not see it as an important subject. Therefore they were most unlikely to send their students to extra classes or tuition.

At the individual statements, 62.6 % stated that parents always provided them with things they needed for their Economics class, 45.5 % stated that parents seldom gave support and motivation when they had difficulty studying Economics and 49.6 % stated that their parents seldom checked their Economics books. This shows a moderate involvement by parents in the students’ Economics education. Further evidence shows that 74.8 % stated that their parents did not send them to extra classes and tuition in Economics. While, 66.6 % also stated that their parents seldom try to help them when they were doing their Economics homework and 56.1 % stated that their parents seldom advised them to study hard on Economics. This might indicate that the parents only had limited knowledge of what Economics is all about as mentioned in the open-ended questions and interviews. Parents need to be discuss post high school plans and have high expectation for students achievements (Desimone, 1999).

In the students’ interview, when asked whether their parents encouraged them to take Economics, most students stated that their parents were neutral, neither encouraging nor discouraging them. Some stated that their parents’ did not know anything about Economics and let them choose whatever subjects they want. However some parents did encourage them to take Economics to learn about business and for future jobs. Parents also asked students to try their best in Economics subject. One student even mentioned that his mother did well in Economics during her school days. However some parents did not encourage students to take Economics.

‘Resources’ are the Economics textbooks, articles from magazines, audio visual materials, computers and the internet that might be used by the students in learning Economics. ‘Resources’ domain had the lowest positive attitude with a mean of 2.07. Two items in this domain had a negative mean below 2.0. This might indicate that resources such as textbooks are not suitable for the students or seemed difficult for them to use. Computer, internet and audio visual materials were seldom used. It could also mean that teachers are not making use of it or setting work for students involving research using the internet. Schools should invest more in resources like these to help improve students’ learning.
At the individual statement, 95.2% of the students did not watch documentaries on Economics topics in the Audio Visual Aids room and 85.4% stated that they did not use the computer room to learn Economics. This might be due to the non-availability of the Audio Visual Aids room and computer room for use as well as the lack of secondary resources such as Economics interactive software and documentary videotapes. However, 68.3% of the students found the Economics textbooks were too difficult to understand and 53.7% stated that Economics textbooks were seldom referred to in class. This might be due to the fact that updated Economics textbooks were not available as mentioned by some teachers and students in the interviews. This could also be due to the students’ weak command of the English language that caused them not to read the textbook. Furthermore, 55.3% of the students stated that they seldom learned Economics using articles from newspapers and magazines. This could be attributed to the teachers’ style of teaching. While, 65.9% never use the internet for their Economics exercises and projects.

In the students’ interview, when asked about their learning strategy used, some students stated that they read the notes given by the teachers. Some used both Economics textbooks and teachers’ notes while others had not opened the Economics textbooks at all. They stated that their textbook was out of date and damaged. Some students were told by the teachers to refer to the teachers’ notes not the Economics textbook. Several students found the Economics textbooks hard to understand and preferred to read teachers’ notes instead. Some students even found their siblings’ and relatives’ notes and past examination papers more useful.

When asked if they had used the internet for Economics, most students stated that they had not used the internet for Economics. A few did try to use it for Economics especially when asked by the teacher to make their own notes. Several students had tried to read newspapers and magazines related to Economics. Others referred to their commerce books of previous classes. A few tried to watch the business news.

With regards to gender, in the table above we can see that both boys and girls seemed to have positive attitude towards all the factors influencing attitude with overall mean values of 2.62 and 2.61 respectively. Both seemed to understand most of the Economics content taught, with mean values of 2.71 and 2.70 respectively. Both boys and girls also seemed to favour Economics to most of the other subjects taken. The mean for ‘Competition from other Subjects’ for boys was 2.62 and girls was 2.53. ‘Class Environment’ too had higher means for both boys and girls, with mean values of 2.89 and 2.91 respectively. These indicate that students felt that their class was conductive to learning. Regarding teaching methods being used, both boys with mean 2.57 and girls with mean 2.56 seemed to indicate their exposure to various teaching methods. This contradict the findings that Economics topics and teaching methods are not appealing to female students which caused a decline in their number taking the subject (Feiner & Roberts, 1995) and that the teaching method and evaluation instruments favour male learning styles (Becker, 1997; 2000) (cited in Jensen & Owen, 2001).

However ‘Resources’ factor showed very low positive attitude. Both boys and girls had lower mean values of 2.12 and 2.03 respectively. This was expected as resources such as textbooks are seldom used or bought as students relied most heavily on teachers’ supports, with mean values of 2.80 for boys and 2.93 for girls. Girls seemed to depend more on their teachers than boys. But this could also indicate that teachers gave more attention to girls when compared to boys. Girls also seemed to depend more on their friends’ supports than
boys, with mean values of 2.74 against 2.65. This could also mean that girls were actively engaged in learning with their friends than boys.

There was low positive attitude towards 'Parents' Supports'. The mean was 2.45 for boys and 2.34 for girls. The possible reason was that parents were not fully aware of what Economics subject was all about and thus could not provide full support to the students in their work and in providing motivation. Students seemed to put more effort in learning Economics with mean of 2.79 for boys and 2.72 for girls.

However the differences in means for all domains above were not statistically significant. Thus we can assume that there were no differences in attitudes between boys and girls towards most of the factors influencing attitude towards Economics subject.

Conclusion

Attitude towards Economics subject has been a concern for Economics teachers. The number of students choosing to learn Economics has been declining throughout the years in a majority of secondary schools in Brunei Darussalam. This year, 2006, there are only 11 schools offering Economics at Form Four level. Some schools have stopped offering the subject for various reasons. The most obvious reason is the decline in the number of students wanting to learn Economics. Therefore assessing the current attitudes of students toward Economics subject is seen as an appropriate first step in finding a solution for the problem. Knowing what the students’ perceptions, thoughts and feelings are towards the Economics subject will enable policy makers to formulate solutions that would promote positive students’ attitudes towards the Economics subject.

A number of conclusions can be derived from the study. First, the evidence seems to suggest that Economics students do have a positive attitude towards Economics subject. They saw the usefulness and practicality of Economics knowledge taught and they also enjoyed learning it. Most Economics students experience some difficulty of the subject. Between the high, average and low achievers the difficulty difference was significant at 0.05 level.

Secondly, selection of students taking Economics might be necessary. Schools need to offer Economics to those students with good results in English and Mathematics. This would ensure better examination results of Economics. In the study high achievers viewed Economics as usefulness and experience the least difficulty in learning it compared to the average and low achievers. This might indicates their understanding of the lessons taught, which can be attributed to their good command of the English language.

However giving basic Economics knowledge to the general population might also be important to ensure some understanding of the working of the economy. Furthermore it might help to reduce the current problems and issues such as unemployment and debts problems or at least ensure some effectiveness of any economic policies undertaken by the government. In the study, low achievers did show greater enjoyment learning Economics than high and average achievers. However giving opportunities to learn Economics to every student would require schools and Economics teachers to develop better methods of teaching Economics. A variety of teaching methods should be used to help all students understand Economics concepts. Schools need to implement staff professional development programs to improve Economics teachers’ content and teaching skills. In the
interviews, students indicated that they had positive attitude towards Economics as a subject. Most stated that they were interested in the subject although some became less interested after actually learning it.

In the study, boys had more positive attitude towards Economics subject than the girls, with means of 2.90 and 2.83 respectively. Boys see the usefulness of Economics and experience less difficulty learning it. However, both boys and girls seemed to enjoy the subject equally, with means of 2.64 and 2.63 respectively. However the differences between boys and girls were all not significant. All this shows that both boys and girls have equal ability to learn Economics. Appropriate teaching methods that provide greater involvement for the girls might be appropriate in improving their understanding and to see the usefulness of the economics concepts taught.

Thirdly, besides teaching methods, several other factors need to be considered in order to improve or at least sustain students’ positive attitudes towards Economics subject. Overall Economics students had positive attitude towards all these factors with a mean of 2.61 and a standard deviation of 0.26 for the whole instrument. Factors that had high students’ positive attitude were ‘Class Environment’, ‘Teacher Supports’, ‘Students’ Efforts’, ‘Friends’ Supports’ and ‘Nature of Economics’. Their means were 2.90, 2.88, 2.74, 2.71 and 2.70 respectively. Moderate positive attitudes were for ‘Competition from Other Subjects’ and ‘Teaching Methods’ with means of 2.57 and 2.56 respectively. While ‘Parents Supports’ and ‘Resources’ had the lowest positive attitude with means of 2.38 and 2.07 respectively.

The study shows that class environment and supports from Economics teachers seemed to influence students positively. This suggests that teachers should pay more attention to the classroom conditions and provision of resources and assistance to the students. Students did indicate their own efforts in trying to improve their understanding of Economics. Support from friends was high as was indicated in the students’ interviews. Students also seemed to like the content of Economics subject. This further proved that most Economics students were still interested in the subject.

Unfortunately only few parental supports were mentioned by the students. In the interviews some students stated that their parents did not have anything to say about Economics when asked for their opinion. Parents themselves may not have been exposed to Economics subject so they could not provide encouraging support and motivation to the students.

Most students seemed to use few resources such as internet and Economics textbook in learning Economics. Students were mostly dependent on teachers’ notes. This might also indicate the students’ lower command of the English language. However students and teachers do indicate that good Economics textbooks are hard to find and some were provided with outdated materials.

With regard to achievers types, high achievers were more influenced by these factors with a mean of 2.70 than the average and low achievers with means of 2.56 and 2.66 respectively for the whole ‘Factors Influencing Attitudes’ instrument.

Between the three groups, high achievers had high positive attitude towards ‘Teacher Supports’, ‘Class Environment’, ‘Nature of Economics’, ‘Friends’ Supports’ and ‘Competition from Other Subjects’. Their means were 3.07, 3.06, 2.84, 2.77 and 2.76 respectively. This shows that high achievers are highly influenced by their teachers, finds their class conducive to learning, understand most of the Economics content than the
average and low achievers. They were highly supported by friends and favour Economics more than most of the other subjects learned. The reasons might be that high achievers understand the lesson well and were active learners in class as well as in seeking assistance from teachers and friends.

Low achievers on the other hand had high positive attitude towards `Students Efforts’, `Teaching Methods’, `Parents Supports’ and `Resources’, with means of 2.89, 2.64, 2.50 and 2.18 respectively. This shows that low achievers put more efforts in learning Economics, were more affected by teaching method used, need supports and encouragement from parents and referred to resources more than the high and average achievers. This might indicates their weak command of English language that led them to understand less of the lessons taught and were exposed to various teaching methods in order to help them. This also caused them to resort to economics books and other resources and parents for supports. Their low self-esteem and shyness could also contribute to their action of not discussing economics problems with their friends and teachers.

However all the differences in means were not significant, except for `Competition from other Subjects’, `Teachers’ Supports’ and `Students’ Efforts’ which were significant at 0.01 level. `Nature of Economics’ and the instrument as a whole were significant at 0.05 level.

With regard to gender, there were similar positive attitudes between boys and girls in the overall attitude towards factors influencing attitudes. However, boys seemed to have a slightly more positive attitude than girls towards `Students’ Efforts’, `Competition from Other subjects’, `Parents Supports’ and `Resources’. Their means were 2.79, 2.62, 2.45 and 2.12 respectively.

Girls had slight positive attitude towards `Teachers’ Supports’, `Class Environment’ and `Friends’ Supports’ with means 2.93, 2.91 and 2.74 respectively. `Nature of Economics’ and `Teaching Methods’ had similar means. However the difference in means were not significant in all cases.

This shows that although boys and girls are similarly influence by all these factors, boys were working harder to understand Economics, prefer to study it, and resorts to parents supports and resources in learning Economics. This might explained their higher positive attitudes, their understanding of Economics usefulness and their experience of less learning difficulty than the girls mentioned earlier. Meanwhile, girls were mostly assisted by teachers, felt comfortable learning in class, and learn economics actively with friends. However both group equally influenced by the Economics contents and the teaching methods used.

Finally, all this puts the emphasis on the delivery methods of the subject in the classroom. Teachers have to develop more student friendly teaching techniques and use simpler language while teaching the subject. This could lead to an increase in enrollment number for the subject. Studying Economics might have an effect on young people’s understanding of economic issues which in turn prepare the future generation for the economics challenges ahead especially as Brunei is moving towards globalisation and diversification. Economic independence require economics literate population. This was important for Brunei Darussalam students as the country actual economic issues and problems were somewhat different than those learned in Economics lessons. Issues such as free medical care, low inflation, non-existence of income tax and financial market are a reality for Bruneian students. These economic issues seem to have little effect on the
students’ daily life, thus making it of less concern amongst the students. Teachers should developed lessons that make students understand, see and feel the effects of these economic issues. Appropriate teaching methods and materials on these economic issues might be considered.

In all, it is up to the education policy makers to decide either to make Economics as an option for students who are good at English and Mathematics subject which would ensure better student performance in Economics subject or to make Economics available to all students which would ensure a higher literacy of economic issues among the population. However either decision would still require the development of better teaching methods and improvement of the other attitudes influencing factors so as to attract more students and improve their understanding of Economics.

References


Anxieties and concerns of science student teachers before and after teaching practice

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Universiti Brunei Darussalam

Abstract
Teaching practice is an integral component of teacher education programme. It provides an avenue for student teachers to experience teaching in a real classroom setting. Under the watchful eyes and professional guidance of the university supervisors and cooperating teachers they are expected to gain confidence and develop effective teaching skills. The demands and expectations placed on teaching practice cause great anxiety and concern for student teachers. However, to date no research has been done in this important area in the local context. The present study investigated causes of anxiety and concern of student teachers before and after teaching practice. The study involved student teachers who were enrolled in the Bachelor of Education (General Science) programme. The same questionnaire was given to the students in the first semester when they have just started the first year course and again after they have completed their teaching practice in the second semester of the fourth year course. Results showed that there were no significant differences in student teachers’ anxieties and concerns before and after school experience. Student teachers in both stages were found to be moderately anxious and concerned about teaching practice. In terms of anxiety, the highest was found to be evaluation anxiety, followed by class control anxiety, professional preparation anxiety and school staff anxiety. In terms of student teachers’ concern, results showed that impact concerns were the greatest concerns, followed by self concerns and task concerns. The study extends our understanding of the underlying fears and stresses which student teachers have on teaching practice. Such information is invaluable for teacher educators so that appropriate interventions could be taken to address some of the areas of anxiety and concern that have been discerned from this study.

Introduction
Fundamental to teacher education is the process of learning to teach in the real classroom settings. As such teaching practice (TP) plays an important role in providing adequate professional experience to enable student teachers (STs), when they graduate and go into their profession, to have a first-hand experience of what it is like to be a teacher. As well as providing an actual teaching setting, TP is reported to shape preservice teachers’ attitudes, values and beliefs about teaching (Darden, Scott, Darden and Westfall, 2001; Deng and Gopinathan, 2003; Koskela and Ganser, 1998), and to provide STs’ need for experience in emotional involvement, personal and professional growth and one-on-one teaching encounters (Henry, 1989).
Furthermore, Chepyator-Thomson and Liu (2003) added that TP provides preservice teachers the opportunities to practice skills of teaching, learn to design and implement curricular activities, work with school administrators and staff members, and get along with students of different physical abilities and cultural differences.

TP is, undoubtedly, an arduous endeavour which requires STs to expense a considerable amount of energy, effort and time. Its complexity and demanding nature also means that STs will require a great deal of attention, guidance and encouragement during this learning process. In this respect, university supervisors (USs) and cooperating teachers (CTs) have an overwhelming responsibility because their influence on developing STs’ classroom competence has a far-reaching effect long after they have left the teacher education institution. Kahan, Sinclair, Saucier and Caiozzi, (2003) suggested that the triad relationship formed between STs, USs and CTs is an important aspect of student teaching experience and that they should work closely together so that STs be given adequate guidance and advice on selecting appropriate curricular materials for lesson presentation.

Many studies have reported that USs have a profound and immediate impact on the nature and quality of the outcomes of the TP experience (Lombardi, 2001; Rikard and Veal, 1996; Turney, Eltis, Towler and Wright, 1985; Shuval and Adder, 1983; Waite, 1992; Zeichner, Liston, Mahlios and Gomez, 1988). In contrast, Tjeerdsma (1998) and Woods and Weasmer (2003) reported that CTs have much greater influence on the outcome of the mentorship than the USs. They reasoned that STs have daily contact and, hence, spent more time with CTs than with USs. Similarly, the much greater influence of CTs on preservice experience has also been reported by Borko and Mayfield (1995) in their studies on STs, and by McIntyre, Byrd and Foxx (1996) in their studies on practising teachers. A study conducted by Richardson-Koehler (1988) revealed that 80% of STs believed their teaching knowledge and practices were attributed to CTs. Furthermore, Pellet, Strayve and Pellet (1999) reported that the influence of CTs extends beyond classroom instruction. They observed that CTs also influence STs with a myriad of other subtle behaviours like clothing selection, grooming, conduct and language beside formal classroom techniques.

Studies have also shown that there are great differences between USs and CTs in their written feedback about STs’ performance. Burton, Stimpson and Lopez-Real (2002) and Glenwright (1999) examined the TP supervision reports by USs and found that most feedback on lessons was judgmental in nature expressing approval, reservations or criticisms, and giving advice and suggestions. On the other hand, Kahan et al (2003) analysed the feedback profiles of CTs and found that they generally focused on management and presentation of subject matter teaching behaviours and gave more positive than corrective feedback. Studies conducted by Richardson-Koehler (1988) and Zahorik (1988) revealed that the influence of CTs’ feedback has a greater impact on the STs than that of the USs. Evidence discerned from these studies illustrated that there are indeed marked differences in expectations and demands of USs and CTs.

The high expectations of USs and CTs inevitably make TP extremely stressful for STs since they have very limited knowledge and practice to cope with the realities of teaching and life of a school. TP is, therefore, extremely demanding given the many facets of responsibilities in which they have to demonstrate sufficient teaching skills and at the same time to satisfy the expectations of the USs and CTs.
Many studies have shown that STs are anxious and apprehensive about TP. For example, Downing (1998) had identified feelings of fear, conflict and tension were common problems faced by beginning teachers on TP. Capel (1997) reported that TP is a cause of anxiety and concern for STs. She found that STs were most anxious about being observed, evaluated and assessed by USs while teaching. In a study, Behets (1990) reported that getting or keeping pupils quiet and how to respond to pupils’ behaviour in class were the greatest concerns expressed by STs. Others had reported that there were conflicts between meeting the requirements of USs and their personal need on one hand (Serpell, 2000) and tensions between insufficient supervision and the assessment of their teaching on the other (Martinez, 1994).

The purpose of this study was to investigate and identify causes of STs’ anxiety and concern before and after their first TP experience. Such information would enable teacher educators to provide appropriate interventions during the initial teacher education courses to help them better cope with the anxieties and stresses of TP when it actually happens in the classroom.

Method

Sample
Students enrolled in the Bachelor of Education (General Science) were selected for the study. This is a four-year programme, and on completion, they will be employed as secondary science teachers teaching Integrated Science to Form 1-3 students as well as teaching Combined Science to Form 4-5 students. Each year this programme attracts only a small number of students due to its entry requirements. Students have to study two of the three science disciplines depending on their science achievement at A-level. In this study only those taking biology were involved. In 2002 cohort, 45 students took biology and the questionnaire on TP was administered to them in the first week of the semester when they have just started their first-year course. This cohort of students were give the same questionnaire four years later after they have completed their first TP in the second semester of the forth year course. Out of the 45 students in this group only 33 students managed to respond and return the questionnaire after TP.

Questionnaires
The questionnaire consisted of 3 parts. Part 1 was to find out STs’ background such as sex and age.
Part 2 was to measure STs’ anxieties about TP. The items were adapted from the Student Teacher Anxiety Scale (STAS) in which the present version has 27 items (Hart, 1987 cited in Capel, 1997). The items were categorised into 4 scales such as evaluation anxiety, class control anxiety, professional preparation anxiety and school staff anxiety Table 1 showed the scales, descriptions and examples of test items in STAS. Each of the scales has 10, 5, 8 and 4 items respectively. The items were scored on a scale of 1 to 5 in which 1 was for items which they considered not anxious, 2 for slightly anxious, 3 for moderately anxious, 4 for very anxious and 5 for extremely anxious about TP.
Part 3 consisted of 15 items to measure STs’ concerns and this was adapted from the Teacher Concerns Questionnaire (TCQ) developed by George (1978 cited in Capel, 1997).
The items were categorised into 3 scales, namely, impact concern, self concern and task concern with each having 5, 4 and 6 items respectively. Table 2 showed the scales, descriptions and examples of test items in TCQ. The items were scored from 1 to 5 in which 1 for items they considered not concerned, 2 for slightly concerned, 3 for moderately concerned, 4 for very concerned and 5 for extremely concerned about TP.

**Table 1** Scale, description and sample test items in STAS

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
<th>Sample item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation anxiety</td>
<td>Extent to which STs are anxious about being observed, evaluated and assessed by supervisor and cooperating teacher.</td>
<td>Wondering how the TP is going in my supervisor’s eyes.</td>
</tr>
<tr>
<td>Class control anxiety</td>
<td>Extent to which STs are anxious about controlling misbehaviours and discipline problems in class.</td>
<td>How to handle disobedience from a student.</td>
</tr>
<tr>
<td>Professional preparation anxiety</td>
<td>Extent to which STs are anxious about preparing lessons which are adequate, appropriate and suitable for the level.</td>
<td>Whether or not my scheme of work is adequate.</td>
</tr>
<tr>
<td>School staff anxiety</td>
<td>Extent to which STs are anxious about getting cooperation from teachers in school.</td>
<td>How helpful members of the school may be</td>
</tr>
</tbody>
</table>

**Table 2** Scale, description and sample test items in TCQ

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
<th>Sample item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact concerns</td>
<td>Extent to which STs are concerned about motivating and giving attention to students in learning.</td>
<td>Guiding students towards intellectual and emotional growth.</td>
</tr>
<tr>
<td>Self concern</td>
<td>Extent to which STs are concerned about gaining acceptance and approval from teachers and supervisors.</td>
<td>Feeling more adequate as a teacher.</td>
</tr>
<tr>
<td>Task concern</td>
<td>Extent to which STs are concerned about organising and maintaining the rigor of teaching.</td>
<td>Too many lessons to teach in a day.</td>
</tr>
</tbody>
</table>
Results and discussion

Reliability of STAS and TCQ

Cronbach’s alpha coefficients were calculated to estimate the internal consistency of the instruments. Values obtained for STAS ranged from 0.71 to 0.90 (Table 3) and for TCQ ranged from 0.70 to 0.86 (Table 4). The instruments, therefore, were considered suitable for the purpose of the present study.

Table 3  Cronbach’s alpha for the four anxiety scales in STAS

<table>
<thead>
<tr>
<th>Anxiety</th>
<th>Number of items</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation</td>
<td>10</td>
<td>0.90</td>
</tr>
<tr>
<td>Class control</td>
<td>5</td>
<td>0.89</td>
</tr>
<tr>
<td>Professional prep.</td>
<td>8</td>
<td>0.87</td>
</tr>
<tr>
<td>School staff</td>
<td>4</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Table 4  Cronbach’s alpha for the three concerns scales in TCQ

<table>
<thead>
<tr>
<th>Concern</th>
<th>Number of items</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact</td>
<td>5</td>
<td>0.86</td>
</tr>
<tr>
<td>Self</td>
<td>4</td>
<td>0.74</td>
</tr>
<tr>
<td>Task</td>
<td>6</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Anxieties of student teachers

The average item mean scores for the four anxiety scales were calculated and shown in Table 5. The data suggested that STs have a moderate level of anxiety about TP. In descending order, evaluation anxiety was found to be the most important, followed by class control, professional preparation and school staff. Results also showed that there was a slight decrease in evaluation and class control anxiety, and a slight increase in professional preparation and school staff anxiety after TP. Based on the t-values, no significant differences were observed in STs’ anxiety between the two stages (Table 5).

Table 5  Item mean scores for anxiety scales in STAQ before and after TP

<table>
<thead>
<tr>
<th>Anxiety</th>
<th>Before TP</th>
<th>After TP</th>
<th>t-value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Evaluation</td>
<td>3.71</td>
<td>0.61</td>
<td>3.48</td>
<td>0.75</td>
</tr>
<tr>
<td>Class control</td>
<td>3.54</td>
<td>0.92</td>
<td>3.32</td>
<td>1.02</td>
</tr>
<tr>
<td>Professional prep.</td>
<td>3.22</td>
<td>0.76</td>
<td>3.23</td>
<td>0.95</td>
</tr>
<tr>
<td>School staff</td>
<td>2.69</td>
<td>0.92</td>
<td>2.88</td>
<td>0.88</td>
</tr>
</tbody>
</table>

Before TP (N) = 45; After TP (N) = 33
Evaluation anxiety

Under this scale, results in Table 6 showed that STs have a slightly lower level of anxiety after TP than before TP. However, t-values showed there were no significant differences in STs’ evaluation anxiety between the two stages with the exception of one item: STs after TP were found to be less anxious being observed by USs than before TP.

Results also showed that STs in both stages were more anxious of being evaluated by USs than by CTs. An item that caused the greatest anxiety was ‘Wondering how the teaching practice is going in the supervisor’s eyes’. Other items that caused high levels of anxiety were ‘Reaction of supervisor to unsuccessful lessons’, ‘Observation by supervisor while teaching’, ‘Assessment by supervisor’, ‘Expectation of supervisor’ and ‘What lessons the supervisor comes in to see’.

STs were found to be less anxious in the presence of CTs in the classroom during lesson. Among the items, ‘Wondering how the TP is going in the cooperating teacher’s eyes’ was the most important. This was followed by ‘Reaction of cooperating teacher to unsuccessful lessons’, ‘Assessment by cooperating teacher’ and ‘Wondering if the cooperating teacher is happy with the TP performance’ (Table 6).

The results indicated that the events that caused the most anxiety to STs were related to observation, evaluation and assessment by USs and CTs in their TP, and that they were found to be slightly more anxious in the presence of their USs than their CTs when they are teaching the lessons.

### Table 6  Means and standard deviations for each individual item in evaluation anxiety scale before and after TP

<table>
<thead>
<tr>
<th>Items</th>
<th>Before TP</th>
<th></th>
<th>After TP</th>
<th></th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wondering how the TP is going in the supervisor’s eyes.</td>
<td>4.13</td>
<td>0.76</td>
<td>3.82</td>
<td>0.95</td>
<td>1.57</td>
</tr>
<tr>
<td>Reaction of supervisor to unsuccessful lessons.</td>
<td>4.02</td>
<td>0.84</td>
<td>3.73</td>
<td>0.98</td>
<td>1.39</td>
</tr>
<tr>
<td>Observation by supervisor while teaching.</td>
<td>3.98</td>
<td>0.96</td>
<td>3.27</td>
<td>1.09</td>
<td>2.95**</td>
</tr>
<tr>
<td>Wondering how the TP is going in the cooperating teacher’s eyes.</td>
<td>3.76</td>
<td>0.88</td>
<td>3.48</td>
<td>1.06</td>
<td>1.29</td>
</tr>
<tr>
<td>Assessment by supervisor.</td>
<td>3.67</td>
<td>0.88</td>
<td>3.55</td>
<td>0.97</td>
<td>0.57</td>
</tr>
<tr>
<td>Reaction of cooperating teacher to unsuccessful lessons.</td>
<td>3.58</td>
<td>0.81</td>
<td>3.45</td>
<td>0.94</td>
<td>0.61</td>
</tr>
<tr>
<td>Expectation of supervisor.</td>
<td>3.58</td>
<td>0.92</td>
<td>3.70</td>
<td>0.88</td>
<td>-0.58</td>
</tr>
<tr>
<td>Assessment by cooperating teacher.</td>
<td>3.53</td>
<td>0.94</td>
<td>3.36</td>
<td>1.08</td>
<td>0.72</td>
</tr>
<tr>
<td>Wondering if the cooperating teacher is happy with the TP performance.</td>
<td>3.44</td>
<td>0.87</td>
<td>3.33</td>
<td>0.84</td>
<td>0.56</td>
</tr>
<tr>
<td>What lessons the supervisor comes in to see.</td>
<td>3.40</td>
<td>1.07</td>
<td>3.15</td>
<td>1.28</td>
<td>0.91</td>
</tr>
</tbody>
</table>
Class control anxiety

There were 5 items categorised under this scale. Results in Table 7 showed that STs before TP were slightly more anxious about class control that after TP. There were significant differences in one item on incidents of misbehaviour in class in which STs before TP were found to be more anxious than STs after TP.

It was also found that ‘Incidents of misbehaviour in class’ seemed to cause the greatest anxiety for STs before TP whilst ‘Class control’ was found to cause the greatest anxiety for STs after TP. Other events that cause moderate level of anxiety were related to ‘Problems of individual disruptive students’, ‘Controlling the noise level in class’ and ‘Handling disobedience from a student’.

Professional preparation anxiety

There were 8 items under this scale. STs after TP were found to be slightly more anxious about ‘Covering the material adequately’, ‘Getting all the paperwork done in time’, ‘Maintaining the standard of preparation’, ‘Completing lesson plan in the required form’ and ‘Selecting suitable lesson content’ than before TP. STs before TP were found to be most anxious about ‘Whether the scheme of work is adequate’ whilst STs after TP were most anxious about ‘Covering the material adequately’. However, no significant differences were observed in all the eight items in professional preparation anxiety before and after TP.

Table 7  Means and standard deviations for each individual item in class control anxiety scale before and after TP

<table>
<thead>
<tr>
<th>Items</th>
<th>Before TP</th>
<th></th>
<th>After TP</th>
<th></th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidents of misbehaviour in class</td>
<td>3.82</td>
<td>1.01</td>
<td>3.33</td>
<td>0.96</td>
<td>2.18*</td>
</tr>
<tr>
<td>Problems of individual disruptive students</td>
<td>3.53</td>
<td>1.06</td>
<td>3.30</td>
<td>1.13</td>
<td>0.91</td>
</tr>
<tr>
<td>Controlling the noise level in class</td>
<td>3.49</td>
<td>1.12</td>
<td>3.06</td>
<td>1.20</td>
<td>1.60</td>
</tr>
<tr>
<td>Handle disobedience from a student</td>
<td>3.47</td>
<td>1.08</td>
<td>3.18</td>
<td>1.10</td>
<td>1.14</td>
</tr>
<tr>
<td>Class control</td>
<td>3.38</td>
<td>1.07</td>
<td>3.39</td>
<td>1.22</td>
<td>-0.06</td>
</tr>
</tbody>
</table>
Table 8  Means and standard deviations for each individual item in professional preparation anxiety scale before and after TP

<table>
<thead>
<tr>
<th>Items</th>
<th>Before TP</th>
<th></th>
<th>After TP</th>
<th></th>
<th>$t$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Whether scheme of work is adequate.</td>
<td>3.36</td>
<td>0.86</td>
<td>3.18</td>
<td>1.10</td>
<td>0.75</td>
</tr>
<tr>
<td>Covering the material adequately.</td>
<td>3.33</td>
<td>0.88</td>
<td>3.61</td>
<td>1.03</td>
<td>-1.23</td>
</tr>
<tr>
<td>Getting all the paperwork done in time.</td>
<td>3.31</td>
<td>1.14</td>
<td>3.39</td>
<td>1.30</td>
<td>-0.29</td>
</tr>
<tr>
<td>Maintaining the standard of preparation.</td>
<td>3.27</td>
<td>0.99</td>
<td>3.39</td>
<td>1.11</td>
<td>-0.52</td>
</tr>
<tr>
<td>Setting work at the right level for students.</td>
<td>3.24</td>
<td>1.07</td>
<td>3.00</td>
<td>1.09</td>
<td>0.99</td>
</tr>
<tr>
<td>Giving students attention without neglecting others.</td>
<td>3.22</td>
<td>0.95</td>
<td>3.03</td>
<td>1.26</td>
<td>0.73</td>
</tr>
<tr>
<td>Completing lesson plan in the required form.</td>
<td>3.07</td>
<td>1.09</td>
<td>3.18</td>
<td>1.16</td>
<td>-0.44</td>
</tr>
<tr>
<td>Selecting suitable lesson content.</td>
<td>2.93</td>
<td>1.25</td>
<td>3.27</td>
<td>1.15</td>
<td>-1.24</td>
</tr>
</tbody>
</table>

School staff anxiety

There were 4 items under this category. Results indicated that STs were slightly anxious about their relationship with members of teachers in schools (Table 9). STs after TP were slightly more anxious about ‘Cooperation with teachers in the school’, ‘How friendly members of the school staff may be’ and ‘Getting on with school staff’ than STs before TP. The item which described ‘How helpful members of the school staff may be’ was found to cause the highest anxiety for STs in both stages. No significant differences were observed in all the four items which indicated that STs’ anxiety on their relationship with teachers in school was the same before and after TP.

Concerns of student teachers

The item mean scores were calculated and presented in Table 10. From the data, it was found that impact concerns have the highest item mean score followed by self concerns and task concerns. This suggested that STs before and after TP were slightly more concerned about their students’ learning than their teaching performance and the nature of the teaching task. There were, however, no significant differences in STs’ concerns between the two stages.
Impact concerns

There are 5 items under this scale (Table 11). Results showed that the greatest impact concern for STs before and after TP was ‘Whether students get the attention they need’. It was also found that there was a slight increase in three of the five impact concerns after TP and the items were: ‘Whether students get the attention they need’, ‘Meeting the needs of different kinds of students’, and ‘Guiding students towards intellectual and emotional growth’. In contrast, ‘Challenging unmotivated students’ and ‘Diagnosing student learning problems’ showed a slight decrease in impact concerns after TP. Analysis of variance to test significant changes, however, showed no significant differences in impact concerns before and after TP (Table 11).

Table 9  Means and standard deviations for each individual item in school staff anxiety scale before and after TP

<table>
<thead>
<tr>
<th>Items</th>
<th>Before TP</th>
<th>After TP</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>How helpful members of the school staff may be.</td>
<td>3.04</td>
<td>2.97</td>
<td>0.35</td>
</tr>
<tr>
<td>Cooperation with teachers in the school</td>
<td>2.62</td>
<td>2.82</td>
<td>-0.73</td>
</tr>
<tr>
<td>How friendly members of the school staff</td>
<td>2.62</td>
<td>2.67</td>
<td>-0.21</td>
</tr>
<tr>
<td>Getting on with school staff</td>
<td>2.47</td>
<td>2.70</td>
<td>-0.95</td>
</tr>
</tbody>
</table>

Table 10  Item mean scores for concern scales in TCQ before and after TP

<table>
<thead>
<tr>
<th>Concern</th>
<th>Before TP</th>
<th>After TP</th>
<th>t-value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact</td>
<td>3.77</td>
<td>3.82</td>
<td>-0.29</td>
<td>0.77</td>
</tr>
<tr>
<td>Self</td>
<td>3.59</td>
<td>3.57</td>
<td>0.15</td>
<td>0.88</td>
</tr>
<tr>
<td>Task</td>
<td>3.57</td>
<td>3.36</td>
<td>1.56</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Before TP (N) = 45; After TP (N) = 33

Self Concerns

Under self concerns, STs before TP were found to have the greatest concern for ‘Getting a favourable evaluation for my teaching’ whilst after TP they were found to have the greatest concern for ‘Doing well when a supervisor is present’ (Table 12). STs after TP were also found to have a slightly less concern for ‘Being accepted and respected by teachers in school’ and ‘Getting a favourable evaluation for my teaching’. Results also showed that there were no significant differences in self concerns for STs between the two stages of TP.
Table 11  Means and standard deviations for each individual item in impact concern scale before and after TP

<table>
<thead>
<tr>
<th>Items</th>
<th>Before TP</th>
<th></th>
<th>After TP</th>
<th></th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Whether students get the attention they need.</td>
<td>3.91</td>
<td>0.87</td>
<td>3.97</td>
<td>0.73</td>
<td>-0.32</td>
</tr>
<tr>
<td>Challenging unmotivated students.</td>
<td>3.87</td>
<td>0.84</td>
<td>3.79</td>
<td>0.78</td>
<td>0.43</td>
</tr>
<tr>
<td>Diagnosing student learning problems.</td>
<td>3.76</td>
<td>0.91</td>
<td>3.70</td>
<td>0.77</td>
<td>0.31</td>
</tr>
<tr>
<td>Meeting the needs of different kinds of students.</td>
<td>3.71</td>
<td>0.99</td>
<td>3.73</td>
<td>0.72</td>
<td>-0.08</td>
</tr>
<tr>
<td>Guiding students towards intellectual and emotional growth.</td>
<td>3.62</td>
<td>0.94</td>
<td>3.91</td>
<td>0.80</td>
<td>-1.45</td>
</tr>
</tbody>
</table>

Task Concerns

The results (Table 13) indicated that STs before and after TP were moderately concerned on all the 6 items placed under this scale. The foremost, and which caused the greatest concern was ‘Lack of instructional materials’. Results also showed there was a slight decrease in task concerns after TP on six of the seven items. One item, however, showed a significant increase after TP and the concern was ‘Too many lessons to teach in a day’ (Table 13).

Table 12  Means and standard deviations for each individual item in self concern scale before and after TP

<table>
<thead>
<tr>
<th>Items</th>
<th>Before TP</th>
<th></th>
<th>After TP</th>
<th></th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Getting favourable evaluation for my teaching.</td>
<td>3.69</td>
<td>0.87</td>
<td>3.58</td>
<td>0.78</td>
<td>0.57</td>
</tr>
<tr>
<td>Doing well when a supervisor is present.</td>
<td>3.71</td>
<td>1.22</td>
<td>3.97</td>
<td>0.81</td>
<td>-1.12</td>
</tr>
<tr>
<td>Feeling more adequate as a teacher.</td>
<td>3.44</td>
<td>1.03</td>
<td>3.45</td>
<td>0.83</td>
<td>-0.05</td>
</tr>
<tr>
<td>Being accepted and respected by teachers.</td>
<td>3.51</td>
<td>1.10</td>
<td>3.27</td>
<td>0.72</td>
<td>1.16</td>
</tr>
</tbody>
</table>
Table 13 Means and Standard Deviations for Each Individual Item in Task Concern Scale before and after TP

<table>
<thead>
<tr>
<th>Items</th>
<th>Before TP</th>
<th>After TP</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of instructional materials.</td>
<td>4.02</td>
<td>3.94</td>
<td>0.42</td>
</tr>
<tr>
<td>Maintaining appropriate degree of class control.</td>
<td>3.82</td>
<td>3.70</td>
<td>0.58</td>
</tr>
<tr>
<td>Routine and inflexibility of teaching.</td>
<td>3.60</td>
<td>3.42</td>
<td>0.90</td>
</tr>
<tr>
<td>Working with too many students each day.</td>
<td>3.29</td>
<td>3.12</td>
<td>0.69</td>
</tr>
<tr>
<td>Too many lessons to teach in a day.</td>
<td>3.58</td>
<td>2.85</td>
<td>2.73**</td>
</tr>
<tr>
<td>Feeling pressure much of the time.</td>
<td>3.31</td>
<td>3.12</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Conclusion

Results of this study showed that STs were moderately anxious and concerned about TP. This concurred with the results reported by Capel (1997) in her studies with first- and second-year physical education students.

STs’ level of anxiety and concerns showed no significant differences before and after TP. In both stages STs were found to have the highest anxiety on evaluation, followed by class control, professional preparation and school staff. Results of the STAS showed that there were a number of specific causes of anxiety of STs. Being observed, evaluated and assessed by USs and CTs seemed to cause the greatest anxiety for STs before and after TP. They were, however, more anxious of being judged by USs than by CTs. The reason could be partly due to the more stringent approach of USs on assessing STs’ teaching performance during TP. Ideally, USs should be more understanding and sympathetic towards STs at this crucial time during which they learn the pragmatic aspect of teaching. USs and STs should work together so that the latter can gain a practical experience that is enjoyable, exciting and rewarding. Unlike USs, STs were found to be less anxious in the presence of CTs. This may be because CTs know the prevailing culture of the school, and hence, are in a better position to help STs with their needs.

At present, there is a move towards gradually increasing the role of CTs in the professional development of STs. This is already happening in England and Wales where schools are given a greater role in the training of teachers (Mau, 1997). In the local context, however, more needs to be done if CTs were to play a more effective role in school experience for STs. As expressed by Tannehill and Goc-Karp (1992) that, too often than not, CTs were selected based on their teaching expertise and not for their supervisory expertise. For this reason, they recommended that CTs should be given a supervision course so that they would be familiar with their responsibilities. Another problem as
identified by Kahan et al (2003) was that CTs might not be able to offer sound advice to STs during TP that subscribes to the philosophy and practice of university lecturers.

Class control was found to be another source of anxiety for STs in both stages of TP. They were moderately anxious about handling misbehaviours, disobedience and disruptive students. McCormack and Thomas (2003) in their study with beginning teachers also reported that beginning teachers in Australia were concerned about discipline problems in class. Welsh (1996) reported that STs encountered some discipline problems in Bruneian primary schools and he recommended that effective classroom management technique that is appropriate to Bruneian culture should be developed in teacher education courses to enable STs to better handle discipline problems.

STs were also moderately anxious about lesson preparation. They were particularly anxious about whether their scheme of work and the material covered in the lessons are adequate. In this case, the role of USs in assisting STs in lesson preparation is essential so that STs can present the lessons effectively to meet the needs of the pupils according to different levels and abilities. Carter and Francis (2001) suggested that the use of school expertise through CTs teaching in the same grade could assist beginning teachers in curriculum planning because they have a first-hand understanding of the contextual issues relating to student needs.

In the present study, STs were found to be slightly anxious about their relationship with school staff. This is in contrast to the reports made by Ramsey (2000) and Smith (1993) which showed that beginning teachers encountered feelings of isolation due to lack of socialisation into the general teaching staff. In the local context, STs are placed on school observation for several weeks. During this time they will be given guidance and advice on matters concerning procedures and structures of the school. This familiarisation exercise is important to enable them to know the teachers whom they will be working with and also to form a closer working relationship with other schoolteachers.

In terms of concerns, results of TCQ showed that impact concerns were the greatest concerns for STs before and after TP, followed by self concerns and task concerns. Behets (1990) also made the same observation in a study on physical education students on their final stage of TP. The results suggested that STs were highly concerned for students. For example they were concerned about how to give sufficient attention to students’ need and to motivate students in learning. In self concerns, STs were greatly concerned about getting favourable evaluation for their teaching performance. This was also confirmed by the results of STAS which showed that being observed, evaluated and assessed caused the most anxiety for STs. In the task concerns, STs were concerned about the availability of sufficient instructional materials for teaching and class control.

The results emerged from this study illustrated that STs are anxious and concerned about TP. One way to help alleviate their anxieties and concerns in areas that have been identified in this study is to provide relevant education courses to address those areas of anxiety and concerns. Understandingly, STs need a lot of support and encouragement during TP, and as such, they should be given as much help as possible in developing their teaching skills and confidence. Moreover, USs and CTs should be more sensitive to the needs of STs so that the latter could prepare themselves fully for their teaching role when they have completed the programme of studies. In Schulman’s (1998) words, the aim of practical experience is ‘the immediate preparation not of skilled practitioners, but of reflective professionals who are disposed to examine their teaching and their students’
learning critically (cited in Deng and Gopinathan, 2003, p. 63). As such, every effort must be taken to ensure that STs attain a high standard of professional practice so that they will be well equipped to face the reality of teaching when they become full-fledged members of the school teaching team. With proper guidance, firm support and encouragement, STs can gain invaluable experience from TP that will have long term implications for teacher effectiveness and job satisfaction.

To conclude, consider this scenario. You have been trained by an expert swimming instructor all the different swimming movements and strokes on the floor without putting you in water. Now he takes you to the deepest end of the swimming pool and expects you to jump into the water. Would you be anxious and concerned that you may not be able to stay afloat let alone swim? This metaphor is similar to TP. STs may have been taught all the pedagogies of teaching, but they do not have the real teaching experience of classroom setting. They will be anxious and concerned about TP just like you before you jump into the pool. As USs, we should be sympathetic and supportive so that STs will be able to gain maximum professional experience during TP. Far from it, they should not be judged or assessed like qualified teachers by school inspectors. It is about time that we should rethink how best we can help our STs on TP.

References


The effectiveness of drug education using puppet theatre in students long term memory

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Abstract
Drug abuse among elementary school students in Indonesia had been increase every year especially in gristle area like Surabaya, East Java. The National Narcotics Board recorded 900 elementary school students in Indonesia that were identified using narcotics in the past five years. Lack of basic knowledge about kind of drugs and effect of abusing them has become one of factor that increase the number of drug abuse among elementary school students. Drug knowledge becomes one of alternatives that can help students avoid using drugs. Knowledge about definition and kind of drug, definition of drug abuse and their effect and symptoms that retained on their long-term memory can lead their future action to avoid drug. The appropriate media and method that can help students retain information they have learnt in long-term memory is puppet theatre. The samples studied included elementary school student in gristle area of drug abuse in Surabaya, East Java. The sampling technique used in this research was purposive sampling. Design experiment used in this study was pretest, posttest and follow-up measurement. Elementary school students in gristle area of drug abuse in Surabaya received drug knowledge questionnaire.

Keywords: Drug Abuse, Drug Education Using Puppet Theatre, Elementary School Students Long Term Memory.

Introduction
Drug abuse is a major problem not only for developed country but also for developing country like Indonesia. Makbul Padmanegara said that number of drug abuse cases were increase rapidly in Indonesia. There were 3478 cases in the year 2000 and it increase to 7140 cases in 2003. It means that every year the cases have been increase for about 47% in Indonesia (http://www.balipost.co.id).

Nowadays in Indonesia, there are not only adult and teenager but also elementary school students have become drug abuse victim. The National Narcotics Board recorded 900 elementary school students in Indonesia that were identified using narcotics in the past five year. The case had been increase in almost all provinces that identified as a gristle area of drug abuse in Indonesia. The provinces are Sumatera Barat, Sumatera Utara, DKI Jakarta, Jawa Barat, DI. Yogyakarta, Jawa Tengah, Jawa Timur, Bali, Sulawesi Utara, Sulawesi Selatan, Sulawesi Tengah, and Kalimantan Barat (Muchlas, 2001).
Lack of drug knowledge among elementary school students is predicted as a significant factor that contributed to the increased of drug abuse cases in Indonesia. Sri Sugiyati said that elementary school students are lack of knowledge about drugs and it dangerous for them (http://www.suarakarya-online.com). Therefore, it needs an effort to increase the drug knowledge of elementary school student in order to reduce number of drug abuse cases in Indonesia. Drug knowledge that elementary school students should have are about definition and kind of drugs, definition of drug abuse and their effect, and symptoms of abusing drugs. In order to make them avoid drugs, drug knowledge they have should be retained in their long term memory.

Program that designed not only to increase drug knowledge of elementary school student but also make them memorized the information becomes an important thing in order to save Indonesian young generation from destruction resulted from drug abuse. Ironically, The Government of Indonesia efforts to combat drug abuse are mostly focus on teenage. According to Ronald (2004), the government of Indonesia does not have a drug education campaign program that is designed especially for increasing drug knowledge of elementary school students (www.pikiran-rakyat.com).

Story telling is an appropriate method to give information related to drug abuse to elementary school students. Ackerman (2002) said that story can be used to delivered message to children (Santrock, 2002: 314). Beside an appropriate method, we have to use an interactive media to draw students attention in order to make them retained the information they had received. One of media that can use to draw students attention is puppet theatre. Research shown that puppet theatre is an effective media to increase drug knowledge of elementary school student (Palupi, 2005). Therefore, the purpose of this research was to evaluate the effectiveness of drug knowledge using puppet theatre for drug knowledge storage in elementary school students long term memory.

Method

Participant
The sample, which selected using purposive sampling technique, consisted of 16 of 3rd grade students from elementary school students in the gristle area of drug abuse in Surabaya, East Java, Indonesia. Eligibility required are: (1) 3rd grade elementary school student, (2) age 8-10 years, (3) IQ on range 80-119 or below average (80-89), average (90-109), and above average (110-119), (4) has a low level of drug knowledge from range between 7.5-25.5.

Design
The design was a pretest, posttest and follow up measurements. This research was conducted in the elementary school in the gristle area of drug abuse in Surabaya, East Java, Indonesia.

Measures
Culture Fair Intelligence Test (CFIT). The CFIT is intelligence test that is valid and reliable to measure student age 8-14 years old ability in a rapid time. This instrument can classically tested on group consist of 20-30 individuals (Cattel et al, 1992, pp. 2). The
instrument consists of 4 subtests which has different perceptual task. The subtest presented in the table below:

**Table 1 CFIT subtest**

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Item</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td>12</td>
<td>3 min</td>
</tr>
<tr>
<td>Classification</td>
<td>14</td>
<td>4 min</td>
</tr>
<tr>
<td>Matrices</td>
<td>12</td>
<td>3 min</td>
</tr>
<tr>
<td>Condition/topology</td>
<td>8</td>
<td>2.5 min</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td>46</td>
<td>12.5min</td>
</tr>
</tbody>
</table>

Source: Cattel, & Cattel (1992, pp. 2)

*Drug Knowledge questionnaires.* The drug knowledge questionnaires contains 30 question about definition of drug, kind of drug, definition of abusing drug, and the effect of consuming drug. This instrument used objective test. Items are in multiple-choice form with three alternatives answer, and scores vary between 0 and 30. In the validating study, the drug knowledge questionnaires was administered to 3rd grade students from elementary school located in the gristle area of drug abuse in Surabaya. The evaluation questionnaires completed by students in the follow-up included demographic item (sex and age) and measures of definition of drugs, kind of drugs, definition of abusing drug, symptoms and effect of abusing drug. The questionnaires shows test-retest reliability exceeding 0.9066 (90.66%) with significant level 5% and reliably distinguishes high and low level of students drug knowledge. Table 2 gives the questionnaire’s specifications table.

**Table 2 Item specifications for the Drug Knowledge Questionnaires**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Term</th>
<th>Specific Facts</th>
<th>Trends and Sequences</th>
<th>Classification and categories</th>
<th>Criteria</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of drugs</td>
<td>2(*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Kind of drugs</td>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Definition of drugs abusing</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17.5</td>
</tr>
<tr>
<td>Drugs abuse symptoms</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Effect drugs abusing</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12.5</td>
</tr>
<tr>
<td><strong>Total (%)</strong></td>
<td>7.5</td>
<td>2.5</td>
<td>32.5</td>
<td>30</td>
<td>27.5</td>
<td>100</td>
</tr>
</tbody>
</table>

(*) Amounts of item questionnaires
All measures can be divided into the following two paired test measure: (a) paired test between pre-test and post-test, (b) paired test between post-test and follow-up measurement of drug knowledge score.

Procedures
Students received questionnaires, that administered by the project staff, and they completed it in the classroom. Before the intervention began, the students were pretested, while the posttests were given after the intervention. Pretest data collected May 2005, posttest data collected after the program was finished which is on June; and follow-up data were collected 2 year after (February 2007).

Treatment
Puppet theatre has seven professional hand puppet players that were selected based on their prior experience as a hand puppet player. The player received approximately 20 hours of training over 1-week period in the story that they perform and program implementation issue.

The treatment implementation are divide in four sections which are, (1) preparation section, (2) Rapport or open section, (3) the show or story telling section, and (4) close section.

In the preparation section, all of Puppet theatre crew and the hand puppet player are preparing all equipment such as stage, hand puppets and the sound system for the show. Before the show or the story telling section begins, rapport is built by the master of ceremony. Then, show is close after master of ceremony ask several question about the show in the close section.

Results
Description of participants
Sixteen students completed all phases of data collection, which are age, IQ score, pretest, posttest and follow-up. Before the program implementation, participants provided data on a number of personal characteristics (gender and age) and IQ score. Participants demographic profile is presented in table 3.

Table 3  Characteristics of participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Pretest</th>
<th>Posttest</th>
<th>2-yr follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Age (year)</td>
<td>9.2</td>
<td>0.72</td>
<td>9.2</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>IQ Score</td>
<td>103.81</td>
<td>12.28</td>
<td>103.81</td>
</tr>
</tbody>
</table>
CFIT

Intelligence score is one of factors that influenced individual understanding ability. Therefore, we only select students who had IQ score (Cattel: 1992) in range between below average (80 – 89), average (90 – 109), and above average (110 – 119) as participants in this study (see table 3).

Drug knowledge

Drug knowledge questionnaires in the pretest, posttest and 2-year follow up measurement scored using correction for guessing formula. Linn & Miller (2005, 348) provide the correction formula for guessing as

\[
Score = \frac{right - wrong}{n - 1}
\]

In this formula, \(n\) is the number of alternatives for an item. Because the questionnaires has three alternatives so the formula used is

\[
Score = \frac{right - wrong}{2}
\]

Descriptive statistics were used to report data from student drug knowledge questionnaires (see table 4). Statistical analysis was conducted using SPSS.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>St.Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>16</td>
<td>18.094</td>
<td>4.695</td>
<td>7.5</td>
<td>25.5</td>
</tr>
<tr>
<td>Posttest</td>
<td>16</td>
<td>25.969</td>
<td>2.778</td>
<td>21</td>
<td>30</td>
</tr>
<tr>
<td>Follow-up</td>
<td>16</td>
<td>24.469</td>
<td>4.540</td>
<td>10.5</td>
<td>30</td>
</tr>
</tbody>
</table>

The purpose of this study is to investigate whether the participants drug knowledge gained from the drug education is still memorized or retained in their long term memory. In order to answer the question, we have to compare the participants drug knowledge gained from drug education and follow-up measurement. The suitable statistical technique to analyze the proposed hypothesis is nonparametric test. The nonparametric technique is chosen because the shape of the population distribution of drug knowledge score is not normal.

The statistical analysis use to compare between the participants drug knowledge gained from drug education and follow-up measurement is Wilcoxon signed-rank test. Wilcoxon signed-rank test is a non-parametric alternative to the paired Student's t-test for the case of two related samples or repeated measurements on a single sample. It used to test difference scores of data collected before and after an experimental manipulation. This test was used to compare not only pretest and posttest but also posttest and follow up measurements.
The Wilcoxon test involves comparisons of differences between measurements, so it requires that the data measured at an interval level of measurement. Therefore, we rank the drug knowledge score and analyze it.

The null hypothesis testing procedure in Wilcoxon signed-rank test is \( H_0: \bar{\delta} = 0 \). The Wilcoxon signed rank statistic \( W_i \) is computed by ordering the absolute values \(|Z_1|, ..., |Z_n|\), the rank of each ordered \(|Z_i|\) is given a rank of \( R_i \). Denote \( \phi_i = I(Z_i>0) \) where \( I(.) \) is an indicator function. The Wilcoxon signed ranked statistic \( W_+ \) is define as,

\[
W^+ = \sum_{i=1}^{n} \phi_i R_i
\]

The central point would expect to be zero. Scores exactly equal to the central point are excluded and the absolute value of the deviations from the central point of the remaining scores is ranked such that the smallest deviation has a rank of 1. The hypothesis testing was analyzed using SPSS.

**Paired test between pretest and posttest of Drug Knowledge using the puppet theatre**

First test compared students pretest and posttest scores. The research hypothesis for the first test is:

\( H_0: \bar{\delta} = 0 \). (The central point of pretest and posttest is equal).
\( H_1: \bar{\delta} \neq 0 \). (The central point of pretest and posttest is not equal), with 5 % \( \alpha \) level of significant.

Result of first hypothesis testing was significant. These mean that the central point between pretest and posttest were significantly different and it describes that the intervention was success in transferring drug knowledge to students.

**Paired test between posttest and 2-year follow up of Drug Knowledge using the puppet theatre**

The second test compared posttest and 2-year follow up measurements. The hypothesis of the second test is:

\( H_0: \bar{\delta} = 0 \). (The central point of posttest and follow up is equal)
\( H_1: \bar{\delta} \neq 0 \). (The central point of posttest and follow up is not equal), with 5% alpha level.

Result of the second hypothesis testing was not significant. These mean that there is no different between the central point of posttest and follow-up measurement. The summary of first and second paired test is present in table 5.

**Table 5** Summary of hypothesis testing

<table>
<thead>
<tr>
<th></th>
<th>( p )-value</th>
<th>( \alpha ) (sig. level)</th>
<th>Conclusion paired test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest-Postest</td>
<td>0.00043</td>
<td>0.05</td>
<td>significant</td>
</tr>
<tr>
<td>Posttest-Follow Up</td>
<td>0.06532</td>
<td>0.05</td>
<td>non-significant</td>
</tr>
</tbody>
</table>
How the testing hypothesis process can describe transferring drug knowledge using Puppet theatre in student is effective for drug knowledge storage in students long-term memory is shown in figure 1.

![Figure 1: The Hypothesis Testing Process](image)

**Figure description**, results of the first hypothesis testing describe that the paired test between pretest and posttest is significant. It indicates the puppet theatre is effective for transferring drug knowledge to the students. The paired test between posttest and 2-year follow up measurement in second hypothesis testing is not significant. It describe that students were stored drug knowledge in their long-term memory. Because of the paired test in second hypothesis testing is not significant or unchanged, we can conclude that puppet theatre is effective for drug knowledge storage in elementary school students long-term memory.

**Discussion**

The purpose of this study was to evaluate the effectiveness of drug knowledge using puppet theatre for drug knowledge storage in elementary school students long term memory. Results indicate that drug education using puppet theatre is effective to retained the participant drug knowledge in their long term memory.

Puppet theatre is a theatre which used puppet as a media to delivered message to children using story telling method. Puppet theatre in this research consists of a set of hand puppet, story and music. Story in this puppet theatre is mainly about drug knowledge (definition of drug, kind of drug, definition of abusing drug, symptoms and effect of abusing drug).

Story in this puppet theatre is appropriate with the elementary school student concrete operational stage, where memory, cognitive scheme and script are optimally developed. Research conducted by Buhler shows that elementary school learner love to hear story (Suryabrata, 1984, pp. 226). The story not only helped students to categorized and differentiated drugs (narcotic and psychotropic) but also helped to developed anti-drug attitude.

Students learned from the story that abusing drug can give a negative impact not only for themselves but also for their family and surrounding; as hergenhahn have discussed in observational learning theory that human learn something from observing their surroundings (Hergenhan, 1993, pp. 347). It is also effective for students according to their moral stage development, which are in the conventional stage. Students in this stage,
the interpersonal concordance or "good boy-nice girl" orientation, has judgement that good behaviour is what pleases or helps others and is approve by them. There is much conformity to stereotypical images of what is majority or "natural" behaviour (Kohlberg, L., http://www.xenodochy.org/ex/lists/moraldev.html).

Follow up measurement result showed that level of drug knowledge of most of the participant is same as in the first study. In other word, we can say that the drug knowledge that was kept in the long term memory is unchanged. These can be explain by examining the information encoding process in the long term memory.

Drug knowledge (story content of puppet theatre) were encode, process and store in their long-term memory. Long-term memory processing of Drug knowledge is describes above:

1. One or more of the body's Receptors sense both of visual (the hand puppet) and auditory (story in the puppet theatre) information.
2. The information changed into electrical wave.
3. Immediately, after sensing information, the act of selective perception takes place within a Sensory Register.
4. The information may then be stored, temporarily, in Working Memory (i.e., Short Term Memory). Visual information stored in iconic storage, while auditory information stored in echoic storage.
5. After existing in Working Memory for less than one second in the form of auditory, articulator, or visual data, the information is subject to rehearsal and moved to Long Term Storage.
6. Semantic encoding takes place upon rehearsal of the information to be stored and the information is permanently stored in Long Term Memory (LTM) and is subject to search and retrieval.
7. The processes of search and retrieval performed by the Response Generator, which can initiate recall directly from LTM or move the information into working or 'conscious' memory.
8. The Response Generator then tells the Effectors or muscles what action to take and the response can be emitted back to the environment.

Drug knowledge questionnaires used in the follow up measurement is same as in the pre-test and post-test so the information that were explored or recalled has the same level. were same as stored in the long term memory is recall in the follow up measurement. Drug knowledge questionnaires used in this research is Beside from the drug knowledge long term memory processing. Overall, research resulted has shown that the puppet theatre proved to be an easily administered, developmentally and cognitively appropriate, and economically accessible as drug abuse prevention media. Students demonstrated statistically significantly stored drug knowledge in their long-term memory.
References


**Internet**


Pembelajaran Ikatan Kimia menggunakan bahan pengajaran berasaskan ‘Web’

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Abstract
Chemical bonding is one of the fundamental concepts in learning chemistry. The purpose of this article is to present the findings of a study on the use of web-based instructional materials in enhancing Form Six students’ understanding of the concept of Chemical Bonding. Qualitative case study was employed in the study and data sources included interviews, observation, fieldnotes and students’ work. Three major findings appeared to influence the students’ learning. It was found that students benefited the web-based instructional materials in learning the concepts. The students found that the instructional materials provided them with abundance of information, assisted them in visualizing the concept of Chemical Bonding, made them remember the concept better and enhanced their motivation in learning chemistry. Secondly, the students admitted that they still needed their teachers as facilitators in this learning environment. Lastly, the study found that there are factors affecting the use of the web-based instructional materials. These included the level of computer skills among the students, students’ dicipline in using web-based materials and availability of the infrastructure.

Pengenalan


Oleh yang demikian, tujuan artikel ini adalah untuk membincangkan dapatan kajian yang mengkaji bagaimana penggunaan bahan pengajaran berasaskan web membantu pelajar memahami konsep Ikatan Kimia dalam kalangan pelajar Tingkatan Enam. Secara khusus, kajian tersebut cuba memperolehi jawapan kepada soalan berikut:

1. Bagaimanakah bahan pengajaran berasaskan web membantu pelajar memahami dalam pembelajaran konsep Ikatan Kimia?
2. Bagaimanakah pelajar menggunakan bahan pengajaran berasaskan web dalam mempelajari konsep Ikatan Kimia.
3. Apakah faktor yang mempengaruhi penggunaan bahan pengajaran berasaskan web dalam pembelajaran konsep Ikatan Kimia.

Kerangka teori dan tinjauan literatur

Maklumat kemudian diproses dan disimpan dalam ingatan jangka masa panjang. Peringkat ini, maklumat dapat disimpan dalam jangka masa yang lama, kuantiti yang tidak terhad, pelbagai jenis maklumat dan kekal (Abbott, 2002).


**Penggunaan ICT dalam pendidikan**


penggunaan kit model dan demonstrasi untuk meningkatkan pemahaman konsep kekutuban dan keterlarutan. Ini menunjukkan bagaimana pentingnya perisian yang menggunakan visualisasi memberi kesan yang mendalam dalam pemahaman pelajar mengenai sifat kimia dan strukturnya di peringkat mikroskopik.

Metodologi


Data dikumpul dengan menggunakan teknik pemerhatian, temubual, hasil kerja pelajar dan nota lapangan. Pemerhatian dijalankan ke atas tingkah laku laku pelajar ketika mereka mencari maklumat menggunakan Internet dan juga ketika mereka membuat persembahan hasil tugas di kelas. Pemerhatian dicatat dalam nota lapangan. Seramai 17 orang pelajar telah ditemubual setelah mereka selesai melengkapkan tugasan mereka. Pelajar yang ditemubual dipilih atas dasar sukarela untuk melibatkan diri dalam kajian tersebut. Selain pemerhatian dan temubual, hasil kerja pelajar, khususnya persembahan Microsoft Powerpoint pelajar dikutip dan dianalisis.

Secara keseluruh, kajian ini melibatkan dua fasa, iaitu fasa pertama dan fasa kedua dan fasa-fasa ini akan dibincangkan dengan lebih lanjut dalam sub-bahagian yang berikut.

Fasa pertama

Fasa kedua
Seramai 17 pelajar secara individu ditemubual selepas mengikuti kaedah pembelajaran semasa fasa pertama. Temubual tersebut dijalankan berpandukan Protokol Temubual yang telah disediakan oleh penyelidik. Protokol ini cuba mencungkil pendapat pelajar terhadap

Kajian rintis

Kutipan dan analisis data

Kaedah analisis perbandingan tekal (Constant Comparative Method of Analysis) telah digunakan dimana data dari pelbagai sumber dibandingkan (Merriam,1998). Berdasarkan kod awalan, dapatan kemudian dikategorikan kepada:

1. Kemahiran komputer dan Internet.
2. Strategi pencarian maklumat.
3. Visualisasi konsep ikatan kimia.
4. Pemahaman konsep Ikatan Kimia.
5. Kaedah terbaik menggunakan bahan pengajaran berasaskan Web dalam pembelajaran kimia.
Kategori ini kemudian dilihat kembali dan digabung agar mencerminkan tujuan kajian dan soalan kajian. Kategori ini akan dibincangkan dalam bahagian dapatan.

Dapatan


Dapatan yang dikemukakan disokong dengan petikan transkripsi temubual, dokumen pelajar iaitu hasil kerja pelajar dan juga nota lapangan. Bagi petikan dari transkripsi, P digunakan bagi mewakili penyelidik dan nama samaran pelajar telah digunakan dalam petikan tersebut bagi menjamin kerahsiaan responden.

Bahan pengajaran berasaskan Web membantu pemahaman pelajar tentang konsep Ikatan Kimia

Secara keseluruhan, bahan pengajaran berasaskan Web telah membantu pelajar daripada aspek berikut; iaitu bahan pengajaran berasaskan Web sebagai sumber pelbagai maklumat, bahan pengajaran berasaskan Web membantu pelajar membuat gambaran mental, memudahkan pelajar mengingati konsep Ikatan Kimia, bahan pengajaran berasaskan Web menarik perhatian dan memotivaskan pelajar.

(a) Bahan pengajaran berasaskan Web sebagai pelbagai sumber

Berdasarkan transkripsi temubual dan hasil dokumen pelajar didapati seramai lima belas daripada tujuh belas subjek kajian menyatakan bahan pengajaran berasaskan Web memudahkan pemahaman Ikatan Kimia. Menurut responden, bahan pengajaran berasaskan Web mampu memberikan banyak maklumat mengenai konsep Ikatan Kimia. Andaian ini dibuat berdasarkan petikan dari transkripsi dengan pelajar seperti Rina,

\[ P \quad : \quad \text{Adakah anda suka pengajaran melalui Laman Web?} \]
\[ Rina : \quad \text{Ya, melalui laman Web kita dapat maklumat lain. Lebih daripada buku dan pengetahuan yang diajar akan lebih banyak dan pengetahuan [kita] meningkat.} \]

Pendapat Rina disokong oleh Tan;
\[ P \quad : \quad \text{Adakah awak suka pembelajaran kimia guna Internet?} \]
\[ Tan : \quad \text{Boleh juga.} \]
\[ P \quad : \quad \text{Kenapa?} \]
\[ Tan : \quad \text{Kita boleh cari maklumat lain yang tiada dalam buku teks.} \]

(b) Bahan pengajaran berasaskan Web membantu visualisasi konsep Ikatan Kimia

Dapatan kajian ini menunjukkan bahawa bahan pengajaran berasaskan Web yang telah dilayari responden mempunyai ciri mengabungkan teks dan grafik atau ilustrasi berupa gambar, imej 2-dimensi, imej 3-dimensi dan beranimasi. Bahan teks dan grafik yang digabungkan bersebelahan antara satu sama lain memberikan kesan visual atau gambaran konsep yang mendalam ketika memahami sesuatu konsep yang abstrak dalam bentuk molekul atau diperingkat mikroskopik yang tidak dapat dilihat secara fizikal.


P : Adakah awak suka pembelajaran kimia menggunakan Internet?
Siva: Ya, suka.
P : Adakah anda faham mengenai konsep sp³?
Siva: sp³ adalah proses orbital s dan orbital p bergabung membentuk aras tenaga yang sama dalam atom karbon. Atom karbon boleh bergabung dengan atom yang lain contohnya hidrogen dan karbon melalui pertindihan orbital dan membentuk ikatan.
P : Pertindihan orbital sp³ dengan orbital atom lain membentuk ikatan apa?
Siva: sp³ membentuk Ikatan Kovalen tunggal iaitu, Ikatan sigma.

**Hybridisation**

- One s and three p orbitals hybridise to give four sp³ orbitals

**Rajah 1** Orbital elektron 2s¹ dan 2p³ dalam atom karbon
Rajah 2 Imej 3-dimensi Hibridasi Orbital sp³ Atom Karbon

Temubual dengan Siva menunjukkan beliau dapat menjelaskan Ikatan Kovalen yang berlaku dalam molekul metana, mempunyai formula molekul CH₄ dan mempunyai pertindihan orbital elektron hibridasi sp³ atom karbon dengan empat orbital elektron 1s² dari empat atom hidrogen. Pendapat ini juga dikongsi bersama Chua “... sp³ treutamanya ikatan yang terbentuk adalah sukar hendak gambarkan. Melalui gambar [yang terdapat] di komputer ada gambar grafik menunjukkan proses yang bergabung untuk membentuk sp³, maka boleh lebih memahami”. Berdasarkan hasil dokumen pelajar dalam Rajah 3 juga menunjukkan kefahaman pelajar tentang pembentukan orbital elektron hibridasi sp³ dalam atom karbon dengan enam orbital elektron 1s¹ dari enam atom hidrogen.

Rajah 3 Imej 3-Dimensi Molekul Metana

(c) Visualisasi memudahkan ingatan
Analisis data menunjukkan tiga belas daripada tujuh belas pelajar menyatakan gambar grafik memudahkan mereka mengingat bentuk geometri struktur molekul, pertindihan orbital antara elektron-elektron yang berkongsi dalam atom-atom yang membentuk molekul seperti molekul air dan molekul ammonia. Petikan transkripsi Yen menyatakan imej 3-dimensi mudah diingat berbanding dengan buku teks dimana buku teks adalah bentuk teks sahaja.
P : Apa jenis grafik dan gambar yang menyebabkan mudah ingat?
Yen : Ya, ada 3-dimensi
P : Adakah ia membantu kamu?
Yen : Ada, ia mudah ingat, gambar lebih mudah ingat.
P : Kalau baca buku, bagaimana pula?
Yen : Baca buku terlalu bosan, ada gambar-gambar [3-D] ini lebih mudah ingat

Dapatan dari kajian ini menunjukkan beberapa orang pelajar menyatakan grafik yang dipaparkan dalam bahan berasaskan Web memudahkan mereka membuat gambaran mental konsep Ikatan Kimia, memudahkan pemahaman dan mudah bagi mereka mengingatinya kembali. Jika menggunakan buku teks sahaja, mereka terpaksa membuat imaginasi sendiri tentang konsep yang dipelajari. Buku teks hanya memaparkan konsep dalam bentuk teks sahaja dan oleh yang demikian pelajar merasakan sukar untuk memahami dan mengingati konsep Ikatan Kimia.

(d) Bahan Web memotivaskan pelajar dan memberikan tumpuan

Dapatan dari data menunjukkan bahawa grafik yang berwarna-warni menarik perhatian, melibatkan pelajar dengan aktif, khususnya dalam pencarian maklumat untuk tugasan mereka. Misalnya, Chua berpendapat "... bertambah minat jika berbanding dengan buku, buku sahaja bosan, jika melayari Internet lebih minat." Pendapat ini juga dikongsi bersama Zul, "... kalau guru sahaja ajar di hadapan, kurang sedikit ... senang bosan. Kita tidak terlibat sama. Jika guna Internet, pelajar terlibat sama."

Ciri yang terdapat pada laman Web dapat menarik minat dan merupakan satu cara memotivaskan pelajar. Mereka lebih meminati bahan pengajaran berasaskan Web jika dibandingkan dengan buku teks yang memaparkan teks sahaja dan juga hanya bergantung kepada pengajaran guru.

Gaya pengajaran dan pembelajaran dalam persekitaran pembelajaran berasaskan Web

Dapatan daripada data mendapati kebanyakan pelajar berpendapat pembelajaran Ikatan Kimia harus dilakukan secara gabungan pengajaran secara tradisional iaitu guru mengajar sebagai fasilitator dan pembelajaran secara ‘Online’ atau pengajaran menggunakan bahan berasaskan Web. Ini jelas ditunjukkan daripada petikan berikut:

P : Adakah pengajaran perlu menggunakan Internet?
Saw : Gabungan buku dengan Internet.
P : Kamu pilih yang mana satu? Guru sahaja, guru dan Internet, atau Internet sahaja?
Saw : Guru dan Internet

Pendapat Saw juga dikongsi dengan Siva. Siva berpendapat guru perlu berperanan sebagai fasilitator, perlu mengajar dan guru mencari laman web yang sesuai terlebih dahulu dan kemudian mencadangkan kepada pelajar melayari laman web tersebut. Chua juga bersetuju dengan Saw dan Siva. Beliau menyatakan "... saya rasa guru dan Internet. Jika saya dapat maklumat dari guru, tiada penerangan yang lebih terperinci dari guru, saya
tidak faham. Maka guru dan Internet ... kedua-duanya perlu.” Oleh yang demikian, adalah jelas bahawa guru masih diperlukan dalam pembelajaran konsep Ikatan Kimia dan bahan berasaskan Web berfungsi menyokong pembelajaran pelajar.

**Faktor-faktor yang mempengaruhi penggunaan bahan berasaskan Web oleh pelajar**


Sesetengah laman Web yang pelajar layari adalah dalam bahasa Inggeris bertahap tinggi. Rina menyatakan, “... bahasa yang digunakan lebih advanced, perlu merujuk kamus.” Bahasa yang digunakan ini mempengaruhi pelajar menggunakan bahan pengajaran tersebut. Tanggapan ini benar bagi Rina dan juga Ling yang menganggap bahasa adalah satu masalah bagi diri mereka.

Faktor yang kedua berkaitan dengan kemudahan infrastruktur serta teknikal. Masalah yang dihadapi ialah muat turun atau ‘download’ laman web yang lambat dan masalah virus yang juga dimuat turun secara automatik bersama program yang dilayari. Siva adalah antara pelajar yang menghadapi masalah komputer di rumahnya sering diancam virus semasa memuat turun sesuatu laman Web. Menurut Siva, komputer di rumahnya tidak mempunyai perlindungan daripada ancaman virus seperti tiada program ‘firewall’. Program ‘Firewall’ adalah untuk mengelakkan komputer daripada serangan virus dengan menapis virus yang ikut serta ketika ‘download’ sesuatu dari laman Web.

Berkaitan dengan Infrastruktur juga, terdapat juga pelajar yang menghadapi masalah akses kepada komputer. Seperti yang dinyatakan oleh Siva, “... sesetengah pelajar tiada Internet di rumah.” Zul juga mengutarakannya kekangan ini, “... kadang-kadang buat di sekolah, kalau di rumah tidak boleh buat kerana bukan semua pelajar ada Internet di rumah” dan ini membuat seorang pelajar itu mempunyai kekangan masa untuk melayari Internet. Jenis capaian Internet juga mempengaruhi pelajar menggunakan Internet. Bagi Yee pula, beliau menggunakan talian Internet jenis ‘dial-up’ di rumah. Muat turun grafik dari laman Web amat lambat dan ini telah membuat Yee berasa putus asa untuk menggunakan Internet.

tergoda dengan program-program lain, contohnya dengar lagu [dari Internet], tengok emel.” Pengakuan ini jelas menunjukkan jika pelajar tiada disiplin diri yang tinggi, mereka mudah terpesong daripada fokus tugasan mereka. Tumpuan mereka mudah teralih kepada laman-laman Web yang bukan akademik.

Kesimpulan dan perbincangan


Ketiga, terdapat tiga faktor yang utama yang boleh mempengaruhi penggunaan bahan berasaskan Web. Pertama, kemahiran komputer, kemahiran mencari maklumat dan penguasaan Bahasa Inggeris dalam kalangan pelajar. Apabila mempelajari sesuatu konsep dengan menggunakan teknologi seperti Internet, pelajar dianggap berhadapan dengan dua tugas yang berbeza. Mengikut Shi et al. (2004), pelajar terpaksa mempelajari menggunakan teknologi tersebut dan tugas yang kedua ialah mempelajari isi kandungan pada masa yang sama. Dalam konteks kajian ini, pelajar juga berhadapan dengan satu lagi tugas iaitu mempelajari konsep yang dipelajari dalam bahasa Inggeris yang bukan bahasa
ibunda mereka. Mereka baru mempelajari sains dalam bahasa Inggeris ketika memasuki Tingkatan 6. Tidak semua pelajar mampu menangani ketiga-tiga tugasan ini dengan baik dan sudah tentu menjadi satu halangan bagi mereka.


**Penutup**


Dapatan daripada kajian ini menunjukkan guru sebagai fasilitator diperlukan untuk menerangkan kepada mereka konsep yang dipaparkan dalam laman-laman Web tertentu. Dengan cara ini, meraka lebih memahami, mudah membuat visualisai, mudah ingat dan lebih bermotivasi serta tidak mudah jemu untuk terus belajar.

Bagi guru yang ingin melaksanakan pengajaran berasakan Web, guru perlu bersedia menjadi pakar isi kandungan dan pakar teknologi di kelas. Sebelum sesuatu pengajaran menggunakan bahan pengajaran berasaskan Web, bagi seorang guru, sedikit sebanyak perlu mengetahui beberapa kemahiran komputer, kemahiran mencari maklumat dan menjadikan kebiasaan baginya menggunakan Internet supaya guru merasa yakin menggunakan komputer dan Internet. Keberkesanan pengajaran berasaskan Web adalah bergantung kepada infrastruktur dan kemudahan peralatan dari segi komputer yang disediakan di sesebuah sekolah.

**Rujukan**


Johnson, R. (1997). *How can computers be used to promote metacognition in primary school students?* Disertasi Doktor Falsafah yang tidak diterbitkan. Monash University, Australia.


The prevalence of depression, anxiety and stress in Brunei preservice student teachers

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Abstract
The survey study investigated the prevalence of depression, anxiety, and stress in trainee teachers at the University of Brunei Darussalam. The random sample consisted of 119 preservice student teachers (32 males and 87 females). Of these 68 were on the BEd programme while 51 were studying for the PGCE qualification. Research data were collected by using the Depression Anxiety Stress Scale, DASS (Lovibond & Lovibond, 1995). All the instrument’s three subscales had satisfactory levels of alpha reliability and were valid for use with the Brunei student sample. There was a higher incidence of depression, anxiety, and stress among females than males. In addition BEd students were more depressed than their PGCE counterparts. Age, gender and the programme of study were not predictors of depression, anxiety and stress in the context of the Brunei student sample used in this study. Consistent with previous research depression, anxiety, and stress were found to be highly correlated. Further research using both quantitative and qualitative methodologies was recommended to gain in-depth insights into the three mental health concerns.

Introduction
There are no universally acceptable definitions for depression, anxiety and stress. However it is possible to describe each of these three behavioural conditions. Depression is a mood disorder that manifests itself in various ways (Rathus & Nevid, 1991). According to Beck (1967) depression can negatively influence a person’s motivation, affect, cognition and physiology. On the other hand anxiety is a general state of uneasiness (fear, tension, worry or apprehension) whose cause is often ambiguous (Fogiel, 1989; Amchin, 1991). In short anxiety is a bodily response to a perceived threat or danger (real or imagined) and it seems to be triggered by an individual’s thoughts, beliefs and feelings (see Shaffer, 2000). The third disorder, stress, is generally believed to be the body’s physical and mental responses to demands made upon it and is often the result of a person’s reaction to outside events, not necessarily the events themselves (see Student Support Services, 2007; Selye, 1974). Stressors can be either positive or negative events (or both).
Objectives of the study

The purpose of the present study was four-fold, namely to:

1. determine the prevalence of depression, anxiety and stress in Brunei student-teacher research participants by gender and program of study;

2. determine the relationship between the independent variables (age, gender and study program) and the dependent variables (depression, anxiety and stress) in the Brunei student sample context.

3. determine the interrelationship between depression, anxiety and stress based on the Brunei university students; and

4. determine the predictors of depression, anxiety and stress in terms of the Brunei tertiary students.

Classification and previous research

Depression, anxiety and stress are classified as diseases by the DSM-IV-TR (American Psychiatric Association, 2000) and the ICD-10-CM (World Health Organisation, 2007). These three mental health problems affect people in nearly all age-groups and walks of life (Rathus & Nevid, 1991). The intensity of any psychological / psychiatric disorder such as depression, anxiety and stress may vary on a continuum or scale ranging from mild / partial (through moderate and severe) to extreme, profound or catastrophic condition (Taylor, 1990; Amchin, 1991). A condition that is extreme, profound or catastrophic is often disabling and the affected person might not function in the normal way without suitable professional intervention. Previous studies of depression, anxiety and stress on people in institutions of learning focused mainly on teachers and school administrators (e.g. Borg et al., 1991; Boyle et al., 1995; Brenner et al., 1985; Chan & Hui, 1995; Cooper & Kelly, 1993; Brown & Ralph, 1992; Buwalda & Kok, 1991; Capel, 1991; Hodge et al., 1994; and Kyriacou, 1987). Most of these studies were on stress rather than depression and anxiety. The studies that investigated depression, anxiety and stress in university students dealt mainly with non trainee teachers rather than student teachers (both preservice and inservice). These studies are listed and briefly discussed below under separate headings for causes of depression, anxiety and stress in university students.

Prevalence incidences in student populations

Research indicates that there is now an increase in the incidence of depression, anxiety and stress in college and university students including all categories of trainee teachers (Benton et al., 2003). The amount and frequency of anxiety and stress were higher than those for depression (Vaidya & Mulgaonkar, 2007). In addition depression, anxiety and stress were more prevalent in female students than males (Eller et al., 2006; Dyrbye et al., 2006;
McKean & Misra, 2000). Also more freshmen were afflicted by these three disorders than sophomores (Capeding, 2002; Pabiton, 2007; Bouteyre et al., 2007). Depression, anxiety and stress appear to be linked to each other but the connections have only been determined correlationally and not experimentally (Edward, 2006). In view of this it is difficult to establish with certainty if (and how) they cause each other. One possible reason why depression, anxiety and stress might co-exist may be due to the fact that they share a few common symptoms, causes and effects (e.g. faulty cognitions or having cognitive distortions). The causes of depression, anxiety and stress in university students are numerous. Though many and different, the causes of stress in various age-groups can be divided into three broad categories: environmental; psychological; and biological (Cohen et al., 1995). Depression, anxiety and stress have each a wide range of effects (see selected examples in Table 1).

Table 1  Categories and symptoms of depression, anxiety and stress

<table>
<thead>
<tr>
<th>Depression</th>
<th>Anxiety</th>
<th>Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Categories</td>
<td>Categories</td>
<td>Categories</td>
</tr>
<tr>
<td>♦ major depression</td>
<td>♦ panic disorder</td>
<td>♦ PTSD*</td>
</tr>
<tr>
<td>♦ bipolar depression</td>
<td>♦ generalized anxiety disorder</td>
<td>♦ optimal stress (eustress)</td>
</tr>
<tr>
<td>♦ dysthymia</td>
<td>♦ phobic disorder</td>
<td>♦ adaptive stress</td>
</tr>
<tr>
<td>♦ cyclothymia</td>
<td>♦ obsessive-compulsive disorder</td>
<td>♦ negative stress</td>
</tr>
<tr>
<td></td>
<td>♦ social anxiety disorder</td>
<td>♦ acute stress</td>
</tr>
<tr>
<td></td>
<td></td>
<td>♦ chronic stress</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Symptoms</td>
<td>Symptoms</td>
</tr>
<tr>
<td>♦ persistent sadness</td>
<td>♦ chronic worries</td>
<td>♦ burnout</td>
</tr>
<tr>
<td>♦ feelings of worthlessness, helplessness, hopelessness</td>
<td>♦ excessive uneasiness</td>
<td>♦ headaches / migraines</td>
</tr>
<tr>
<td>♦ thoughts of death and suicidal ideation</td>
<td>♦ body trembling/shaking</td>
<td>♦ hypertension / HBP</td>
</tr>
<tr>
<td>♦ insomnia or hypersomnia</td>
<td>♦ abdominal distress</td>
<td>♦ intolerance, irritability</td>
</tr>
<tr>
<td>♦ fatigue or loss of energy</td>
<td>♦ frequent urination</td>
<td>♦ tension</td>
</tr>
<tr>
<td>♦ relying on alcohol/drugs</td>
<td>♦ autonomic hyperactivity</td>
<td>♦ ulcers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>♦ stroke</td>
</tr>
<tr>
<td></td>
<td></td>
<td>♦ impotence / sexual dysfunction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>♦ menstrual disorders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>♦ procrastinating</td>
</tr>
</tbody>
</table>

* Posttraumatic stress disorder
Causes of depression in university students

The causes of depression in tertiary students including trainee teachers are many and varied. In addition the causal factors may be categorized as being either internal (genetic/hereditary or external (environmental). The literature sources consulted for this study (Sisk, 2007; Gavin, 2004; Capeding, 2002; Pabiton, 2004, 2007; Sayiner, 2006; Bouteyre et al., 2007; Andrews & Wilding, 2004; Eller et al., 2006) included the following as the main causative factors for depression in university students:

- separation from family and transitioning from home to university environment
- increased academic workload and demands
- challenges of living independently for the first time
- financial problems, crises and responsibilities
- peer pressure
- being stalked, sexual assault / harassment and rape (for females)
- culture shock due to cultural differences (for foreign students)
- relationship problems (social-interpersonal)
- unrealistic expectations of students and their parents (e.g. perfectionism and the all-or-nothing thinking mentality)
- poor time management
- drugs, alcohol, and lack of adequate sleep
- negative self-interpretation or appraisal and low self-esteem
- daily hassles of doing course work
- assignment papers, mid-term tests, projects and final examinations

Causes of anxiety in university students

Like depression, the causes of anxiety in tertiary students are also numerous and multifaceted. A literature review of a few selected previous studies (Fogiel, 1989; Pabiton, 2004, 2007; Leary, 1991; Amchin, 1991; Jenkins et al., 1990; Head & Lindsey, 1983; Douglas, 2001) indicated the following factors as some of the major causes of anxiety among university students:

- overwhelming workload
- feelings of inadequacy
- low self-esteem
- admission (selection / placement) tests
- academic tests and examinations
- taking mathematical, statistical and other quantitative courses
- oral or verbal participation during lectures, tutorials and laboratory sessions
- making verbal seminar presentations
- public speaking or giving a speech
- meeting deadlines for assignments, papers and projects
- repeated failure and lack of experience of success
- fear of failure and exclusion from school (dropping out)
Causes of stress in university students

Similar to depression and anxiety there is equally a wide range of factors that contribute to stress in university students. The majority of the causes seem to be person-age-situation specific. For instance people experience different stressors in different places (e.g. home context, school setting and work environment). In addition children and adolescents, middle-aged persons, and the old appear to have different stressors. Previous studies indicated the following as among the common causes of stress to university students (Burns, 2003; Rathus & Nevid, 1991; Student Support Services, 2007; Amchin, 1991; Taylor, 1990; Australian Counselling Association, 2007; Burnard et al. 2007a, b; Cohen, Kessler & Underwood-Gordon, 1995; Jenkins, Gibbs & Szymanski, 1990):

- revising for examinations and sitting tests
- meeting deadlines for coursework assessments (assignments, papers, projects, etc.)
- pressure of combining paid work and study (e.g. part-time students)
- procrastinating or leaving assignments to the last minute
- adjusting to life in a new environment or country
- out of control debts to meet the cost of attending university
- broken relationships
- excessive, unrealistic and unreasonable workload
- long hours of learning and studying
- being a workaholic
- taking difficult courses without proper background and abilities
- repeated failure and lack of experience of success
- poor health
- studying in English as a second or third language
- role of biological factors (e.g. stress hormones and the autonomic nervous system
- drugs and alcohol

Assessment of depression, anxiety and stress

There is a wide range of psychological and psychiatric instruments that measure depression, anxiety and stress. The Self-Rating Depression Scale (Zung, 1965), Beck Depression Inventory (Beck, 1967), Hamilton Rating Scale for Depression (Hamilton,
and the Irrational Beliefs Test (Jones, 1969) are among the most widely used measures of depression. The examples of instruments used in measuring anxiety include the N Scale in the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1968), the Rating Instrument for Anxiety Disorders (Zung, 1971) and the Test Anxiety Scale (Sarason, 1972). With regard to stress, several measurement instruments are in use. They include the Occupational Stress Inventory (Osipow & Spokane, 1987), the Maslach Burnout Inventory (Maslach & Jackson, 1986), Ways of Coping Questionnaire (Folkman & Lazarus, 1988), the Teacher Stress Inventory (Fimian, 1984), and the Stress Appraisal Measure (Peacock & Wong, 1990). The reliability, validity and other psychometric matters relating to these instruments are discussed in their respective technical manuals. In addition to these tests, depression, anxiety and stress may also be assessed qualitatively through formal observations and diagnostic interviews.

Design

The field survey method was used to investigate the research problem. Like all other approaches to research, field surveys have their own limitations. For instance the findings from field surveys may not show cause-and-effect relationships among the variables probed. Despite this and other disadvantages, the rationale for employing this research strategy was three-fold. First, the investigator wanted to use as respondents many student teachers taking a selected educational psychology course. Second, the researcher wanted to give on-the-spot assistance to participants who needed help to complete the data collection instrument properly in order to increase the number of usable returns. Third, the investigator wished to obtain the research data as quickly as possible.

Sample

The target population of the study were trainee teachers taking an educational psychology course taught by the researcher. There were 124 students on the course but only 119 were present on the day the instrument was administered. Of these, 32 (27%) were males while 87 (73%) were females. The students were on the BEd (68, 57%) and PGCE (51, 43%) teacher education programmes. The age of all the research participants ranged from 18 to 39 (Mean = 24.6; SD = 5.8). There was no statistically significant gender differences in age between males (Mean = 23.8; SD = 4.9) and females (Mean = 24.9; SD = 6.0) when the 2-tailed t-test for independent groups was applied [t(117) = 0.94, p > .05]. However the BEd students (Mean = 23.6; SD = 6.8) and PGCE students (Mean = 25.9; SD = 3.7) differed significantly in age [t(117) - 2.14; p < .05].

Instrument

Data for the study were collected with the Depression Anxiety Stress Scale (DASS) developed by Lovibond and Lovibond (1995). This is a self-report scale designed to measure the negative emotional states of depression, anxiety and stress. The scale contains
42 items divided into three subscales (depression, anxiety and stress) each with 14 items. The depression scale had an alpha reliability of .83 and a mean nonspurious item-total correlation of .46 as construct validity coefficient. The alpha consistency reliability for the anxiety scale was .74 with a mean corrected item-total correlation of .38 as evidence of construct validity. The stress scale was the most reliable (Cronbach alpha = .84) and valid (mean attenuated item-total correlation = .49). Internal consistency reliability estimated by Cronbach (1951) alpha is considered acceptable when in the .70 - .80 range (Guilford & Fruchter, 1978; Carmines & Zeller, 1979). In addition psychometric theory holds that an item is valid if it correlated positively and highly with adjusted total scores of which it does not form a part (Rust & Golombok, 1989). The minimum acceptable average item-total correlation as evidence of construct validity is .30 (Gagolin & Swartz, 1992).

All the three subscales are Likert-type instruments each with a 4-point response format (ranging from 0 = did not apply to me at all, to 3 = applied to me very much or most of the time). The scales measure different aspects of depression, anxiety and stress. Furthermore different specific characteristics are used to identify or label high scores on each scale. A section for collection of biodata was added to the three subscales. Prior to administering the instrument, ethical conditions for participating in the study were verbally explained to the respondents. These included voluntary participation, anonymity, confidentiality and protection from both psychological and physical harm.

**Variable selection and model fitting**

Initially many demographic factors were (during pre-testing phase of the instrument) identified as possible independent variables for inclusion and investigation in this study. These factors were then inter-correlated to reduce the large pool of independent variables. Where sets of variables were positively and strongly correlated (i.e., $\geq .70$), a single variable was used to represent the set and the other variables were dropped from the inclusion criteria. In this way, age, gender, and programme of study were chosen as the independent variables. The dependent variables were depression, anxiety and stress.

**Data analysis**

Data from the DASS may be used either in form of raw scores or transformed scores (Z-scores or percentiles). In this study raw scores were used and analysed by descriptive statistics (frequencies, percentages, mean and standard deviation) and inferential statistics (t-tests, correlations, and regression analyses). The multiple regression analyses were conducted for each of the dependent measures to determine which independent variables were significantly related to the dependent measures while controlling for the contribution of all other independent variables. An interpretive guide for various types of DASS scores is presented in Table 2.
Table 2  DASS interpretive guide

<table>
<thead>
<tr>
<th>Rating</th>
<th>Z-scores</th>
<th>Percentiles</th>
<th>Depression</th>
<th>Anxiety</th>
<th>Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profound</td>
<td>&gt; 3.0</td>
<td>98 – 100</td>
<td>28 +</td>
<td>20 +</td>
<td>34 +</td>
</tr>
<tr>
<td>Severe</td>
<td>2.0 – 3.0</td>
<td>95 – 98</td>
<td>21 – 27</td>
<td>15 – 19</td>
<td>26 – 33</td>
</tr>
<tr>
<td>Moderate</td>
<td>1.0 – 2.0</td>
<td>87 – 95</td>
<td>14 – 20</td>
<td>10 – 14</td>
<td>19 – 25</td>
</tr>
<tr>
<td>Mild/Partial</td>
<td>0.5 – 1.0</td>
<td>78 – 87</td>
<td>10 – 13</td>
<td>8 – 9</td>
<td>15 – 18</td>
</tr>
<tr>
<td>Normal</td>
<td>&lt; 0.5</td>
<td>0 – 78</td>
<td>0 – 9</td>
<td>0 – 7</td>
<td>0 – 14</td>
</tr>
</tbody>
</table>


Results

The findings of the study are presented below according to objectives of the investigation.

Depression in student teachers

The incidence of depression among the research participants is presented in Table 3. Only two students had profound depression (both of them females). However 7 students had severe depression (most of them females). The two females with profound depression were both on the BEd programme. Of the 7 trainee teachers with severe depression, 5 were doing the BEd programme and 2 the PGCE course. A number of students (43, 36%) had moderate-to-mild depression while the majority (67, 56%) were functioning at the normal level on depression scale.

Table 3  Frequency distributions of depression scores (N = 119)

<table>
<thead>
<tr>
<th>Score range</th>
<th>Males (n = 32)</th>
<th>Females (n = 87)</th>
<th>BEd (n = 68)</th>
<th>PGCE (n = 51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 – 42</td>
<td>0 (0.00) *</td>
<td>2 (2.30)</td>
<td>2 (2.94)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>21 - 27</td>
<td>1 (3.10)</td>
<td>6 (6.90)</td>
<td>5 (7.35)</td>
<td>2 (3.92)</td>
</tr>
<tr>
<td>14 – 20</td>
<td>8 (25.00)</td>
<td>11 (12.64)</td>
<td>11 (16.18)</td>
<td>8 (15.69)</td>
</tr>
<tr>
<td>10 – 13</td>
<td>4 (12.50)</td>
<td>20 (22.99)</td>
<td>15 (22.06)</td>
<td>9 (17.65)</td>
</tr>
<tr>
<td>0 – 9</td>
<td>19 (59.40)</td>
<td>48 (55.17)</td>
<td>35 (51.47)</td>
<td>32 (62.74)</td>
</tr>
</tbody>
</table>

* Frequency (percent)

Anxiety in student teachers

Table 4 shows the levels of anxiety in trainee teachers and the number of students affected by gender and study programme. Anxiety affected the females and BEd students most at all levels of the score intervals. Only 25 (21%) students were operating at the normal level with regard to anxiety.
Table 4  Frequency distributions of anxiety scores (N = 119)

<table>
<thead>
<tr>
<th>Score range</th>
<th>Males (n = 32)</th>
<th>Females (n = 87)</th>
<th>BEd (n = 68)</th>
<th>PGCE (n = 51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 – 42</td>
<td>2 (6.25) *</td>
<td>7 (8.05)</td>
<td>5 (7.35)</td>
<td>4 (7.84)</td>
</tr>
<tr>
<td>15 – 19</td>
<td>4 (12.50)</td>
<td>14 (16.09)</td>
<td>12 (17.65)</td>
<td>6 (11.77)</td>
</tr>
<tr>
<td>10 – 14</td>
<td>13 (40.63)</td>
<td>32 (36.78)</td>
<td>27 (39.70)</td>
<td>18 (35.29)</td>
</tr>
<tr>
<td>8 – 9</td>
<td>6 (18.75)</td>
<td>16 (18.39)</td>
<td>12 (17.65)</td>
<td>10 (19.61)</td>
</tr>
<tr>
<td>0 - 7</td>
<td>7 (21.87)</td>
<td>18 (20.69)</td>
<td>12 (17.65)</td>
<td>13 (25.49)</td>
</tr>
</tbody>
</table>

* Frequency (percent)

Stress in student teachers

Only one female BEd student had profound stress according to Table 5. Most of the students with severe stress were also females on the BEd programmes. There were 50 (42%) students with mild to moderate levels of stress. The majority of students (60, 50%) had normal levels of stress.

Table 5  Frequency distributions of stress scores (N = 119)

<table>
<thead>
<tr>
<th>Score range</th>
<th>Males (n = 32)</th>
<th>Females (n = 87)</th>
<th>BEd (n = 68)</th>
<th>PGCE (n = 51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>34 – 42</td>
<td>0 (0.00) *</td>
<td>1 (1.15)</td>
<td>1 (1.47)</td>
<td>0 (0.00)</td>
</tr>
<tr>
<td>26 – 33</td>
<td>3 (9.37)</td>
<td>5 (5.75)</td>
<td>6 (8.82)</td>
<td>2 (3.92)</td>
</tr>
<tr>
<td>19 – 25</td>
<td>5 (15.63)</td>
<td>17 (19.54)</td>
<td>13 (19.12)</td>
<td>9 (17.65)</td>
</tr>
<tr>
<td>15 – 18</td>
<td>7 (21.88)</td>
<td>21 (24.14)</td>
<td>14 (20.59)</td>
<td>14 (27.45)</td>
</tr>
<tr>
<td>0 - 14</td>
<td>17 (53.12)</td>
<td>43 (49.42)</td>
<td>34 (50.00)</td>
<td>26 (50.98)</td>
</tr>
</tbody>
</table>

* Frequency (percent)

Depression, anxiety and stress by gender

Although females scored slightly higher than their male counterparts on all the three subscales (depression, anxiety and stress), t-test analyses gave no significant gender differences (see Table 6). At the group level, mean scores in Table 5 indicate that both genders were functioning at the normal levels on depression. However the two genders were functioning at the moderate levels of anxiety. With regard to stress, the males and females were functioning at the normal and mild/partial levels respectively (see Table 1 for these group comparisons).
Table 6  Differences in depression, anxiety and stress by gender (N = 119)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Gender</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t (117)</th>
<th>P (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>Males</td>
<td>32</td>
<td>9.13</td>
<td>5.56</td>
<td>0.53</td>
<td>.599</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>87</td>
<td>9.82</td>
<td>6.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>Males</td>
<td>32</td>
<td>11.06</td>
<td>4.82</td>
<td>0.30</td>
<td>.765</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>87</td>
<td>11.39</td>
<td>5.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>Males</td>
<td>32</td>
<td>14.03</td>
<td>6.32</td>
<td>0.81</td>
<td>.419</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>87</td>
<td>15.14</td>
<td>6.69</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Depression, anxiety and stress by study program

Table 7 shows that there was a significant difference in levels of depression by study programme. PGCE students were functioning at the normal levels of depression while the BEd students were at the mild/partial levels. T-test analyses did not yield any significant differences between students on the two study programmes with respect to anxiety and stress. Both groups were, on average, functioning at the moderate levels of anxiety (see Table 1). PGCE students had lower levels of stress (normal) compared to BEd Students (mild/partial levels).

Table 7  Differences in depression, anxiety and stress by programme (N = 119)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Program</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t (117)</th>
<th>P (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>BEd</td>
<td>68</td>
<td>10.74</td>
<td>6.76</td>
<td>2.24</td>
<td>.027</td>
</tr>
<tr>
<td></td>
<td>PGCE</td>
<td>51</td>
<td>8.16</td>
<td>5.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>BEd</td>
<td>68</td>
<td>11.89</td>
<td>5.29</td>
<td>1.42</td>
<td>.157</td>
</tr>
<tr>
<td></td>
<td>PGCE</td>
<td>51</td>
<td>10.51</td>
<td>5.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>BEd</td>
<td>68</td>
<td>15.56</td>
<td>6.94</td>
<td>1.38</td>
<td>.170</td>
</tr>
<tr>
<td></td>
<td>PGCE</td>
<td>51</td>
<td>13.88</td>
<td>6.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Relationship between the study variables

The extent to which the study variables were related to each other is presented in Table 8. A low but significant positive correlation was obtained between age and programme of study. Age correlated negatively and insignificantly with gender. The relationship between gender and study programme was positive but nonsignificant. Age and gender correlated insignificantly with all the three dependent variables (depression, anxiety, and stress). Of the three independent variables (age, gender, and programme) only programme of study correlated significantly, though negatively, with depression. However there was a high degree of relationship among all the dependent variables.
Table 8  Intercorrelations among the study variables (N = 119)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Age</th>
<th>Gender</th>
<th>Programme</th>
<th>Depression</th>
<th>Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-.086</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program</td>
<td>.194*</td>
<td>.126</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>-.129</td>
<td>-.049</td>
<td>-.203*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>.005</td>
<td>-.028</td>
<td>-.131</td>
<td>.680**</td>
<td>1</td>
</tr>
<tr>
<td>Stress</td>
<td>.059</td>
<td>-.075</td>
<td>-.127</td>
<td>.648**</td>
<td>.647**</td>
</tr>
</tbody>
</table>

*p < .05 (2-tailed), ** p < .01 (2-tailed)

Prediction of depression, anxiety and stress

Though ideal each of the three regression models presented in Table 9 was inefficient and produced standardised beta ratios or weights that were nonsignificant. Table 9 shows that none of the three independent variables (age, gender and programme) was a predictor of any of the three dependent variables (depression, anxiety and stress). All the three multiple regression models were nonsignificant with low R Squares and low F-values.

Table 9  Multiple regression analyses of independent variables versus dependent variables (N = 119)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Depression</th>
<th>Anxiety</th>
<th>Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td>t</td>
<td>Beta</td>
</tr>
<tr>
<td>Age</td>
<td>-.097</td>
<td>-1.041</td>
<td>.030</td>
</tr>
<tr>
<td>Gender</td>
<td>-.034</td>
<td>.373</td>
<td>-.008</td>
</tr>
<tr>
<td>Programme</td>
<td>-.179</td>
<td>-1.916</td>
<td>-.135</td>
</tr>
<tr>
<td>R Square</td>
<td>.051</td>
<td></td>
<td>.018</td>
</tr>
<tr>
<td>F (3, 115)</td>
<td>2.040</td>
<td>.705</td>
<td>1.015</td>
</tr>
<tr>
<td>p(2-tailed)</td>
<td>.112</td>
<td>.551</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

Like trainee teachers in other countries, university student teachers in Brunei Darussalam also have many problems of a psychological nature. The present study identified depression, anxiety and stress as some of the problems preservice trainee teachers have in Brunei. Consistent with previous research Brunei female student teachers were in general more affected with depression, anxiety and stress than their male counterparts (see Eller et al., 2006; Dyrbye et al., 2006; McKean & Misra, 2000). These findings raise a number of questions and implications that need to be addressed: what are the causes of these problems? Why are the problems persisting; and how can the problems be resolved?

The causes of depression, anxiety and stress among student teachers in Brunei can be many, varied and not easy to know as noted from the literature review in this study. Similar to previous research this study found that age, gender and programme of study were not predictors of depression, anxiety, and stress in the Brunei student teachers context.
(see also Boutyere et al., 2007). This finding calls for further research to identify the real causes of depression, anxiety and stress in Brunei student teachers. The fact that depression, anxiety, and stress were found to be highly correlated in this study as in the previous investigations (see Edward, 2006) complicates the problem. It makes it difficult to isolate or separate the causes of these three mental health problems. The implication drawn from all this is that more sophisticated research employing both quantitative and qualitative procedures needs to be conducted to identify the causes. Further research utilizing interviews could particularly help address a wide range of questions such as: why were females more prone to depression, anxiety and stress than males? Why were BEd students more depressed than PGCE students? These and other related questions need to be researched to gain in-depth insights into the problems.

Identifying trainee teachers’ problems is, in itself, an important undertaking but not enough. An equally important obligation is to provide suitable and adequate interventions to solve the problems. This is perhaps where more attention, efforts and resources need to be directed to. The provision of satisfactory solutions might be quite challenging because depression, anxiety and stress are personal rather than academic problems that require counselling interventions. Some of the problems that will be encountered may include the following: how will students be encouraged to undergo voluntary psychological assessment and therapy?

Conclusion

The study investigated the incidence of depression, anxiety and stress among student teachers at the University of Brunei Darussalam. Ample evidence from the study confirmed that these problems affect some Brunei trainee teachers of both genders in the two study programmes investigated. Further research was recommended to gain deeper understanding of the problems and their possible solutions.

References


Quality of technology use in science and mathematics teaching

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Abstract
Inservice and preservice student teachers with complementary teaching experience and technology skills respectively were trained to observe, describe and comment on science and mathematics teaching with technology in primary schools. They found that there were teachers who used technology to “show and tell” about, and “drill and kill” science and mathematics. The use of technology needs to move beyond “drill-and-practice’ modes. However, it is encouraging that there were also teachers who made good use of quality electronic resources such as virtual experiments and manipulatives for science and mathematics teaching and learning from the internet. This paper discusses the spectra of primary and secondary school teaching and learning of science and mathematics with technology, including research findings by post-graduate students (Kam, 2007; Sim, 2007).

There should be more practice-oriented and evidence-based solutions to persistent problems in the teaching and learning of science and mathematics, with and without technology. Judicious use of technology could provide our students with the quality science and mathematics education that they need and deserve after all the effort and expenses on curriculum reforms in recent years.

Introduction
The global development of technology in education and e-initiatives is costly and includes the introduction of Information and Communications Technology (ICT) into the school curricula and teacher education. Many “veteran” teachers are not so quite oriented toward ICT and the more independent pedagogical orientations that complement that approach of teaching (Goh & Leong, 2006). Many decision-makers in education seem to fit Cuban’s (2006) sentiment that the mere use of technology itself can effect quality teaching and learning. Educationists have said for decades that personal computers, laptops, and hand-held devices are only vehicles for transporting instructional methods. Machines cannot replace what teachers can do in classrooms. Many people do not seem to realize that teachers ask questions, give examples, lecture, guide discussion, drill, use small groups, individualize instruction, organize project-based learning, and craft blends of these teaching practices. Cuban’s (Education Week, 2006) commentary drew responses such as that any improvement in education takes dedication on the part of teachers, school leadership and parents to learner-centered education. If we truly wish to empower our students, we must plan learner-centered lessons, put the tools in our students’ hands and coach. Technology has great potential for raising student achievement. However, a laptop
alone will not do it. There are many more factors that have to be in place. If the teacher knows how to use the software and can model it effectively, then the technology can make an impact on student understanding and achievement.

Furthermore, LeCourt’s (2001) proposition is that technology should not be reduced to merely being a function of education – a tool or be regarded as a means to promote more democratic educational practices. Educational practices and cultural practices are inextricable. However, many still regard technology as ‘yet another ideologically neutral tool to support the teaching of skills’, or even more worrying for “drill-and-practice” and “drill-and-kill” similar to the teaching machines of old.

Not only do our students possess skills and experiences that previous generations do not, but the very neurological structures and pathways they have developed as part of their learning are based on the technologies they use to create, store, and disseminate information. More importantly, these pathways and the categories, taxonomies, and other tools they use for thinking are different from those used by their teachers. The quality of teaching and learning interactions and thinking can be raised to greater levels through such ecological uses of technology (Schilling, 2005; Warschauer, 1998). Such benefits are not just the raising of test scores in some perfectly controlled experimental research as expounded by Cuban. Technology users get to practice how to research and analyse information, communicate ideas, and adapt and apply such information readily available from experts who share their knowledge unselfishly over the internet. These are essential skills and competences applied with technology which are needed to excel in this modern world of increasing challenges for all nations. Schools must rise to such challenges of providing such learning opportunities for students, and for educating all students to utilise technology effectively and efficiently. The fact that some teachers and lecturers in Brunei are already buying their own laptops and LCD projectors to use in class shows the benefits and usefulness of these emerging technologies.

There are many constraints of high-stakes testing and examination-oriented curricula, inadequate budgets and ICT facilities that teachers and students face in schools (Kam, 2007; Sim, 2007). These and other constraints drive teachers to use ICT in very instrumental ways, such as presenting lessons passively and also delivering drill and practice of examination and practice questions using technology, even over sophisticated learning management systems. All school teachers in Brunei Darussalam are encouraged to integrate ICT into the teaching and learning of subjects across the curriculum in pedagogically sound ways.

**Research Objectives**

This research sought to investigate whether technology has been used in schools in Brunei to support learning activities such as exploration, manipulation and articulation of what they are learning (speculation, conjecturing, hypothesis testing, and reflection on what they do) in science and mathematics. The researcher also sought to determine if there is quality use of technology for enhanced interactive learning of science and mathematics. The effective and efficient use of such expensive technology should include teaching interactive practices that can enhance the development of process skills and higher-order reasoning and thinking skills.
Background of the Study

Quality Use of Technology
Quality use of technology in science and mathematics and other subject areas in schools is elusive. Miller, Averis, Door and Glover (2005) in their large-scale research in England on the use of technology such as the interactive whiteboard (IAW) suggested a developmental approach, with teachers progressing through three stages. Teachers selected as examples of best practice would ‘demonstrate’ qualities that are identified as enhanced interactive. The three progressive stages of the IAW or technology teacher are: (1) Supported didactic: Technology is used only as a visual support to the lesson and not as an integral tool to conceptual development. There is little interactivity, pupil involvement or discussion; (2) Interactive: The teacher makes use of technology to stimulate pupils’ responses from time to time and to demonstrate some concepts. Elements of lessons challenge pupils to think, by the use of a variety of verbal, visual and aesthetic stimuli; and (3) Enhanced interactive: This approach is at a much higher cognitive level marked by a change of thinking on the part of teachers who plan to use the technology as an integral part of lessons, and seek to integrate concept and cognitive development in a way that exploits the interactive capacity of the technology. These teachers are aware of the techniques available, are fluent in their use and structure lessons so that there are lots of opportunities for pupils to respond to technology/IAW stimuli – as individuals, pairs or groups.

With enhanced interactive learning, technology is used as a means of prompting discussion, explaining processes and developing hypotheses or structures which are then tested by varied applications. A wide variety of materials are used including ‘home-grown’ and internet resources, and IAW specific and commercial software. The ‘best practice’ teachers selected for their study were all working at either the interactive or the enhanced interactive stages, with all of them demonstrating elements of enhanced interactivity. In almost all cases, they each had an IAW in their classroom and used it all the time.

Oldknow (2004) in an earlier study reported that the Mathematics Curriculum IT Support Group from the Department of Education and Skills (DfES) in the United Kingdom had come up with six ways in which ICT could assist students in learning mathematics. They are: learning from feedback; observing of patterns; seeing connections; working with dynamic images; exploring of data; and teaching about computers. These are features of enhanced interactivity necessary for quality mathematics teaching and learning.

Such quality use of technology in mathematics education is further supported by Hennessy and Ruthven (2003) who identified several cases of successful ICT use in secondary mathematics and developed a model as reference for other teachers. Teachers should try to use ICT if they realize that ICT could provide students with opportunities such as i) an interactive learning environment, ii) the capability for immediate feedback, and iii) possibility of an investigative approach. The authors posited that the main goal of a teacher is to assist students to develop cognitively. Once teachers realize the potential of ICT, they will try to adopt it in their practices.
Similarly, quality classroom teaching and learning of science should reflect creative expression and exploration in instructional activities that integrate science and technology (Cleland, Wetzel, Zambo, Buss, & Rillero, 1999). The effective use of technology includes:

- Visualization and understanding of scientific processes and systems
- Information-seeking and researching
- Experimenting and inferencing in science
- Communicating findings and ideas; and language development which is especially challenging in the Brunei context where English is hardly used outside of the classroom.

Strategies for Using Technology
Many teachers in Brunei have positive attitudes toward application software, and the use of internet and CD-ROM resources in their teaching (Goh & Leong, 2006; Sallimah & Leong, 2002). However, when it comes to using such resources directly in classroom instruction there are reservations, barriers and constraints of facilities and resources (Kam, 2007; Leong, 2006; Sim, 2007; Susilawati, 2005). We need not keep re-inventing the wheel and making teachers produce software or pay lots of money to commercial software developers and consultants. Rather, we should be able to hasten the process of achieving quality use of technology in teaching from researchers who have gone ahead and opened up such new frontiers of knowledge. The challenge is to explore how we can maximize returns with less expenditure, especially with all the wonderful instructional e-resources freely available on the internet from renowned universities, institutions and agencies. Links to examples of such relevant e-resources are available on http://shbie.wordpress.com and the researcher’s website www.e-journalofeducation.com. Many of these e-resources have been identified and evaluated by student teachers and the author in their technology courses.

It is encouraging that there are teachers and educators in teacher education in Brunei who are continuously exploring innovative, pragmatic and active ways of using ICT ecologically and effectively (Goh & Leong, 2006; Jabaidah, 2001; Kam, 2007; Sallimah & Leong, 2002; Sim, 2007). These teachers remain focused on students’ understanding, creativity, thinking and performance in examinations as well, while making use of the technology in their teaching and learning, providing elements of enhanced interactivity in the classroom and developing higher order thinking skills that are required in public examinations. It would be unwise to teach without focusing on such high-stake examinations. Such teachers should be encouraged to lead others in continuous professional development activities which appear to be far and in between (Kam, 2007; Sim, 2007, Susilawati, 2005).

Method

Primary and secondary schools in Brunei have been provided with computer laboratories, internet access and interactive whiteboards for several years. Diploma graduates in computer studies are employed as ICT teachers in primary schools in Brunei to assist in providing support for regular school teachers involved in the implementation of ICT across
the curriculum. Sixty-four such teachers have been admitted for a one-year teacher education programme in the last 2 years. There were 27 ICT student teachers involved in this study. Another nine inservice primary mathematics and science teachers were also involved in the study. These 36 teachers were enrolled in a technology in primary school mathematics and science education course which the researcher was teaching.

These student teachers were assigned in small groups of twos and threes to primary schools to observe science and mathematics lessons taught in the computer laboratories using technology. They were prepared to take notes of hardware and software used during the lessons and the kinds of activities, and teacher-pupil and pupil-pupil interactions that take place during the ICT-science and mathematics lessons. The student teachers were also asked to include in their reports their own comments on the lessons they had observed, and make suggestions of changes in the lessons they would make if they were to teach the lessons themselves.

The reports of these student teachers were analyzed, summarised and discussed. Key findings of research into technology use in secondary school science and mathematics teaching in Brunei are also discussed. The researches on secondary school science and mathematics were conducted by Master of Education students who wanted to investigate the status of teaching of these subjects using technology.

Features of lessons observed were analysed to determine if there is quality use of technology for enhanced interactive learning of science and mathematics. Teaching practices that enhanced the development of process skills and higher-order reasoning and thinking skills were deemed to reflect quality use of technology in the teaching of science and mathematics. Low level interactive use of technology for recall of facts and drill-and-practice which were popular in the 1980s were regarded as not fully utilising the power of such expensive technology provided in schools. The essence of investigations, inquiry, explorations and communication of ideas that are the heartbeats of science and mathematics must be evident in the teaching of these subjects whether with or without technology.

Results and Discussion

Primary School Mathematics

Descriptions of lessons observed by preservice student teachers with technology background and skills, their suggestions and comments by the researcher were discussed in lectures and are summarized in Tables 1 to 5 in the appendices. The lessons observed were not so motivating or encouraging. The interactivity of teacher-pupils-technology was low. Suggestions of the preservice teachers were also not pedagogically strong nor very interactive and motivating. These student teachers did not have earlier teacher training or teaching experience, and were only just taking a course on ICT and teaching of mathematics and science in addition to general education courses. This research activity helped them reflect on the many ways that the two subjects could be taught more effectively; and also that technology should be used more effectively in the teaching and learning of science and mathematics. These preservice teachers need more courses on methods of teaching primary school mathematics.
Descriptions of lessons observed by inservice student teachers with teaching experience, their suggestions and comments by the researcher were similarly discussed and summarized in Tables 6 to 8. The comments of these inservice teachers reflected their years of teaching experience, and better knowledge of pedagogy than the preservice HND teachers. They were able to assess that the three lessons observed were also not so motivating or challenging. The interactivity of teacher-pupils-technology was low. Suggestions of the inservice teachers were better pedagogically, more interactive and challenging. Much more effort seems to be needed to raise the quality of technology use in primary school mathematics.

Table 1 Technology Use in Primary 5: Four Operations

<table>
<thead>
<tr>
<th>Observations reported by preservice ICT student teachers</th>
<th>Suggestions by student teachers</th>
<th>Comments by researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAW was used for interactive drill exercises created with Hot potatoes and from websites. Pupils could use the network in the lab to access the activities.</td>
<td>Interesting and useful.</td>
<td>Place value and number sense lacking and such difficulties were not addressed. (Some interactivity, more of drill and practice)</td>
</tr>
</tbody>
</table>

Both preservice and inservice teachers reported that they had benefited from the classroom observations and discussions and reflections that ensued during course seminars and workshops. They realised that quality teaching of mathematics reflects the effective use of technology in:

- Development of mathematical vocabulary and meaning
- Logical thinking and relationships of concepts
- Exploring new mathematical ideas
- Problem-solving and problem-posing
- Communicating ideas and language development.
### Table 2  Technology Use in Primary 5: Improper Fractions and Mixed Numbers

<table>
<thead>
<tr>
<th>Observations reported by preservice ICT student teachers</th>
<th>Suggestions by student teachers of changes</th>
<th>Comments by researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAW used for whole class discussion and try activities on the IAW individually. Example of five halves of circle used to show $\frac{5}{2}$. Pupils selected improper fractions from list e.g. $\frac{5}{3}, \frac{10}{5}, \frac{3}{7}, \frac{3}{2}$ MS Excel activity prepared with conditional formatting was also used by pupils in pairs filling in the cells, e.g. $\frac{3}{2} = \frac{2}{2} + \frac{1}{2} = 1 \frac{1}{2}$ Online activities similar to the Excel activity and other fraction games were also used by the pupils in pairs.</td>
<td>Better for teacher to draw the circles and rectangles while explaining on the IAW. Colored visual displays of animation, graphics and text could be clearer. Activity could have been downloaded and carried out offline. Allow pupils to draw their own representations using MS Office tools.</td>
<td>No multiple representations of fractions used. Problem-solving and problem-posing not used. More of whole class practice of not so challenging tasks were done repeatedly. (Not sure if pupils understand the concepts. There are websites with good virtual manipulatives that could be used – some interactivity)</td>
</tr>
</tbody>
</table>

### Table 3  Technology Use in Primary 4: Place Value and Addition with 4-Digit Numbers

<table>
<thead>
<tr>
<th>Observations reported by preservice ICT student teachers</th>
<th>Suggestions by student teachers</th>
<th>Comments by researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used IAW to explain procedure for addition of two 4-digit numbers. Used standard algorithm and Hot potatoes.</td>
<td>Teacher was clear and pupils understood the teacher’s explanations.</td>
<td>Understanding of place value with virtual manipulatives could be more useful. (Some interactivity)</td>
</tr>
</tbody>
</table>

### Table 4  Technology Use in Primary 3: Shapes

<table>
<thead>
<tr>
<th>Observations reported by preservice ICT student teachers</th>
<th>Suggestions by student teachers of changes</th>
<th>Comments by researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software of basic shapes were used by pupils in pairs. Pupils picked shapes, added colors and patterns, and discussed the shapes on the IAW.</td>
<td>More creative for pupils to draw their own shapes. Teacher could relate shapes to real objects.</td>
<td>Discussion could be at a higher level of interactivity.</td>
</tr>
</tbody>
</table>
Table 5  Technology Use in Primary 1: Subtraction with regrouping

<table>
<thead>
<tr>
<th>Observations reported by preservice ICT student teachers</th>
<th>Suggestions by student teachers of changes</th>
<th>Comments by researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powerpoint slides with animation were used to show standard algorithm of $15 - 7$. Finger counting from 7 up to 15 was shown. The teacher focused pupils’ attention on these similarities: $_ + 7 = 15$; $7 + 8 = 15$; $15 - 7 = 8$</td>
<td>Only one pupil can do the activity at a time on the IAW. Pupils found it difficult to do the subtraction with regrouping.</td>
<td>Difficulty not addressed. Alternative methods of counting, and number sense could be used. (Little interactivity)</td>
</tr>
</tbody>
</table>

Table 6  Technology Use in Primary 5: Geometrical shapes

<table>
<thead>
<tr>
<th>Observations by inservice student teachers</th>
<th>Suggestions by trained teachers</th>
<th>Comments by researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined different shapes to form objects on IAW. Whole class discussion/interaction, then pupils worked in pairs on PCs. Interesting use of ‘Active Studio’ program.</td>
<td>More challenging to learn the properties of the shapes, e.g. fitting triangles into rectangles, etc.</td>
<td>Quite good interactivity. Could explore Euclidean geometry software for drawing.</td>
</tr>
</tbody>
</table>

Table 7  Technology Use in Primary 4: Fractions

<table>
<thead>
<tr>
<th>Observations reported by inservice student teachers</th>
<th>Suggestions by trained teachers</th>
<th>Comments by researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher demonstrated answering worksheet on IAW. Pupils were interested but not attentive. Pupils worked in pairs and manipulate numbers on simple fractions.</td>
<td>Not enough opportunities for pupils to explore understanding of fractions. Teaching method is limited to ‘drill-&amp;-practice’</td>
<td>Suggestions of more interactivity by inservice teachers. Virtual manipulatives from the internet could be useful.</td>
</tr>
</tbody>
</table>

Table 8  Technology Use in Primary 5: Four Operations

<table>
<thead>
<tr>
<th>Observations reported by inservice student teachers</th>
<th>Suggestions by trained teachers</th>
<th>Comments by researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math games from <a href="http://www.funbrain.com">www.funbrain.com</a> were used. Pupils working in pairs could choose the games. Pupils enjoyed the games and could even surf the internet for other games.</td>
<td>Pupils improved their reading and ICT skills. Pupils could help each other when working in pairs.</td>
<td>Concepts to be taught and learned?</td>
</tr>
</tbody>
</table>
Similar comments were obtained from primary science lessons observed. The topics, levels, suggestions and comments of student teachers are summarised in Tables 9 to 12. The inservice student teachers’ comments on the lessons were again more insightful as they had been trained in science methods courses and had experience teaching primary science and mathematics for at least five years (Table 11). Likewise, these preservice teachers need more courses on methods of teaching primary school science.

There were instances of “teacher explaining science” and “drill-and-practice” of science facts in the lessons on water cycle, magnets, animals with backbone, heat, shoot system, and infectious diseases. Low level interactivity was seen in the “fill-in-the-blanks” exercise after viewing pictures and videos from a CD-ROM on electricity.

In contrast, several effective science lessons were observed. There was some quality use of technology in these lessons. Pupils made predictions when carrying out virtual tests on different kinds of materials. This particular resource was from a BBC website. A little quality use of technology was seen in the lesson where pupils had to write sentences about planets from a powerpoint presentation on planets.

### Table 10.1  Inservice Student Teachers’ Pertinent Comments on Science Lessons Observed

<table>
<thead>
<tr>
<th>No.</th>
<th>Summary of observations reported by inservice teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water cycle – Primary 4</td>
</tr>
<tr>
<td></td>
<td>• Teacher used IWB for demonstration of concepts and skills</td>
</tr>
<tr>
<td></td>
<td>• All the activities were based on drill-and-practice</td>
</tr>
<tr>
<td>2</td>
<td>Characteristics of various kinds of materials – Primary 5</td>
</tr>
<tr>
<td></td>
<td>• BBC website with tests for materials used.</td>
</tr>
</tbody>
</table>
• Pupils were interested, attentive, and skilful in using ICT and Internet
• Pupils make predictions when carrying out virtual tests on different kinds of materials

3 Planets – Primary 6
• Pupils working in pairs typed in sentences about the planets.

Table 10.2 Preservice Student Teachers’ Pertinent Comments on Science Lessons Observed

<table>
<thead>
<tr>
<th>No.</th>
<th>Summary of observations reported by preservice teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Magnets – Primary 5a</td>
</tr>
<tr>
<td></td>
<td>• IWB flipcharts used for whole class factual revision and recall of content from previous lesson such as definition and types of magnets.</td>
</tr>
<tr>
<td></td>
<td>• Online Internet activities used by pupils in pairs at the end of the lesson.</td>
</tr>
<tr>
<td>2</td>
<td>Magnets – Primary 5b</td>
</tr>
<tr>
<td></td>
<td>• Showed pictures of types of magnets on IWB.</td>
</tr>
<tr>
<td></td>
<td>• Object is magnetic or non-magnetic and which attract or repel (meaning “not attract”?). Interactive “fill-in-the-blanks” exercise used.</td>
</tr>
<tr>
<td>3</td>
<td>Electricity – Primary 6</td>
</tr>
<tr>
<td></td>
<td>• Colorful and attractive images used to present lesson on IWB</td>
</tr>
<tr>
<td></td>
<td>• Science CD-ROM with text, video and graphics was also used</td>
</tr>
<tr>
<td></td>
<td>• Pupils take turns to go to IWB individually to answer the questions on the CD</td>
</tr>
<tr>
<td>4</td>
<td>Animals with backbone – Primary 5</td>
</tr>
<tr>
<td></td>
<td>• Powerpoint presentation on IWB was used to label the parts of a fish and bird.</td>
</tr>
<tr>
<td></td>
<td>• For the last 10 minutes, the teacher showed pupils websites of vertebrates.</td>
</tr>
<tr>
<td></td>
<td>• Teachers asked factual questions that required only very short responses.</td>
</tr>
<tr>
<td></td>
<td>• Pupils use laser pointer on the IWB. [Children should not use laser pointers for safety reasons, could accidentally be pointed at the eyes.]</td>
</tr>
<tr>
<td>5</td>
<td>Heat – Primary 4</td>
</tr>
<tr>
<td></td>
<td>• IWB was used to show pictures of hot objects. Pupils were asked what they would feel if they touched the objects.</td>
</tr>
<tr>
<td></td>
<td>• Questions were prepared on the IWB for pupils to answer.</td>
</tr>
<tr>
<td>6</td>
<td>Shoot system: Fruits and seeds – Primary 5</td>
</tr>
<tr>
<td></td>
<td>• Teachers talk about the topic using powerpoint and IWB.</td>
</tr>
<tr>
<td></td>
<td>• Pupils answer factual questions on IWB.</td>
</tr>
<tr>
<td></td>
<td>• Very factual slides used in presentation and worksheet.</td>
</tr>
<tr>
<td>7</td>
<td>Infectious diseases – Primary 5</td>
</tr>
<tr>
<td></td>
<td>• Textbook website used</td>
</tr>
<tr>
<td></td>
<td>• Powerpoint presentation with ‘ActivStudio’ ‘drag &amp; drop’ feature used on IWB MSWord and Excel used for fill-in-the-blanks exercises</td>
</tr>
</tbody>
</table>
Table 11  Inservice Teachers’ Suggestions for Lessons Observed

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic and Class</th>
<th>Suggestions by trained teachers of change if any</th>
<th>Comments by researcher</th>
</tr>
</thead>
</table>
| 1   | Water cycle – Primary 4 | • Most pupils were not very motivated – activities did not require higher order thinking  
• Many pupils could not remember what they had learnt  
• Activities were not suitable for developing concepts on water cycle. More appropriate for reinforcement of learning.  
• A story format ‘I was a raindrop’ with pictures and videos could be used to determine pupils’ prior knowledge, stimulate discussion and promote higher order thinking  
• Use of water in everyday life and ways to conserve water should be discussed. | Teachers should be wary of becoming ‘show-and-tell’ and ‘interactive drill-and-practice’ teachers  
• ICT facilities should also be made available in normal classrooms other than in the computer laboratories; or at least in more resource rooms that teachers could use for teaching with technology. |
| 2   | Characteristics of various kinds of materials – Primary 5 | Activities are useful  
• Inquiry-based science could be carried out. | Actual available materials could also be used for inquiry learning in science together with the virtual experiments where possible |
| 3   | Planets – Primary 6 | • The lesson was to increase the competency of pupils’ typing skills and use of MS Word.  
• Pupils could recall important science content learned. | Could be more open-ended |

The student teachers were able to reflect on the discussions of science lessons observed and begin to view effective and quality use of technology in science teaching as providing:

- Visualization and understanding of scientific processes and systems
- Information-seeking and researching
- Experimenting and inferencing in science
- Communicating findings and ideas; and language development.
Table 12.1 Preservice Teachers’ Suggestions for Lessons Observed I

<table>
<thead>
<tr>
<th>No.</th>
<th>Suggestions by preservice teachers of change if any</th>
<th>Comments by researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Colored visual displays of animation, graphics and text could be clearer to show the actual part of an object that is attracted by the magnet. Videos could have been used. Encourage pupils to search for more information.</td>
<td>Minimal engagement of pupils in science processes and why, how and what if questions related to: (a) Experimenting and inferencing; (b) Communicating findings and ideas; and language development. Content of repulsion property of magnets was not discussed. More of whole class practice of not so challenging tasks repeated with minimal active participation of pupils.</td>
</tr>
<tr>
<td>2</td>
<td>Pupil participation on IWB is limited. Materials should be brought along for pupils to try out.</td>
<td>Could use bar and ring magnets to show attraction and repulsion of poles of two magnets. Use compass for finding directions, e.g. direction for Muslims to pray (MIB). More discussions in class needed for more challenging interactivity.</td>
</tr>
<tr>
<td>3</td>
<td>Pupils were attracted by the images and distracted from the content. Some pupils liked but some did not like to answer questions on the IWB in front of the class.</td>
<td>Preservice ICT student teachers avoided discussion of the science content and its delivery which is again ‘show-and-tell’ and ‘interactive drill-and-practice’. Real experiments could be supplemented with virtual experiments from the internet.</td>
</tr>
<tr>
<td>4</td>
<td>Activities other than powerpoint presentation of parts of fish and bird could have been used. ‘Virtual zoos’ from the internet could be used to show the variety of vertebrates. More higher order questions could be asked by the teacher. MCQs could be prepared.</td>
<td>Two-tiered MCQ would be more challenging as reasoning and higher order thinking could be developed and assessed.</td>
</tr>
</tbody>
</table>
Table 12.2  Preservice Teachers’ Suggestions for Lessons Observed II

<table>
<thead>
<tr>
<th></th>
<th>Heat – Primary 4</th>
<th>Shoot system: Fruits and seeds – Primary 5</th>
<th>Infectious diseases – Primary 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Bring along a glass and a pot of hot water to show heat flow.</td>
<td>It is easier to show real fruits and seeds to pupils than on computers.</td>
<td>Good practice for pupils</td>
</tr>
<tr>
<td></td>
<td>The lesson should focus on key concepts and their relationships, with students developing their own concept maps with adaptive feedback and tutorials.</td>
<td>Could use concept maps to develop understanding of key concepts and language related to the topic.</td>
<td>More challenging activities could be carried out using ICT.</td>
</tr>
</tbody>
</table>

Secondary School Science and Mathematics

As in primary schools, there were also a few cases of innovative secondary school mathematics teachers observed by Kam (2007) in Brunei. Such innovative teachers made use of limited ICT facilities that were available to come up with ICT lessons that could arouse students’ interest and introduce interactivity into their classrooms. Some useful websites identified by student teachers and used by practising teachers are listed in Table 13. Especially beneficial are simulations of science processes, simulated science experiments and virtual manipulatives which are freely available from the internet. Such identified useful e-resources are listed on http://shbie.wordpress.com and the researcher’s own website, www.e-journalofeducation.com and could be used to challenge and develop students’ thinking and problem-solving skills. Such pedagogy would reflect the quality of technology use in science and mathematics teaching.

Although IAWs were employed in many of the lessons observed, they did not achieve the level of enhanced interactivity proposed by Miller et al. (2005) and observed in England. However, they were indications that a few teachers were infusing technology into their teaching. In a paper, General ICT Policy Elements, written by UNESCO Bangkok (2003) the authors present this salient information.

The UNESCO, Bangkok report states:

Teachers will use computers if they find them beneficial. They will not use them:

- if it takes too long to master the skills of using the machine and its software;
- if it takes longer to prepare classes;
- if there is the risk of an embarrassing situation where the computer gets stuck or crashes (with the even greater risk that some insolent kid will get it unstuck);
- if its proposed use does not follow the curriculum; or
- if the skills learned are not required in tests.
Table 13  Useful Mathematics and Science Websites Identified by Student Teachers

<table>
<thead>
<tr>
<th>TOPIC/LEVEL</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equivalent Fractions</td>
<td><a href="http://www2">http://www2</a> dsu nodak edu/users/edkuk/public_html/FractAdd/FRAMACO .html</td>
</tr>
<tr>
<td></td>
<td><a href="http://arcytech">http://arcytech</a> org/java/fractions/fractions html</td>
</tr>
<tr>
<td></td>
<td><a href="http://nlvm">http://nlvm</a> usu edu/en/nav/frames asid 102_g_1_t_1 html</td>
</tr>
<tr>
<td></td>
<td><a href="http://nlvm">http://nlvm</a> usu edu/en/nav/frames asid 102_g_2_t_1.html</td>
</tr>
<tr>
<td>Fractions Sets</td>
<td><a href="http://www">http://www</a> visualfractions com/Identify_sets html</td>
</tr>
<tr>
<td>Identify Fractions</td>
<td><a href="http://www">http://www</a> visualfractions com/EnterCircle html</td>
</tr>
<tr>
<td>With Circles</td>
<td><a href="http://www">http://www</a> visualfractions com/MixedCircle html</td>
</tr>
<tr>
<td></td>
<td><a href="http://www">http://www</a> visualfractions com/MixtoFrCircle html</td>
</tr>
<tr>
<td>Addition</td>
<td><a href="http://www">http://www</a> nlvm usu edu/en/nav/frames asid 154_g_2_t_1.html</td>
</tr>
<tr>
<td>Subtraction</td>
<td><a href="http://www">http://www</a> nlvm usu edu/en/nav/frames asid 155_g_2_t_1.html</td>
</tr>
<tr>
<td>Multiplication</td>
<td><a href="http://www">http://www</a> nlvm usu edu/en/nav/frames asid 192_g_2_t_1.html</td>
</tr>
<tr>
<td>Division</td>
<td><a href="http://www">http://www</a> nlvm usu edu/en/nav/frames asid 193_g_2_t_1.html</td>
</tr>
<tr>
<td>4 Arithmetic</td>
<td><a href="http://www">http://www</a> playkidsgames com/games/apples/default html</td>
</tr>
<tr>
<td>operations</td>
<td><a href="http://www">http://www</a> factmonster com/math/flashcards html</td>
</tr>
<tr>
<td></td>
<td><a href="http://www">http://www</a> primarygames co uk/pg2/speedgrid/speedadd/urikaadd2res html</td>
</tr>
<tr>
<td></td>
<td><a href="http://www">http://www</a> primarygames co uk/PG5/Eggs/Add/eggsadd html</td>
</tr>
<tr>
<td></td>
<td><a href="http://www">http://www</a> primarygames co uk/pg2/speedgrid/speedsub/urikasub2res html</td>
</tr>
<tr>
<td></td>
<td><a href="http://www">http://www</a> primarygames co uk/PG5/Eggs/Sub/eggssubb.html</td>
</tr>
<tr>
<td></td>
<td><a href="http://www">http://www</a> primarygames co uk/pg4/Multipods/multipods html</td>
</tr>
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<td></td>
<td><a href="http://www">http://www</a> primarygames co uk/pg2/sumsense/summulti html</td>
</tr>
<tr>
<td></td>
<td><a href="http://www">http://www</a> primarygames co uk/pg4/Divipods/divipods html</td>
</tr>
<tr>
<td></td>
<td><a href="http://www">http://www</a> primarygames co uk/pg2/sumsense/sumdiv html</td>
</tr>
<tr>
<td>Fractions</td>
<td><a href="http://www">http://www</a> dositey com/math/mistery2 html#s</td>
</tr>
<tr>
<td>Comparing</td>
<td><a href="http://www">http://www</a> bbc co uk/skillswise/numbers/fractiondecimalpercentag e/ comparing/comparingall3/game.shtml</td>
</tr>
<tr>
<td>Fractions, Decimals and Percents</td>
<td></td>
</tr>
<tr>
<td>Numbers and operations</td>
<td><a href="http://teacher">http://teacher</a> scholastic com/mathhunt/StartGame asp?QuizID=4</td>
</tr>
<tr>
<td>Visual Fractions</td>
<td><a href="http://www">http://www</a> visualfractions com/index html</td>
</tr>
<tr>
<td>National Library of Virtual Manipulatives (NLVM)</td>
<td><a href="http://nlvm">http://nlvm</a> usu edu/en/nav/category_g_2_t_1.html</td>
</tr>
<tr>
<td>Properties of materials</td>
<td>The National Library of Virtual Manipulatives (NLVM) is an NSF supported project that began in 1999 to develop a library of uniquely interactive, web-based virtual manipulatives or concept tutorials, mostly in the form of Java applets, for mathematics instruction (K-12 emphasis). The project includes dissemination and extensive internal and external evaluation.</td>
</tr>
<tr>
<td>WebQuests</td>
<td><a href="http://www">http://www</a> primarygames co uk/schools/revisewise/science/materials/</td>
</tr>
<tr>
<td></td>
<td><a href="http://www">http://www</a> geocities com/jessubdcded/</td>
</tr>
</tbody>
</table>
Kam (2007) and Sim (2007) found that professional development ICT courses for teachers were too generic and too few. Many teachers have not been trained. Besides skills in using technology, science and mathematics teachers need to be provided training on the use of subject-specific software and e-resources, and how such software and e-resources from the internet could be used effectively in the teaching and learning of science and mathematics. Secondary school science and mathematics teachers were not very motivated to use technology. Among the reasons cited were:

- No benefits for examinations were seen by teachers
- Not enough facilities and software
- Need changes in curriculum and examination
- Need instructional e-resources to be readily available
- Teachers are very busy people, have no time to learn and develop courseware/tools [A PATHWAY THAT HAS NOT WORKED]
- Time-table constraints and breakdown of equipment.

Uptake of technology by secondary school science and mathematics teachers in Brunei has been slow. About 25% of mathematics teachers and 15% of science teachers were reported to be actively using technology for instructional purposes. There are efforts to provide more technology teaching facilities for teachers and hopefully the quality and effectiveness of technology use can also be improved.

Centres of Excellence are suggested to provide a means for dedicated study in an area of promise in schools. They could be set up on a temporary basis with a life-cycle of three to five years [tied to the normal cycle of granting agencies]. During that time students could be encouraged to assist and pursue in studies related to the centres, UBD academicians could work collaboratively with teachers to write papers on the topic or write grant proposals to acquire soft-money to establish or further the interest of the centres. Ministry officials could capitalize on the energy of teachers, university staff and students to test out their own initiatives. In brief the Centres of Excellence become a means to try out innovations in a consistent and dedicated way and to keep records of results which become diffused into instructional resource planning in Brunei.

Participation by the Ministry in the university’s programs correlated with Centres of Excellence and sponsored by a project initiated by the Ministry gives the Ministry input and partnership into the research mechanism normally directed by the university. This kind of participation would be healthy for both partners and keeps the whole system, including schools, stimulated. In fact, this is one of the important purposes in the Centres of Excellence concept. The Ministry of Education has recently set up an Advisory Board for the Sultan Hassanal Bolkiah Institute of Education, UBD, so that there is greater coherence and partnership in education in Brunei. This could be one of the initiatives of the Advisory Board.
Critical features that need to be adopted to ensure successful development of educators’ and students’ learning in science and mathematics through use of technology include:

- **Ownership principle:** Teachers and students need to be involved directly in their own development and acquisition of knowledge, skills and processes. Learning by being told what to do or what to learn is not effective and has limitations.
- **Incremental development and nurturing with positive feedback** sustain self-confidence and passion for learning.
- **Start small but think BIG.** Start from what learners can do and progress with ambitious targets of achievement.
- **Teachers provide support and facilitate.**

**Conclusion**

In Brunei, ICT teachers have been helping subject teachers with the necessary technology preparations and resources for lessons with ICT resources. Subject teachers are learning ICT skills to become more independent. These two groups of teachers share expertise and experience, and learn from each other. With the availability of technology, there is a danger of teachers switching from “chalk-and-talk” with “drill-and-practice” to “show-and-tell” with “interactive drill-and-practice” which could become “drill-and-kill”. Teachers were seen to be doing and explaining. Pupils are the ones who need the practice and should be the ones doing, thinking, exploring, explaining and communicating creatively.

The use of IAW and data projection could lead easily to “show and tell” rather than more challenging whole class and small group interactions and activities. Very cleverly, some teachers have been able to combine various effective strategies in teaching science and mathematics with their own resources while also addressing examination orientations. Pupils worked (individually, in pairs, or in threes) on the PCs doing the activities related to examination-type tasks while they were also being demonstrated on the IAW or LCD projection screen. There could be more open-ended cognitive and metacognitive tasks and mini-projects/practical investigative activities that promote meaningful learning and investigations of the content and processes of science and mathematics. Many useful virtual manipulative resources for mathematics and virtual science experiments are freely available on the internet. Demonstration of concepts with the use of a variety of verbal, visual and aesthetic stimuli helps students to comprehend better and challenges them to think (Miller et al., 2005). Computers and technology should take their place as a natural and powerful part of the teaching and learning process, affecting both aspects of teaching and learning in three ways. This new technology influences how information is presented; how students interact both with the medium and through the medium with the teacher and other learners; and how knowledge is structured. Brumfit (1998) discussed issues of bilingual texts generating questions about awareness, the relationship between control and freedom in language learning, the positive effects of ICT on motivation, and also the close interaction between the data that we can derive from our teaching materials and research data that previously had not been available. All these are possibilities accelerated by new technological resources that can lead to the quality use of technology.
There is a need in Brunei to capitalise on multimedia technology which offers opportunities for creative expression and exploration in instructional activities that integrate mathematics, science and technology (Cleland et al., 1999; Greenberg, 1998; Thomas, Johnson & Stevenson, 1996). With current available multimedia, nonlinear access, autonomy and self-regulation are incorporated into software design. Learning and teaching can be made more fun, more interesting and interactive, and more independent and individually challenging.

There is an urgency to develop and monitor the adoption of quality use of technology so that relevant e-resources and pedagogy could be shared nation-wide to enhance teachers’ skills and achieve higher levels of innovation and interactivity in teaching and learning. However, this is difficult without more technology-capable personnel, more technology facilities, and changes in curriculum and examination orientations.

There should be more practice-oriented and evidence-based solutions to persistent problems in the teaching and learning of science and mathematics, with and without technology. There should be more of classroom-based research on important issues and less of trivial and arm-chair survey questionnaire type of research. Research evidence should be useful for policymakers to make informed curriculum and policy decisions, especially on strategies such as how to close the achievement gap in key subject areas of the school curriculum. Such judicious use of technology could provide our students with the quality science and mathematics education that they need and deserve after all the effort and expenses on curriculum reforms in recent years.

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Sim, J. (2007). Factors that contribute to the low uptake of information and communication technology by secondary science teachers in teaching Unpublished MEd dissertation, University Brunei Darussalam, Brunei.


Students on teaching practice: some influences shaping the development of secondary school ESL teachers in Brunei Darussalam

SUE NAIR
Universiti Brunei Darussalam

Abstract
University and school-based teacher educators in Brunei Darussalam are working towards a redefinition of their roles in the education of future teachers. Within this framework, the roles of university based supervisors and school based co-operating teachers in the education of students on teaching practice are being examined. To inform proposals about possible changes to these roles, research was carried out into what and how students learn on teaching practice.

Five pre-service ESL student teachers attached to secondary schools were asked to complete weekly journals in which they described and reflected upon significant episodes in their teaching experience. In some instances, the journal writing became dialogic in nature. Data were also gathered through discussion with these students, based on their journals and on observations of their teaching; and from materials in their teaching practice files, for example lesson plans and evaluations.

This paper will report on the analysis of these journals, files, observations and conversations. In particular, it will consider:
• What important insights about teaching and learning the students gained during their practicum
• Who/what helped the students develop and refine these insights into teaching and learning
• How these insights influenced their approach to ESL teaching

The findings suggest student teachers need more support as they critically examine their own practice. The relevance of the findings to the changing nature of the school/university partnership in educating future ESL teachers in Brunei Darussalam, in particular the roles of university based supervisors and school based co-operating teachers, is discussed and recommendations made.

Introduction

The school based component of teacher education courses has enormous potential for developing the expertise of student teachers. Professional and personal growth on teaching practice may include students learning about: themselves and their identities as teachers; their pupils as individuals and learners; the dynamics of teaching and learning; the school curriculum and the syllabus(es) of their own specialism(s); teaching techniques; and how to interact within the corporate and social culture of the school.
The influences which may affect this learning are both personal and situated in the context of the teaching practice. Research has shown that student teachers’ previous language learning experiences influence their learning on teacher education programmes (Borg, 2006, pp. 50-54). Thus, a student teacher’s experience, both as a pupil observing teaching and teachers and as a pre-service student acquiring subject and pedagogical knowledge, will interact with the learning on school attachment to shape very individual perceptions of teaching and learning.

The school context, too, will have a powerful effect on what student teachers learn. The variables are numerous and may include: the beliefs of the cooperating teachers (Nettle, 1998) and those of the student teachers (Zanting, Verloop & Vermunt, 2001); the culture of the school in terms of the ways in which it includes student teachers (Graham & Roberts, 2007) and the prevailing classroom pedagogy (Edwards and Protheroe, 2003); and the students’ relationships with the pupils they teach (Knoblauch & Hoy, 2008). Outside the school context, McNamara, 1994, found friends and relatives also influenced classroom practice.

It has been suggested (for example, Metcalf & Kahlich, 1996, pp. 98-99) that school attachments are not always a positive experience. Amongst other difficulties, extended teaching practice may negatively affect student teachers’ attitudes, knowledge and classroom practice; the requirement for more teaching practice placements may be difficult to satisfy and cooperating teachers may feel overwhelmed; and the receiving schools may not provide student teachers with sufficiently diverse teaching experiences.

Where learning does take place on teaching practice, that learning has been characterised as moving from the imitation of a model of teaching to the development of “more sophisticated practical theories about how children learn and the knowledge they are trying to teach” (Furlong, 2000, pp. 13).

Practical theory has been described as:

“. . . private, integrated but ever-changing system of knowledge, experience and values which is relevant to teaching practice at any particular time . . . a personal construct which is continuously established in the individual through a series of diverse events (such as practical experience, reading, listening looking at other people’s practice) which are mixed together or integrated with the changing perspective provided by the individual’s values and ideals.” (Handal & Lauvas [1987, p. 8] in Francis, 1995, pp. 229.)

In other words, students gradually develop their own practical theories about what underpins a good lesson. Their increasing knowledge of how children learn, why a particular approach to introducing, practising and/or reinforcing the target language has been chosen, and what alternatives may be appropriate will inform their professional planning and decision making.

To develop the practical theories of teaching and learning they bring to teaching practice, student teachers need to reflect on the complex processes involved in classroom interactions. To do this, individuals’ practical theories need to be made explicit, to be challenged by others, so greater insight into these theories is generated and student teachers develop a much richer and deeper understanding of their professional role. Such individual and collaborative knowledge construction could be achieved in a number of ways. Furlong
(2000, pp. 15) suggests focused and specific conversations about teaching between student teachers and their mentors. Clarke (2004) suggests journal writing. This allows student teachers to identify their own concerns and share them with an audience which will use the reflections as a platform to encourage the development of the writer’s practical theories.

Whilst recognising that establishing a direct causal link, negative or positive, between influences and student development on teaching practice is not possible within the scope of this study, if at all, it is hoped the study will provide some insights into what influences were perceived to contribute to the students’ development as teachers.

**Context of the study**

**Provision of teaching practice placements in Brunei Darussalam**

Brunei Darussalam is a small sultanate of 5,765 square kilometres with a population in 2004 of approximately 357,800 (Government of Brunei Darussalam, 2006). There is one provider of teacher education, located in the Universiti of Brunei Darussalam, educating teachers for all schools. Teaching practice for potential secondary school teachers usually takes place in one of Brunei Darussalam’s 39 government secondary and pre-university institutions which have a combined pupil enrolment of 35,359 (Government of Brunei Darussalam, 2007). In addition, student teachers may be placed, at their own request, in one of 14 private secondary and pre-university institutions follow the same curriculum as the government schools (Government of Brunei Darussalam, 2008).

**Policy context**

Pre-service TESL students taking the four year (eight semester) B.A. (Ed) degree have a four week observation period in schools at the end of the sixth semester, and a 14 week teaching practice at the end of the eighth semester.

Since 2007, there has been a progressive move towards educating teachers to be mentors to students on teaching practice. Previously, the emphasis in university educator led, pre-teaching practice briefings of school based educators had been on student assessment. Not surprisingly, a number of school and university based educators still regard student assessment as by far their most important role on teaching practice.

In 2008, the pre-teaching practice briefing became a briefing-cum-workshop for deputy head teachers, whose responsibility it is to co-ordinate teaching practice in their schools. The session, which anticipated the attachment under discussion in this article, introduced the concept of mentoring and provided handouts on supporting student teachers’ self-evaluation and collaborative teaching. The intention was that the deputy heads would share these, and new assessment forms, with the co-operating teachers in their schools. Schools were encouraged to give students the opportunity to work as teaching assistants in the first week; and to gradually transfer control of the assigned classes to the student teacher in the subsequent few weeks. The cooperating teachers’ role as advisors was emphasised. As evaluators, they were to base their final grade on the student’s performance at the end of the teaching practice.

The introduction of a wider teaching practice role for school based educators heralds proposed changes in the structure and time duration of teaching practice. For example, it has been suggested that at the end of semester four, students will spend four weeks in
school as teachers’ assistants; that the culmination of semester six will be a seven week teaching practice; and that the final 14 week teaching practice will straddle semesters seven and eight and be embedded in a methodology course.

Such a framework for teaching practice will hasten a move towards school based educators taking responsibility for student assessment. Currently, university and school based educators consult on an equal footing to decide the grade and mark which will be awarded to the student teacher(s) under their supervision. However, in the proposed model school based educators will be responsible for assessing the students’ performance on a pass/fail basis in semesters four and six. A list of competencies and attributes will be provided to standardise this procedure. University based educators will contribute to assessment in semesters seven and eight only.

Focus of the study

University and school based teacher educators in Brunei Darussalam are working towards a redefinition of their roles in the education of future teachers. To inform proposals about possible changes to these roles, research was carried out into what and how students learn on teaching practice.

Research questions

The following questions were posed:

- What important insights about teaching and learning did the students gain during their practicum?
- Who/what helped the students develop and refine these insights into teaching and learning?
- How did these insights influence their approach to ESL teaching?

Participants

Five pre-service ESL secondary level teachers, three female and two male, aged 23-25, and in the final semester of a four year undergraduate education degree, formed a convenience sample. However, they represent the full range of competence of the seven students in the cohort from which they were identified. They are characterised by similarity of cultural background and reflect the small community of educators in Brunei Darussalam. Two of the students have relatives in the schools to which they were attached. Two were attached to schools which they had attended as pupils. The mentor of one is an old friend of the student’s mother.

All the students are fluent speakers and writers of English, having used the language for academic purposes since Primary 4. All speak and write Malay and two also speak Chinese dialects. Their previous experience as a member of the staff in a secondary school
was a four week observation period at the end of the sixth semester of their eight semester course.

Sites

Three of the students were placed in two government schools accepting boys and girls as day pupils and located in urban areas. One was placed in a girls’ school in a rural area which, as well as day pupils, accepts boarding pupils from surrounding less accessible areas. One student was placed in an independent school for boys and girls from kindergarten to upper secondary level, also in an urban area.

Methodology

The research strategy concentrates on a small sample as learning to teach is a particular and situated experience affected by numerous factors, for example: the placement school’s culture, the quality of support the student receives from school and university based advisors and the classes assigned to the student. Qualitative evidence, then, would be most useful in answering the research questions.

During a pre-teaching practice briefing on 2nd February, 2008, for the five student teachers, a research assignment was distributed requesting them to write reflectively and retrospectively about their experiences on teaching practice. (See Appendix A). The students agreed to participate in the research and chose to submit a weekly journal via e-mail. English has always been the medium of academic study for these students and no other language was considered for this assignment. The journals included descriptive, analytical, reflective and introspective writing which sometimes required a response. Thus, a basis was provided for a dialogue between the researcher and the writer.

Throughout the fourteen week practicum, which took place from 11th February to 29th May 2008, the researcher observed each student three or four times and participated in pre- and post- observation meetings with the students, some of which took place in the school, others in the university. Other meetings took place at the students’ request. Notes were made on these meetings and observations.

At the end of the teaching practice, as part of the course requirements, students submitted files which included a record of their involvement in school activities beyond their roles as ESL teachers of their assigned classes, lesson plans and their evaluations of those lesson plans. These, too, were used as data to answer the research questions. The data were then coded and categorised to identify themes and relationships and a set of generalisations developed.

The data used in this article was read by the students and minor changes made where requested.
Limitations of the study

Students’ written and oral responses will have been affected by the following factors:

- Students knew in advance of writing their journals they would be used for research purposes
- The students were not “equally capable of engaging productively in reflective writing” (Borg, 2006, pp.252-253). Sometimes, the cognitive and socio-cultural demands of writing objectively about their experiences limited the richness of the data in the journals
- The researcher had taught ESL methodology courses to the students
- The researcher’s role as the students’ university based supervisor who would assess their teaching practice performance.

These last two factors may have influenced the researcher, too. In addition:

- Information was not collected from the cooperating teachers
- The findings are based on the teaching practice experience of five students in four schools so cannot be regarded as generalisable.

Findings

A summary of the relevant data concerning each student is given below. The names of the students and teachers have been changed. Where meaning was obscured, minor grammatical changes were made to the students’ writing.

Lily

Lily was placed in an urban government secondary school for boys and girls where there was a shortage of English teachers. She was given a seat in the English department’s staffroom. She took over two lower secondary classes of pupils who found learning English a challenge and for whom there was no regular English teacher. Lily was required to continue the work done with the class by relief teachers from other subject areas, whose prepared lessons she taught in her first classes. The cooperating teacher was an experienced English teacher whose free periods coincided with only one of the times when Lily was teaching. Thus, she came twice to Lily’s classes, both times in April, to formally observe Lily. The supervisor made three formal observations in March, April and May and made a further two visits to talk with the cooperating teacher. Lily met with the supervisor four times at the university.

Observing the classes, Lily’s only recorded insight was:

“The most obvious thing about Secondary 2G and 2H was that they had major disciplinary problems and I had to be prepared to handle them” (Journal, 18th February).
The journal and lesson evaluations catalogue ways in which Lily tries to cope with this situation: yelling, reasoning, and manipulating classroom dynamics through group work. There is no record of any assistance being given until the journal entry of 1st April:

“My supervisor reminded me that I should make use of punishment which is more effective instead of just making students stand at the back of the classroom”.

The students in question had come late, and appropriate ways of encouraging punctuality were considered in the post observation discussion. The lesson evaluation of April 22nd reveals Lily implementing a few of these measures: “Some of the students were disruptive and I sent them off to the discipline master’s office. 2 boys came 15 minutes late. I took their names and told them that if they did it again I would call their parents.”

Conversation and observation revealed that one of her main strategies was to use Brunei Malay, though the Ministry of Education would prefer English lessons to be conducted entirely in English. She comments on her cooperating teacher’s reaction to this use of Malay in the journal on 22nd April: “She also clarified the fact that she wasn’t sure if I was allowed to use Brunei Malay next to English when I teach.” In fact, clarity was never achieved in this area.

For Lily, her most important insight in the early days and weeks was that the pupils needed to be disciplined. This insight was developed and refined only through her own practice. No models of good practice were observed, there was no joint planning and teaching. Neither the cooperating teacher nor the supervisor engaged Lily in dialogue which encouraged practical theorizing.

Lesson evaluations and journal entries reveal Lily recognizing her pupils’ interests in, for example: aliens and UFOs, ghost and horror stories and ‘amazing but true’ accounts. These insights encouraged her to find a horror story on which she based a comprehension. Lily also noted her pupils’ difficulties: “The reason why I have purposely dedicated one lesson on tenses is because the students have difficulty in modifying tense” (Journal, 8th April). The worksheet was returned and corrections done, but there was no reflection on whether this had been a useful activity.

Marking the mid-year exams provided further insights into the pupils’ abilities:

“My experience in marking the mid-year papers taught me many things. Namely, it showed me the level of English for Secondary 2G and 2H, the common mistakes among students in these form classes, the difficulty they suffer in spelling words in English, the vocabulary level of the learners in these classes and also their interest in learning English language” (Journal, 19th May).

Responding to these insights, Lily was assisted by a member of the English department. The journal entry for 20th May records:

“The table I used (common mistakes made by Bruneian learners) was given to me by one of the teachers who is teaching a Form 4 English Language class. I asked for her suggestion on how to do corrections with students when dealing with Paper 1 (composition writing paper). Then she indicated that the mistakes made were very common throughout Secondary 1 to Secondary 4. She reminded me that
I just need to draw real examples from some of the students’ composition and explain to them why they are not allowed to construct sentences that way. This lesson was used for the mid-year exam paper 2 corrections.”

Despite the fact the resource was intended for use with upper secondary classes, the lesson evaluation is very positive:

“The outline of common errors given to me by Ms X. was very useful and most definitely effective in teaching students to be careful with their sentences in English. It reflects the fact that students have interference from their L1 and are not aware of it. I would definitely use this guideline for future classes.” (21st May.) It is perhaps this success which encouraged her to prepare grammar work for the pupils who were asked to complete “2 pages of grammar exercises every day . . . as homework” (Journal, 26th May).

In the later stages of the teaching practice, then, teaching and learning were greatly influenced by Lily’s response to the pupils’ examination performance and her interpretation of a teacher’s advice.

Other potential influences were acknowledged:

“What I learned from my evaluation is that I should always have a back-up plan for those students who have completed their worksheet earlier than others. I should have prepared something else for them to do once they have finished their work. This is because students tend to start disrupting their peers when they have nothing to do” (Journal 1st April); and, “I asked my cooperating teacher whether I could see her after school to discuss some things to do with my evaluation. She said that would be alright. I met her and she gave me her evaluation and commented on some of the things I had to improve” (Journal 22nd April).

However, Lily did not record these conversations in full and there is no evidence they had any influence on the teaching and learning in her classroom.

Lily was unable to take advantage of any opportunities to reflect broadly on the teaching and learning process. Neither Lily’s writing nor her conversations indicate any developing identity as a teacher. She does not discuss teachers’ qualities, workload, satisfaction, characteristics or her future plans. This evidence suggests her teaching practice was characterised by isolation and negative learning.

Tommy

Placed in the same government school as Lily and seated at a table opposite her, initially Tommy was assigned to teach two well motivated upper secondary classes. These pupils are expected to be GCE ‘O’ level English language candidates in 2009. One of Tommy’s co-operating teachers, an experienced teacher, taught these classes. However, she was on leave for the last nine weeks of the teaching practice, when Tommy was asked to teach another one of her upper secondary classes. These pupils would be candidates for the IGCSE examination in 2009. A second cooperating teacher was appointed, but teaching and invigilation duties meant there were no classroom visits by cooperating teachers in the
last nine weeks, though there were three formal observations in the first six weeks. The supervisor observed four classes, in February, March, April and May and made two other visits to the school to meet with Tommy and one of the cooperating teachers. Tommy made eight visits to the supervisor at the university.

In the early stages of the teaching practice, Tommy’s greatest insight into teaching and learning concerned lesson planning. The need to do this, within a time frame and in a way which would respond to the needs of his classes, together with the recognition of the organisation and the work involved, echoes throughout his journal entries for the first four weeks.

In the fifth week he records:

“The F4A2 lesson plans that I’d been so happy with (mainly just because I’d managed to get them done on time) were practically torn apart by Sue within two minutes of her seeing the exercises I’d arranged. . . Well, in the 1st place I’ll admit they were pretty poor exercises to begin with, but that was quite a blow to my confidence: (I’d come into this week feeling pretty happy about myself actually.) Oh well; chalk that up to experience. . . . Basically other than the fact the exercises were REALLY poor, I’d also overlooked the fact that the lessons should have linked to each other. . . So basically, Sue came in on Monday, and after tearing apart my plans in school, invited me to see her in her office to rethink a new set of things to do. After a few hours I was still completely lost, but her ideas had given me a suggestion of what to do. Upon reaching home I immediately set about preparing a new set of plans and exercises: Grammar on Tuesday, Vocabulary and Writing on Wednesday (when Sue would come). What I ended up with was a set of lessons that meshed together better than before, with a more logical flow of activities to boot. Still that was a very stressful way to start the week! The lessons for F4A2 were nice though . . . . My lessons with F4F were okay this week too. I gave them a writing exercise and modelled it for them too. I think they got more scaffolding than before . . .” (Journal, 15th March).

Five weeks further into teaching practice, Tommy is relieving what he perceives to be the boredom of revision classes by planning lessons: “I'm also planning something big for the last 10 lesson cycle, probably reading or acting a few plays or comic strips, and possibly having groups write their own scripts as a writing task. I'm not even sure if that's going to take up all of 10 lessons (depending on the set tasks, it might take only 3!), but I haven't set it in stone yet, and am still wallowing around for resources. If I get them to act though, I might even bring in a camera to record it, and borrow a laptop, projector and speakers from the other teachers. But we'll see.” (E-mail communication. 25th April.)

Tommy has confidently taken ownership of his own practice. This confidence is jolted by Tommy’s experiences as a relief teacher with non-academic classes. This provides Tommy with insights into what appears to him to be a different world of teaching and learning:

“Dealing with dull students is such a pain. Like Y. says, now I know how it feels to teach, erm, for lack of a better term… stupid students. (More on this later)...
Another point that I noticed for the 1st time (which also reinforces to me how good I have it with my classes), is how badly behaved repeater students can be. . . . Discussion with other teachers in the staffroom has put the classes beyond counseling, but the discipline teacher . . . says that there really isn’t anything they can do about the “children.”

On the “stupid students”… I also relieved 2 “O” Level repeater classes, and… Good God, now I really know what the other teachers have to face… I guess not all kids can be angels… The experience was a real eye-opener!

P.S. Yes, I know about how I’m not supposed to label students… while I can tolerate F4J… the repeater classes don’t deserve the benefit. If I ever get classes like these, I resolve to do the best I can with them, no more” (Journal, 12th April).

Adopting such an attitude is clearly a coping mechanism to help Tommy deal with a situation which will have undermined his emerging self confidence. His identification with the prevailing staffroom opinions will further strengthen his developing identity as a teacher. Nevertheless, if such attitudes harden, they are likely to have a negative influence on his approach to teaching.

Three weeks of revision, one week of exams and one week of corrections took up a large part of Tommy’s teaching practice. This proved to be frustrating:

“In my own classes, I’ve started examination revision, using “O” Level past year papers, as was suggested to me by Mr.A. So I got some ready, and guided students through Paper 2 (I’ll do Paper 1 next week), although letting them do Paper 2 may have been a mistake. Even though I gave the students (in both classes) heaps of support, with vocabulary, explanation, etc, the text was simply too difficult. Next time I do this (whenever that may be…) I’ll definitely plan different series of lessons to build up to the paper.” (Journal, 12th April.) His anxiety about the gap between the pupils’ language skills and those demanded by the “O” level paper is emphasized in the lesson evaluations for a high ability class. Spending so much time on vocabulary, he “couldn’t actually start them on the questions” (Evaluation, 16th April) and when they did begin the questions, “most only did until question 5, the paper was that difficult.” (Evaluation, 19th April.) Of another class he says “The difficulty of the paper simply floored most of them. More help will be needed; a correction class will be arranged.” (Evaluation, 16th April.) By 26th April, he records: “This week I continued to finish up revision with the students, doing corrections and whatnot. I’m learning that this isn’t a particularly exciting time to be a teacher.” He finds invigilation and marking boring, “with not much to be learned or taught.” (Journal, 10th May.) Marking the papers, he comments: “I tasked myself with wading through my marking as quickly as I could, so I had a couple of days to tinker with lesson plans for the last 2 weeks.” (Journal, 10th May.)

Returning the papers he says:

“As expected, the kids complained that the paper was too hard. I don’t blame them. The amount of summaries not done due to ‘lack of time’ is testament to it. . . .
They did their corrections unquestioningly, and I hope they’ll at least learn something about this experience” (Evaluation, 14th May).

These insights provide a great contrast to the excitement of planning his own lessons, and demonstrate that in these circumstances, Tommy found teaching and learning unrewarding. To improve the situation, he believes he will need to spend more time focusing on exam papers, suggesting that in future his approach to ESL teaching may be more examination orientated.

From his time in school, Tommy gained a number of important insights into teaching and learning. One was that he enjoyed the intellectual and creative challenges presented by planning sequences of lessons based on resources he felt pupils would enjoy and which would develop appropriate language skills. His own practice, the support of his supervisor and discussion with other teachers helped him refine the pedagogical insights needed to develop such lessons. His approach to ESL teaching became more adventurous, more practical and provided appropriate opportunities to practise the identified skills.

However, he gained stereotypical and negative views of some of his pupils as learners. These were the result of his unhappy experiences covering classes for absent teachers. The experiences were interpreted for him in staffroom discussion, contributing to his decision that non-academic pupils did not deserve the same amount of attention as their more able counterparts. Such defensive attitudes may help with survival in the early stages of professional development but, if retained, will have an adverse effect on Tommy’s professional development.

Tommy saw his activities in the examination period as something completely different from teaching. Formal assessment was a stressful experience for him and, in his view, the pupils, whom he could only hope learned something from the process. Other teachers, including his cooperating teacher, provided him with past papers and teaching suggestions, which he sometimes felt were inappropriate; and there was some staffroom discussion about the suitability, in terms of difficulty level and culture, of the examination questions. However, it was his practical experience in the classroom which taught Tommy most about the formal assessment of pupils. There is no evidence Tommy was assisted to critically examine that experience, perhaps by discussing whether the skills to be examined were actually being practised in his revision classes. It seems likely that in the future he will feel he needs to spend more class time on examination preparation.

Yani’s urban school provided education for boys and girls from the surrounding area. She was given a seat in the general staffroom and two cooperating teachers, both experienced teachers of English. She was required to teach two upper secondary classes, who would be expected to take public examinations in 2009. Yani was formally observed twice by each of the cooperating teachers and three times by the supervisor, who made another visit to talk with the cooperating teachers. Yani turned frequently to one cooperating teacher in particular for help and advice. In addition, Yani made four visits to the supervisor in the university.

The beginning and end of the teaching practice period were marked by school based tests and examinations. Monthly tests made it difficult to set up a first visit and Yani asked
the supervisor not to visit during the revision time in May as the teaching would not be of a high standard.

One of Yani’s most important insights concerned classroom dynamics. She was finding one class particularly challenging. One cooperating teacher advised her to give the class a lot of work to keep them quiet. Yani then went to another source for advice.

“I also talked about this to my other TP friends – some also happen to teach form 4F. Apparently, they also experienced the same thing. Class control is almost impossible to accomplish. So we went to see their form teacher and complained a lot! . . . The teacher told us that the only way to control 4F is to embarrass them in front of the class [but I can’t see why I should solve it by deficit punishment]. So yesterday, I drew their initial seating arrangements and made necessary changes. I made sure the naughty ones and the passive students sit in front where I can observe them and check their work constantly. Today, with new seating arrangement and the fact that their form teacher reprimanded them [thanks to our complaints] – the class, amazingly, behaves well. Some still disrupted the class, but it was tolerable and it wasn’t as bad as before. (One can only hope they stay this way)” (Journal 5th April).

Two weeks later she writes:

“Few weeks ago, I made a new seating arrangement (only for English class) - for form 4F. There is a tremendous change ever since, the boys are less disruptive, they do their work quietly and some of the girls no longer talk to their friends. It’s fabulous! They actually did and handed in their class work on time! Some are still disruptive of course, but it’s tolerable this time. Today, the form teacher of form 4F decided to make the seating arrangement permanent! I couldn’t be more happy about it” (Journal, 19th April).

Yani took on the responsibility of completing the effective revision, demonstrating an excellent knowledge of the pupils after two months working with them. She had the dual reward of an improved teaching and learning situation and official recognition of the success of her efforts.

Insight into a pupil’s family problems encouraged Yani to recognise there was more than one dimension to classroom dynamics. After listening to and advising a student who had run out of her class in tears, Yani reflects:

“So what did I really learn from all this? Talking to the form teacher really helped, and I really think that teachers should be taught how to handle kids with problems, because it does really have such a huge impact on how the children behave in class. All I can do now is read my “Guidance and Counselling” lecture notes – and just go through the basic ideas on how to give counselling” (Journal, 19th April).

However, there is no record that the learning opportunities provided by the discussions with the pupil and the form teacher, or reading the guidance and counselling notes, were subjected to the kind of critical examination which could have informed Yani’s
professional practice. She was beginning to shift her perspective on learning from a teacher’s to a pupil’s and this insight could have been developed to include aspects of classroom behaviour.

Despite the revised seating arrangement, Yani’s classroom management difficulties continued. “Interesting and fun filled activities” were disrupted by a few and the rest of the class then followed their example. Yani summarises the insights into teaching and learning she gained from meeting this challenge:

"I learnt a lot from all this, at times the hard way. From the start, as naïve as this may sound, I always wanted to be that fun yet firm teacher, that Ss will learn to respect and most importantly, enjoy and learn a lot in class. What I’m really saying is, although some of the people in form 4F are intolerable, I no longer see that as a challenge or a hindrance for me to become a good teacher. If they don’t appreciate me, at least my other class respect me – in fact they (4F), without knowing it, teach me that I should be firmer in class. They made me stronger, to be less naïve - they taught me that I should give them a lot of exercises to do, so they would be quiet and finish their work on time (they did!), I learnt they love it when I read story books to them and they do exercises/activities based on the book. For me, the rewarding experience after I read them the storybook “Voodoo Island”, (we finished reading it last Saturday) – couple of girls came to the staffroom during break time and asked if I have other storybooks which they could borrow- (THEY begin to love reading!). So I told them to see my CT, and my CT lent them some reading books” (Journal, 28th April).

Yani has not lived up to her initial vision of herself as a teacher, which she now sees as naïve. However, she has enough confidence to believe she is becoming a good teacher. She identifies lessons learned about the appropriate methodology to establish authority in the classroom. Both the strategies, a lot of exercises and reading aloud as a stimulus for language work, were recommended by one of the cooperating teachers and were successful, though situated and short term, solutions to Yani’s class control difficulties. However, she makes no mention of what the pupils were learning through these activities. Clearly, a few have become interested in reading, a wonderful but incidental outcome. Yani’s objective was class control rather than language learning. A deeper and broader discussion of the use of exercises and story books in the classroom may have contributed to a wider understanding of teaching and learning. Such a conversation may have enabled Yani to begin to take ownership of her own practice. Neither the supervisor nor the cooperating teacher initiated this discussion.

Dexter

Dexter asked to be placed in the private school in which he had been a student and in which a relative holds a position of responsibility. Situated in a busy urban area, this is a K-10 school, offering places to boys and girls. Given a seat in the general staffroom, he was asked to teach two lower secondary mixed ability classes. His two cooperating teachers, one of whom had known him as a pupil, each visited the classroom twice to observe formally; the supervisor observed him three times and visited a fourth time to talk to the cooperating teachers. Dexter visited the supervisor four times.
Dexter’s desire to teach was fuelled to some extent by memories of teachers he had disliked and a determination to be different. He works with young people in his spare time, in the role of a friend and supporter. A high academic achiever, he was studying linguistics when his peers were completing two of the four courses in the undergraduate programme considering methods of teaching. It was almost inevitable that classroom management would be a challenge which would strongly encourage Dexter to gain insights into teaching and learning.

In the second week he describes a class disrupted by a few students as like “a fish market” (Journal 24th February). By week 5:

“Quite frankly, I’m tired of always trying to get them to sit or settle down.” (Journal, 16th March.) This continues: “It’s tiring always having to yell. How does one handle this?” (Journal 6th April).

He answered the question by planning activity filled lessons, for example: making sandwiches to practise the use of sequencers and imperatives; comparing and evaluating video clips; creating and evaluating directions to destinations around the school; and basing comprehension work on video clips.

Much of this was appreciated by his colleagues:

“The audio-visual comprehension activity I created was a big hit this week. After I did it with my class on Monday, I asked my CT if she’d like me to do the same lesson with her other classes. She jumped at the offer. Another teacher also ‘got on the bandwagon’, and I ended up doing the lesson with all four Secondary 2 classes, and even one Secondary 4 class. I definitely plan to create another AV lesson before the end of my TP” (Journal 12th April).

However, despite his, his pupils’ and his colleagues’ enjoyment of these lessons, his cooperating teachers and his supervisor continually referred to the need to exercise more classroom control. In this respect, he was not adhering to the norms and values of the school. His response to this and his own frustrations are recorded in part below:

“But amidst all this critical appraisal of my own ostensible lack of authority, I can’t help but feel that there has to be at least some benefit to being the ‘nice guy’, some saving grace that shows my effort to be myself has not been wasted. My students (at least the ones that respond to positive reinforcement) do enjoy the lessons. Most of them, even if they’re not the best students do show evidence that they appreciate my methods. So basically, my attempts at not being disliked have paid off. But at what price?

All that aside, when it comes down to it, as a teacher I have to put my foot down from the get-go and set out the rules clearly for the class. It may not be easy, but it does not require being mean. It just means being firm and letting them know that although I want the class to be fun, it also has to be controlled and organized. In the long run, it will save everyone a lot of trouble and help the whole learning process, for both my students and me.
My chances of salvaging discipline with these two TP classes are slim at best. Hopefully with future classes I teach I will have a clearer mind and a stronger resolve when it comes to proper classroom management” (Journal, 10th May).

These insights concern the foundation of Dexter’s identity as a teacher. They reveal the tension between his desire to make teaching fun, and the need to have a more congenial environment in which to work; between a wish to be a popular friend, and a desire to teach effectively a subject he has a passion for; between being one’s self and being the teacher figure he is expected to be.

If Dexter does teach again at this level, he will need to establish a classroom persona with which he feels at ease. This performance aspect of teaching was not considered in all the advice given to Dexter. Dexter himself, his cooperating teachers and his supervisor were more concerned with eliciting a performance from him which would ensure he obtained a good grade for his teaching practice. A performance for a lifetime in teaching was not considered.

Maria
Maria was placed in a rural girls’ secondary school which also has boarding facilities for students from homes too distant to make possible the daily journey to school. A seat was provided for her in one of the general staffrooms. Maria had been a pupil at the school, and her mother has a position of responsibility there. Maria was given two lower secondary classes to teach, one of which found learning English a greater challenge. Her cooperating teacher had studied with Maria’s mother. The cooperating teacher formally observed Maria five times and the supervisor observed four times. Maria visited the supervisor five times at the university.

Maria’s relationship with her cooperating teacher was characterised by a relaxed, sympathetic and professionally informed communication which supported Maria practically and emotionally throughout the teaching practice. “Again, thank God for CTs. It’s always nice to have a bouncing board. Someone to discuss things with and feel you are understood” (Journal 24th April.) This relationship contributed enormously to Maria’s recognition of the collegiality of teaching.

The importance to Maria of this collegiality is emphasised when she identifies the lessons she has learned from teaching practice:

“An excellent support network made up of subject peers, TP supervisor and CT ensures a fruitful TP. I was lucky to have such. TP is after all a learning journey and not just a chance for evaluation. Having people to talk to about the subject and the teaching process, to bounce ideas and give comments on them - I learnt a lot from the interactions and they help me grow as a teacher” (Journal: Undated End note).

These insights are reflected in Maria’s sharing of ideas with other TESL student teachers and may inform her life as a qualified teacher.

Another major insight into teaching and learning was into the nature of teaching itself:
“Along with other TP teachers, I worry whether or not I’ll end up deciding that I do not want to teach after the TP experience. Teaching can be monotonous and draining I admit, but I sincerely hope in times like those I’ll remember how gratifying it feels to see students’ faces light up in understanding. Or how students show they want to learn simply by wanting to contribute in class or by asking questions or for help. Yes, teachers (I know I am guilty of such) may overrate their impact on children’s learning or children’s lives, but this belief motivates them to teach. And I am all for finding your own rewards” (Journal: Undated End note).

Maria is seeing practice through the eyes of an experienced teacher. The maturity of this insight into teachers’ motivation derives from Maria’s personal practice and discussion with other students and qualified teachers in the school. The influence on her approach to ESL teaching is hard to quantify: indeed, the insight reflects as much on Maria’s current teaching as it does on her possible future teaching. Since her current approach provides her with such pleasure, it is likely there will be more of the same.

For Maria, the same means constantly trying to improve teaching and learning in the classroom. For example, having tried a process writing approach (Journals, 15th and 17th April) and now lacking confidence in teaching writing, she asked the cooperating teacher to observe her teaching writing using a genre based approach. Maria gave a lesson with which she was less than satisfied:

“So it was with dread that I came to my CT for a brief feedback session. Surprisingly, she said she thought it went just fine. . . She also gave valuable suggestions on how the class could have been better. For example, instead of giving them the freedom of writing about anyone they want, she suggested that I make them follow the model and write about a friend. At this moment, I mentally slapped my forehead, chastising myself for not learning from past mistakes (remember your comments about the recipe class? Where I should’ve made them create revolting sandwiches, LIKE THE MODEL, instead of writing about other revolting stuffs?) She also gave me suggestions on how I could expand and improve the writing frame to provide 2A with more support, like deconstructing the model and use of headings etc. She also outlined how she would structure her writing classes - like what to do for pre-writing, actual writing and post-writing. Overall it has been a good experience for me” (Journal, 19th April).

Here is a happy coincidence of school and university based educators promoting a similar approach which the student practises. The cooperating teacher’s advice and support together with more experience will ensure Maria eventually acquires a richer understanding of the teaching of writing.

Maria’s journal demonstrates the practical theorising about her emerging professional skills and identity which characterises a sophisticated, reflective beginning teacher. She says:

“I love the feeling of being able to connect theory to practice” (Journal 21st February).
The desire to do this illuminates her commentaries, and her joy when everything comes together in a successful lesson is transparent. Describing a lesson with the less able of her two classes, Maria reports:

“Learning from my mistakes from 2C, this time with 2A I reviewed the rules even with some examples from the text and I managed the class hour in sections. And it worked brilliantly! I could feel that the lesson was more focused and students could focus on one aspect before moving on to another. When we checked the answers together, I elicited a mixture of able and less able students and most were able to answer correctly and even tell me why the answer was such when I asked for explanations. As a bonus, I could feel the rising enthusiasm from the students as they noticed that most of their answers were correct, showing themselves that they could achieve. I myself could not contain my excitement as they showed their ability to apply the rules. The icing on top of the cake was the spontaneous cheering for themselves when they counted their marks in the end. As one student puts it “‘Cher, more than 5 right answers!”, and that is enough to make them happy.” (Journal, 13th May.)

Maria’s increasing knowledge of how children learn, why a particular approach to learning the target language is appropriate, and what alternatives may be used informs her professional planning and decision making. The influences shaping Maria’s professional development have contributed to the development of a teacher who is ready to enter a community of international professionals.

Discussion

Insights gained, their development and their influence on teaching

The important insights into teaching and learning the students gained from their practicum concerned their own identity as teachers, the collegiality of teachers, classroom management and dynamics, pedagogy, formal evaluation and pupils’ interests, abilities and backgrounds. Naturally, these insights arose from their classroom teaching and incidental learning through observation and everyday interaction with other students, pupils and teachers.

Clearly, the nature of these insights was dictated to a great extent by the situations in which the students worked. Even those in the same school had very different experiences and acquired very different insights into teaching and learning. Not surprisingly, then, where these insights were developed, a variety of people and factors can be identified as contributing to that development.

Marking the mid-year exams confirmed and extended Lily’s insights into her pupils’ abilities. These insights were developed and refined through dialogue with an English teacher and dealt only with pupils’ errors. The consequence of this narrow evaluation of student learning was that Lily incorporated more de-contextualised grammar teaching into her lessons. Well intended efforts to develop students’ insights do not always have positive results.
Tommy’s recognition of the importance of planning was developed and refined through his own practice, discussion with colleagues and the intervention of his supervisor. Eventually, this learning had a positive effect on his teaching, helping him become a more confident, organised and interesting teacher. However, Tommy’s interactions in the staffroom served to strengthen his view of non-academic pupils as “stupid”, a view unlikely to promote useful teaching and learning for these pupils.

Writing the journal helped Dexter refine and develop his insights into his role in the classroom and may contribute to the development of a classroom persona with which he feels more comfortable. It is perhaps only if this is achieved that Dexter will remain in teaching.

The single greatest influence on the development and refinement of Maria’s many insights into teaching was Maria herself. Her journal reveals she took the practical and theoretical advice offered by books on pedagogy, websites, conference presentations, lecture notes, lecturers, her pupils, her classroom experience, her supervisor, fellow students and teachers, and her cooperating teacher in particular. She reflected on these to refine and develop her own professional practice. The result was that she became a better informed, more confident, skilled and successful teacher.

Subject teachers, the supervisor, staffroom talk, writing reflectively, and the active synthesis of a multitude of factors, then, helped students refine their insights into teaching and learning.

Some factors contributing to the limited development of students’ insights
The research reveals a number of factors obscuring both students’ insights and the development of those insights. These factors are not unique to Brunei Darussalam.

Inadequate preparation for school practice
The relevance of the university based methodology courses to their school experience was not recognised by most students. Maria, for example, did not recall her peer teaching experience when planning a writing lesson for her pupils. Yani felt she should know more about supporting pupils with problems. Clearly, university-based practical work is very different from the classroom reality. Nonetheless, it should inform students’ classroom practice.

Too often, it fails to do so. Graham, citing international research from 1990 to 2001, states, “Teacher education programs have been described as fragmented, lacking coherence and consistency, and as not providing powerful learning to pre-service teachers” (Graham, 2006, pp.1128). Waters refers to work in Hong Kong and the U.K. which supports the view that “. . . teachers frequently have difficulty in transferring propositional, off-the-job knowledge from the context in which it is studied to the work-place” (Waters, 2005, pp. 213).

Inappropriate and time consuming responsibilities given to student teachers
A shortage of ESL teachers in Brunei Darussalam has placed a considerable strain on serving teachers and affected the quality of the students’ teaching practice experience. Two students were expected to take independent responsibility for the delivery of the curriculum to the classes they taught. Two students were given so many relief classes to teach they were unable to teach effectively: “Since Monday, I have six relief periods each
day! So draining!” (E-mail communication, 6th May); “I do a lot of relief duty. Standing in for classes, replacing shifts and whatnot . . .” (E-mail communication, 2nd May).

Some of this teaching experience was very negative, shaping views which discourage insights into teaching, as Lily and Tommy’s experiences with classes of non-academic students demonstrate. “. . . it would seem that student teachers, operating in relative isolation as quasi teachers, are more likely to close down on complexity than independently seek it when interpreting classroom life” (Edwards & Protheroe, 2003, pp. 231). Student teachers may justifiably ask: Why further complicate an already difficult situation?

Inappropriate practicum experience is not peculiar to Brunei Darussalam. Habsah Hussin’s research (2008) confirms that, in at least one state in Malaysia, a shortage of well qualified English teachers limits the learning opportunities for some ESL student teachers.

**Insufficient support from experienced educators**

Too often students had limited access to supporting professional educators and their insights remained unexplored. In three of the four schools, pre-service teaching was seen as an individual performance to be supported by occasional advice from a teacher, not necessarily the cooperating teacher. There was very limited access to models of good teaching or to other teacher’s planning and decision making processes.

In some situations, the insights were viewed as practical problems which needed an immediate solution: for example, more exercises, reading a novel, or making use of existing school administrative structures in response to classroom management issues. Such practical expediency ensured these solutions were situated in the particular culture of the school, or even the classroom, and may not be transferable to other teaching situations.

The support offered to students by professional educators is the subject of considerable discussion in the literature, for example Furlong, 2008 and Yendol-Hoppey, 2007. Some conclusions mirror those of this research: “The student teachers’ detailed responses presented us with no evidence of their mentors helping them to interpret classroom events during the act of teaching. Insights about how to manage children and use resources came through student teachers’ own trial and error and through conversations with their mentors.” (Edwards & Protheroe, 2003, pp. 235.)

**Examination driven curriculum**

The examination driven curriculum impacted on the students’ experiences in a number of ways. No-one was given an examination class to teach, and the majority of classes consisted of low ability pupils. It is perhaps not surprising that teachers who will be judged on their pupils’ examination results want to protect their potentially good candidates from the initial practices of students.

There was less time for teaching than might be expected in a fourteen week school attachment. School based tests and examinations occupy between nine and twelve weeks and in some cases up to a third of the teaching time in a year in Brunei Darussalam’s secondary schools (Upex, 2005, pp.158). This emphasis on exam preparation made it difficult for the supervisor to observe three of the five students.

In such an outcomes driven environment, student teachers’ learning may not be so much about broadening their perspectives as narrowing their concerns. The process of dialogue and questioning essential to reflection may be “perceived as conflicting with the
‘coverage’ mentality of a standardised environment” (Ward & McCotter, 2004, pp. 244). This led to a focus on pupils as exam candidates rather than pupils as learners: attention was paid to examination requirements rather than pupils’ learning needs. Tommy, in particular, expressed frustration with this situation. He recognised the narrow concern with pupils’ test scores precluded a wider reflection on teaching and learning. However, the drive to achieve results left little energy for reflection on the broader implications of this approach to education.

The stifling effect of excessive formal assessment of pupils is acknowledged, in particular in a variety of research in England and America, for example, Edwards & Protheroe, 2003 and Ward & McCotter, 2004. Jones’ research into school-based training in England and Germany states: “In a climate of total quality control mentors may feel reluctant to allow trainees sufficient leeway in exploring different styles and approaches . . .” (Jones, 2004, pp. 262). Such reluctance is inevitable in a culture where a teacher’s effectiveness is based on pupils’ examination scores.

**Summative evaluation of student teachers**

Summative evaluation of the student teachers is clearly at odds with the formative nature of learning on teaching practice. Dexter’s need to become an authority figure was strongly emphasised because it was felt this persona was required for him to meet the course criteria. The need for a more reflective consideration of his motivation to be a teacher was obscured by a desire to make sure he was successful. Cooperating educators acting as both advisors and assessors inhibited Dexter’s development.

The summative evaluation practised by the majority of the educators resulted in students: “. . . looking for some ideas for great lessons which will give him/her good grades.” (Maria’s Journal, 23rd April.) It also led to conversations between students and their evaluators which emphasised the evaluator’s knowledge of teaching and learning. Such practices encourage a superficial reproduction of a borrowed lesson and the promotion of a ‘knowledge to practice’ model of support (Edwards & Protheroe, 2003, pp. 238) rather than the development and refinement of insights.

**Conservative school culture**

Attitudes are shaped by the contexts in which learning takes place. The staffroom conversations in which students participated and the advice they were given was often very conservative, serving only to reproduce the prevailing views of more experienced and perhaps disillusioned teachers. This discourages both insights and their development promoting dependence on conventional wisdom. This may have contributed, too, to a noticeable lack of discussion of the school curriculum and the ESL syllabus in particular.

Day points out that a large number of teachers work in school cultures which emphasise control over development and value self-reliance and self-sufficiency over the sharing of problems and issues. Such cultures isolate teachers from meaningful professional dialogue. (Day, 1999, pp.225-226.) Cochran-Smith suggests: “. . . the problem with student teaching, whether actively or by default, is its conservative effect and its tendency to perpetuate existing instructional and institutional arrangements.” (Cochran-Smith, 1991, pp. 108.) These British and American commentators suggest conservative school cultures are not confined to Brunei Darussalam.
The identified factors limiting the professional development of students on teaching practice in Brunei Darussalam, then, are described in studies conducted in other countries. Where the situation in Brunei Darussalam may pose particular constraints on student learning in schools is in the inappropriate and time-consuming responsibilities given to student teachers. No doubt in other countries experiencing teacher shortages students are asked to stand in the stead of a qualified teacher. However, every student in the sample had to take on some relief teaching: three students were required to do a tiring amount of relief teaching, two being responsible for all or some of the timetable of absent or non-existent teachers. In such a small sample, this seems a lot of relief teaching. Its impact certainly contributed to the failure of one student to achieve an adequate professional standard.

Recommendations

Pre-service education cannot be seen in isolation from the national education system in which it is situated. The constraints to student teachers’ learning on teaching practice identified in the research need to be addressed by a number of stakeholders, including policy makers. For example, teaching needs to be made a more attractive option to high achieving graduates. Nevertheless, university and school-based educators can influence the instructional contexts in which teaching practice takes place.

One means being explored is the move towards a closer partnership in the education of teachers. As school based educators take on greater responsibility within this partnership, the following recommendations are made:

1. It is essential the partnership agrees on the desirable outcomes of pre-service teacher education and, within that framework, the teaching practice outcomes. Amongst other benefits, such a discussion will contribute to a more transparent consideration of appropriate roles and tasks for student teachers in schools.

2. University and school based educators, as well as student teachers, need to agree on their respective roles in supporting students on teaching practice. As Furlong (2008) suggests, it is perhaps the responsibility of the university based educator to encourage students to engage in practical theorising. The university based educator is also best placed to help students develop a ‘generality of knowing about teaching and learning which can be used across settings’ (Edwards and Protheroe, 2003, p. 232). School based educators, as experts in ESL teaching who have a unique situational knowledge of the school, structure the students’ learning experiences. Student teachers must recognise their responsibility to critically examine their developing practice, to engage in practical theorising.

3. It is essential to create professional development opportunities which offer support to educators in their roles on teaching practice. At the very least, such opportunities will need to:
   - encourage a learning through experience model which will require a shift from reporting on students’ performance to listening to their interpretation of practice, to
helping students question what they do in the classroom so that they gain ownership of their practice and acquire more informed ways of interpreting classroom events
• support educators in helping students achieve this through, for example, promoting team teaching and the joint planning and evaluation of lessons
• enable the implementation of more formative means of formal evaluation

4. University based courses should better prepare students for teaching practice. For example:
• courses could include the opportunity for students to teach lessons in real classrooms which they would then critically examine, together with both the university and school based educators
• through developing students’ observation skills and so helping them to understand the skills used by experienced teachers
• by teaching students to develop a habit of reflection through helping them perceive and use writing as a process of learning, as a platform from which to move from the specific to the general.

Suggestions for further research

Research on a wide range of issues could be conducted to inform the proposed partnership between university and school based educators. Some suggestions are made below:

• What do school and university educators in Brunei Darussalam think pre-service ESL teachers should learn?
• How do cooperating teachers’ and supervisors’ conversations with students influence students’ teaching and learning on teaching practice in Brunei Darussalam?
• What do students, cooperating teachers and supervisors perceive to be their roles on teaching practice?
• How can school and university partnerships in Brunei Darussalam be promoted successfully?

Conclusion

The research has identified a number of constraints preventing student teachers in Brunei Darussalam fully developing and refining the insights into teaching and learning acquired on teaching practice. Some of these constraints can be addressed by the establishment of a more robust partnership between school and university based educators. Much work is needed to build the foundations of such a partnership. Greater clarity of the roles each partner is expected to play, together with more opportunities for the professional development of all educators, will enhance the quality of the pre-service students’ professional education. In achieving this, the partners will be contributing to the education of teachers with the teaching skills and knowledge to enable them to meet local needs and international standards.
Acknowledgements

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Notes

The following definitions may be useful:

`Cher`: Teacher

`CT`: School based cooperating teacher whose role is both to support and evaluate the student teacher

`Relief teacher`: A teacher substituting for another teacher

`Repeater students`: Pupils who have failed an academic year and are repeating it.

`Secondary 4`: Year 10

`Supervisor`: University based educator whose role is both to support and evaluate the student teacher

References


Appendix A

SHBIE
Universiti Brunei Darussalam

30th January 2008

Dear

Research is being carried out into what and how students learn on teaching practice. To gather data for that research, we would like you to keep a weekly journal in which you complete the following tasks:

1. Describe a significant episode(s) in your teaching experience this week.
2. Reflect on the episode(s) by answering the questions below:
   a. What important insight(s) about teaching have you gained from this/these experiences?
   b. Who/what helped you develop/refine this insight about teaching?
   c. How do you think this will influence your way of teaching?

Thank you for your invaluable contribution to this research project.
Studying abroad: Universiti Brunei Darussalam tutors’ impressions

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Abstract
This brief research focuses on a comparison between the educational experiences of tutors who were undergraduates at Universiti Brunei Darussalam (UBD) and then pursued their masters’ programmes in the United Kingdom (UK). Responses to questions concerning the tutors’ impressions of the positives and negatives of their experiences in both locations provide insights into the degree of educational benefit, over and above the masters award itself, gained from the period of study abroad. These insights can prove of value to those who prepare first degree holders and potential tutors for their time in a very different social and education system. Responses fall into two main categories: those with a specific academic orientation and those with a broader socio-cultural bias. The implications of this dichotomy are discussed.

Introduction
Studying abroad, both at undergraduate and post-graduate levels, is now common practice for many thousands of students throughout the world. For example, in the United States, during the academic year 2004-2005 there were 565,000 international students enrolled in universities and colleges, and of those 58% came from Asia. In the United Kingdom, during the academic year 2005-2006, there were 330,080 international students studying in higher education institutions (Higher Education Statistics Agency, UK). Of those, 33% came from European Union countries and 42% from Asia.

The financial dimension to this diaspora is significant. According to data from the Universities U.K. organization, international students generated GBP1.25 billion in tuition fees during the 2003-2004 academic year, as a part of GBP4 billion from higher education international activities. This figure rose to GBP10.6 billion when non-university students were included.

There is no doubt that higher education in the United Kingdom, particularly at university level, is now guided as much by commercial as academic considerations. Universities, of which there are one hundred and sixty-six, including one hundred and thirty in England, may not be willing to openly admit that they need full-fee-paying
international students in order to survive. However, the importance of attracting such students is evident from the number of universities opening offices, appointing agents or attending education fairs in the Asian region in particular. Brunei is no stranger to this phenomenon, where British and Australian universities are particularly well represented, at least in part thanks to the promotional activities of the British Council. For example in March 2007, twenty-eight UK universities were represented and in 2008, twenty-four (British Council, Brunei). This entrepreneurial energy is understandable as the Bruneian government sponsors able, first-degree holders to enroll for a masters programme in the U.K. Once successful, many such students return to become tutor/lecturers in the Universiti Brunei Darussalam. Of the thirteen respondents in this survey eight are members of the Sultan Hassanal Bolkiah Institute of Education (SHBIE); two are members of the Faculty of Business, Economics and Policy Studies (FBEPS); one is in the Faculty of Science (FOS); one is in the Academy of Brunei Studies (APB) and one in the Centre for Islamic Banking, Finance and Management.

It is these returning international students who are the focus of this investigation. Do Bruneian students, once embedded in a very different educational system from the one they have experienced for up to sixteen years, conform to the Asian stereotype of “obedient and unquestioning behaviour” (Littlewood, 2000, p31). Do our putative lecturers have a stereotypical attitude of total commitment to work and achievement? And, if they do and are successful in gaining their higher degree, is the experience of studying abroad necessarily a good thing? One author (Liu, 1998) certainly doesn’t think so:

"Programmes in North America, Britain and Australia (NABA) are often ethnocentric and that, as such, do not take into full account the different educational contexts and traditions in which international TESOL graduates will later teach. They often encourage students-teachers from overseas to adopt ideas and practices that are valued in NABA but may not be very useful in their home environment" (pp. 7).

This telling point is reflected in some of the observations submitted by the respondents. Open-ended, qualitative questionnaires were completed by thirteen returnees whose impressions are presented and discussed in the main part of this paper.

A further stereotype that has not gone unchallenged is that Asian students are extremely reluctant to question their tutors or enter into discussion sessions, a reticence that is not helpful when involved with the UK university (and western) teaching/learning model. It may well be that any such reticence is not a result of a culturally defined respect for an authority figure but is situation specific and/or relating to ESL competency (Cheng, 2000). Fortunately, due to the language competence of Bruneian students selected to study in the UK English may only present a challenge to those whose undergraduate degree was in the Malay medium. Certainly at an anecdotal level, the standard of spoken English of the returnees, after one year in the UK, appears proficient and in some cases fluent.
Responses

Thirteen tutors responded to seven open-ended questions relating to their impressions of their time in the United Kingdom whilst enrolled on a masters degree programme, as well as their experiences as undergraduates at the Universiti Brunei Darussalam. Several respondents took the opportunity to make observations relating to socio-cultural issues that gave a wider meaning to the concept of education, over and above the pursuit of academic studies. Such students’ impressions relating to their ‘abroad’ experience could well be summed up by the aphorism that “travel broadens the mind”, which is one justification for sending such talented Bruneians overseas in the first place.

What follows is a summary of the respondents’ thoughts relating to issues raised by seven open-ended questions. Information will be presented under sub-headings made up of each of the questions.

Question 1. What were the differences between the Universiti Brunei Darussalam teaching/learning experience and abroad?

Two of the respondents pointed out that they thought this was an invalid question since the comparison was between a postgraduate and an undergraduate programme. However, that concern did not prevent them from pointing out such differences; specifically that an undergraduate course at UBD is lecture based, with a high degree of support, even ‘spoon-feeding’, whereas in the United Kingdom postgraduate students were expected to find out information for themselves through independent, self-driven learning. This abroad, teaching/learning model was, according to the majority of respondents, greatly enhanced by the availability of efficient ICT resources, as well as easy access to a wide range of academic journals. Crucially, it was emphasized by most respondents that their tutors expected them to have read the required research journal articles prior to attending a tutorial or lecture. It was noted that this did not happen at UBD due to a lack of resources, due to a lack of expectation from lecturers or because the heavy work loads did not allow time for such reading to occur.

Several respondents commented upon the reticence of students at UBD to make comments or raise questions during tutorials and a stereotypical unwillingness to join in or contribute to discussions. However, such activities were a central part of the UK learning model, which tended to present very real challenges to those who had rarely, if ever, said anything in lectures or tutorials. Two quotes well suffice to illustrate this:

• “Students were very eager to offer counter-points to the lecturers.”
• “The class was more open and critical (of the lecturer) and this sometimes lead to hot debate which was daunting at first, but it made me more confident in raising my own opinions and views.”

Another interesting impression identified by respondents related to the lack of international students at UBD: “the population is mostly locals rather than international”. However, with the UK student population “the multicultural nature of my group made learning more real (as when discussing issues where we could link personal experiences to theory)”. Clearly, alternative perspectives and insights into different lives were a valued
component of the learning experience, one that could only be provided due to the international nature of the postgraduate population.

A final theme relating to question one was that of personal change or self-discovery relating to the clear requirement for independent, self-driven learning whilst placed in an environment containing a relatively high degree of freedom. In other words, one could choose to behave in a disciplined way when in class but take the opportunity to lose focus once out of class. The nature and range of these non-study activities was something most students had not previously been confronted with, since the social mores of Brunei and the UK are significantly different in many respects. It would appear that, since all returned with their degrees, they successfully dealt with the challenges faced (eg, learning to manage finances, learning to clean one’s accommodation, learning to cater for oneself, learning to use public transport, avoiding drinking, gambling and clubs, getting too involved with university societies).

Question 2. If there are differences what are the points for and against the UBD model?

The responses were mixed but there was a bias towards the ‘against’ perspective. Points for the UBD experience related to familiarity with the environment, courses that fitted into students’ expectations and the non-competitive nature of the work environment. However, serious concerns were expressed over lack of resources, very heavy work load, large numbers of students in some lectures, emphasis on text-books rather than journals and the tendency to spoon-feed with handouts that effectively snuffed out any motivation towards independent learning. Perhaps the issue of most concern related to the quantity and quality of the ICT services availability at UBD. They did not compare well with what was available in the UK universities attended by the respondents.

Question 3. If there are differences what are the points for and against the abroad model?

The responses to the question can be summed up in two words “culture shock” (cf. Toffler, 1970, pp 315-316). Once they arrive in the UK students are confronted by a significantly different approach to teaching/learning, in a different socio-cultural context, whilst facing a new and different set of academic and personal expectations.

The words of the respondents themselves can be put to good use to illustrate their experiences:

• “You are faced with an unstructured situation where each student needs to be proactive in order to progress”
• “There was a much less formal and more chaotic atmosphere where you are encouraged to express your views without any fear of repercussions”
• “It is a challenge adjusting to everything new: environment, workload, independence, freedom, weather, even if the staff at UBD had warned us”
• “We are expected to be independent but too much independence and a student might lose their way”
However, several points highlighted both academic and other non-academic dimensions to the ‘abroad’ experience that are worthy of noting, especially for those students on a personal voyage of self-discovery.

As one obviously open-minded respondent says “once in the UK you have a range of opportunities such as visiting museums, art galleries and going to concerts. You have the chance to meet people from all over the world and you can easily travel to other countries”. Being open-minded may well be an important contributing factor to being able to benefit from a period of study in the United Kingdom since, according to more than one respondent, taking responsibility for your academic and non-academic performance leads to self-growth.

One response, relating to the issue of work assessment, may also serve to support one the key elements in the upcoming SPN21 philosophy, formulated by the Brunei Ministry of Education. The comment relates to the issue of exams versus course work:

“In the UK most of the modules were coursework oriented and we were assessed throughout the whole semester. I preferred doing the course work as it tests a lot of things like research skill, critical thinking etc, rather than just studying the whole course the night before the exam”.

An honest insight into at least one undergraduate’s approach to revision at UBD. Other postgraduates also shared their preferences for the course work based, continuous assessment model, particularly because it served to de-emphasize the importance of exams; an educational requirement they had grown up with.

From the responses received, there were many more points in favour of the abroad model than against, once the critical confrontation with culture shock had been dealt with. How well this was achieved will, to use one returnee’s words, depend upon each individual:

“(the perception of) experiences may differ from one person to another due to differences in one’s personality”.

This acknowledgement of the ‘affective’ is very different from another postgraduate who thought that those selected to study abroad have at least a second class degree so “should be able to cope”.

**Question 4. What are the factors that contribute to a successful (or unsuccessful) abroad study experience?**

In summary: being open-minded, planning ahead prior to departure and most importantly being able to cope with the challenges that ‘abroad’ will throw up. Part of that coping will relate to maintaining open channels of communication back to family and friends in Brunei, as well as forming one’s own network of friends and course-mates in the UK.

The importance of the support services offered by universities was also highlighted (IT help, library help, accommodation help). Also, having the self-confidence to find out answers through enquiry and independent effort was considered extremely valuable; part of the affective education process that parallels the cognitive one.
One respondent was particularly insightful when answering question four and hence is quoted, in full, about the positives of their time in the UK:

- **An environment** (inside and outside uni grounds) which gives you full freedom and independence, gives you opportunities to work through life challenges by yourself and question your strength mentally, emotionally and physically with support so far away at home.
- **An exposure to an environment** very different from home, one that is advanced and systematic in development yet has its own flaws.
- **An environment that is passionate about learning and rich in providing the resources to support all levels of learning not just academically but for personal growth, cultivation of oneself as an individual for oneself and for the community.**

For this particular postgraduate it seems clear that the stay in the UK was definitely an opportunity for ‘mind broadening’. The lasting impression given by the respondents is that successful abroad study experiences depended as much, if not more, on being able to cope with the demands of adjusting to a new environment than dealing with the academic programmes themselves.

**Question 5. Is there anything from the abroad university experience that you feel should be incorporated into the UBD undergraduate programmes?**

The responses for this question take the form of a ‘wish list’ that would benefit from a reality check, since it is difficult to know, and the respondents only offer the ‘what’ rather then the ‘how’, if rhetoric and reality can meet. Some examples will suffice to indicate the authors’ concerns:

- **Promote lots of group discussions and project work that will allow students to be critical and creative at the same time.**
- **Encourage independent self-driven study.**
- **Yes, encourage students to be proactive and to develop a sense of independence.**
- **Offer critical support to UBD students when writing assignments to let them know they are on the right track.**
- **Encourage UBD students to read more, especially journals.**
- **Discourage the stereotype of the reticent Asian student who will not challenge authority.**

To be fair two respondents were realistic, both of them making the point that a postgraduate teaching/learning model from the United Kingdom may have little to offer undergraduates in Brunei:

- **It might not be possible to incorporate such experiences into an undergraduate programme here in UBD.**
- **Difficult because of different levels, different teaching/learning models, different cultural contexts. The postgraduate UK teaching model would not be suitable for undergraduates at UBD.**
In summary the responses to question five point to life at UBD as it might be, rather than as it is at present.

**Question 6. How does your abroad experience benefit you as a member of the academic staff at UBD?**

No clear theme emerged in responses to this question, although each respondent offered their own particular perceived benefits. Touched on were such topics as the importance of e-learning; emphasis on the use of research data and journals; trying to employ different teaching models; the benefits of being exposed to English English as opposed to the variety spoken in Brunei; learning discussion skills; becoming more independent both as a learner in particular and as a person; trying to be open minded as researcher and lecturer and being sufficiently inspired by the UK experience to create new courses once back in UBD.

It is evident that each individual benefited in his or her unique and individual way from the experiences gained from their year at a UK University.

**Question 7. Are there any other issues concerning your UBD-abroad experience that you would like to raise?**

Only four postgraduates felt they wished to respond to this question. The points raised were as follows:

- *People are individuals and what they make of their abroad experience will vary from person to person.*
- *UBD should open up, be more dynamic and should work more closely on research projects linked to government departments.*
- *It is not possible to compare undergraduate with postgraduate programmes.*
- *Each faculty and department should have its own resources room with books, journals and computer access.*

Responses to the seven questions set out above will be discussed below.

**Discussion**

The impressions of their study abroad experiences, as reported by the thirteen postgraduates who completed the questionnaire, appear to have been shaped by two distinct influences: issues relating to academic considerations and issues relating to personal growth and self-discovery. However, the authors note that this is not a dichotomy but a dynamic mixture of experiences in which the influence is two-way. Perhaps the clearest example is the academic requirement that, in the UK, postgraduates are expected to become self-directed, independent learners who are prepared to ‘find out’ for themselves. However, as well as involving cognition, such a change will require a review of attitudes and values, as well as the embracing of new challenges whilst, at the same time, placing serious demands upon the individual and his or her personality. Hence the phrase ‘being open-minded’ that cropped up in many of the respondents answers.
There seems little doubt that the respondents, each in his or her own way, learnt not only about their chosen areas of expertise but also about themselves. Just how much of their academic experience can be translated from a UK context to be of value in Brunei is, however, a matter for debate; the rather idealistic responses to questions five and six tend to support this view. In fact it may be that importation of academic ideas from a postgraduate degree course in the UK to an undergraduate programme in an Asian university that is only twenty years old (and therefore in its relative infancy) may not be a viable goal. This dilemma is extremely well summed up by one of the respondents, whose use of the word ‘comfort’ connotes a very different mind-set from the UK context where the idea of making students feel comfortable is arguably not a high academic priority:

"Being a former student allows me to view in and out of the box. As much as I want these changes to happen with UBD, I sympathize with my students and understand their predicament. I, therefore, know that whatever method of teaching I apply to my students must be a ‘blended’ method to cater to their comfort. It is not wise in my opinion to adopt the abroad system so suddenly much of the style will not work perhaps with local students such as teaching without lecture notes. I came in to do two chapters to cover for a colleague; I have experimented not to give lecture notes as my colleague had previously done for his sixteen other chapters but the students told me they were unhappy with the situation and hoped that I would provide the notes as it will help them focus on what to read for the exams. As disappointing as it is, I am not mad because their expectations have been met that their lecturer will provide handouts in every lecture."

So some postgraduates brought back teaching/learning ideas that they could use, as seen in information offered in response to question five, but others did not. And this leads to what might be the most interesting revelation produced by this brief survey. What is gained from a masters programme in a UK university (over and above a postgraduate qualification) may not obvious or self-evident because it will not be mentioned on the degree certificate.

Every respondent unequivocally stated that he or she had changed as a person. They had become more independent; they had learned not to expect spoon-feeding; they had learned to be more open-minded; they had learned to cope with potential culture-shock when finding themselves in a strange socio-cultural environment; they dealt with challenges they had never faced before and they had overcome them. In other words, their trip resulted in significant personal growth, over and above increased academic knowledge. This is surely the best meaning of the word ‘education’, yet may not be the one that either the postgraduates or their sponsors had in mind as a first priority. It may well be that personal change will be more enduring and beneficial to each individual than knowledge acquired, since the former can last whilst the latter might become outdated or forgotten.
Acknowledgement

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References

Changing teachers’ perceptions and the use of ICT resources in teaching and learning in Brunei Darussalam

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Abstract
The integration of ICT into teaching and learning across the curriculum is a practice very much desired by the Ministry of Education, Brunei Darussalam. However, some Bruneian teachers still have reservations in utilizing ICT in their classrooms because they feel that the available ICT instructional materials are not integrally-related to the school curriculum. To support the use of ICT resources in classrooms, an ICT resource project was initiated by a team of researchers from Sultan Hassanal Bolkiah Institute of Education, Universiti Brunei Darussalam. A survey was conducted on teachers’ preferences for types of ICT teaching resources, ways of accessing, developing and improving ICT resources and their attitudes towards university-school partnerships. Parts of the results are analysed and discussed in this paper for moving teachers in the direction of technology adoption.

Introduction
The use of computer technologies and software in teaching and learning across subjects has presented many challenges to teachers and educationists. The speed and intensity of Information Communication Technology (ICT) have touched many education systems in more complex societies but now it is also increasingly influencing other developing countries. Whilst the pace of technological developments has been rapid, the capacity of education practitioners to exploit new developments for educational purposes in theoretical and practical developments for teaching and learning across curriculum is still far behind and the gap is not getting narrower. Nevertheless, the aspirations for ICT as an extension of teaching and learning aids and supports have remained at the forefront of the education development agendas of many countries including Brunei Darussalam. ICT is becoming the dominant mode of teaching and learning; it is no longer a luxury but a necessity. There has also been significant growth in research to study the impact of ICT and efficacy of ICT
in formal educational contexts. In a fast developing area of ICT, it is therefore invaluable to survey the ‘landscape’ both in an attempt to understand where we are now and to get our bearing regarding future directions of integrating ICT in education.

Background

The integration of ICT in teaching and learning across the curriculum began in the year 2000. University of Brunei Darussalam (UBD) through the Sultan Hassanal Bolkiah Institute of Education (SHBIE) has offered several ICT courses to develop pre-service teachers and practicing teachers’ competencies in ICT and its potential uses in education (Leong, 2001). Some SHBIE academic staff members have also been actively engaged in ICT research and have undertaken projects that enhance the roles of ICT in education (Sallimah & Leong, 2002).

Seeing the importance of ICT for purposes of teaching and learning, a team of SHBIE’s researchers had initiated and embarked on a project basically to develop a model on how teachers can utilize and integrate ICT in teaching and learning in Brunei Darussalam schools. The data, information and the results of the project are partially used and discussed in this paper. The effort contributed by the project team members will hopefully provide some useful information for further research and future development in the use of ICT for teaching and learning.

The project was conceptualized based on the belief among some researchers that teachers were facing constraints in the use of ICT in teaching and learning across subjects in Brunei Darussalam amid rapid development of technology and the huge investment taken to support it financially. Teachers in schools initially were simply not ready to try and had not learned to use the technology. Without readiness teachers may resist change. Sallimah and Leong (2002) reported that teachers, despite lacking the know-how had positive attitudes towards ICT. They had difficulty in using and integrating ICT in their teaching. Similarly, Leong (2001) reported that only a small percentage of teachers were using ICT in their teaching. Other reasons given by teachers for not using ICT in teaching include: lack of teachers’ skills of developing ICT materials; not confident in using ICT; readily available materials were not directly relevant to the topics in the science curriculum (Sallimah & Leong, 2002); and lack of technical support (Leong 2001).

Other constraints which deterred teachers from using ICT in their teaching were related to school inability to support ICT infrastructure. The rate of change of technology is very rapid and costly. Efforts and initiatives to provide infrastructure demands heavy investment. Technology has changed so rapidly particularly in relation to acquiring and replacing hardware and software frequently. Even if hardware and software were available in the market schools may not be able to afford them as these items are too costly as schools always have limited educational budgets (Leong, 2001). Consequently schools are always lagging behind. To overcome these difficulties, accessibility and interactivity to local and global world’s knowledge are critical. Firstly, ICT can develop students’ curiosity. Secondly, it can develop students’ confidence and creativity in the ability to explore, communicate, create and develop knowledge. Thirdly, it can encourage students to share information from internet with other students. For teachers, ICT helps them to monitor students’ progress, revise lesson plans and personalise students’ learning by
tailoring the level and activity to meet each student's requirements.

Currently, SHBIE conducts a number of ICT and other related ICT courses and through these courses a large number of ICT teaching materials have been developed by students as a partial requirement for their coursework. However, these materials have not been fully utilized in teaching and learning. Foreseeing the potential of these materials for teaching and learning, a project collaborated by a team of SHBIE researchers called an “Equity Model to Support Teaching and Learning Activities in Brunei Darussalam” was established. Primarily the aim of the project was to initiate greater involvement of practicing teachers in the resources-creating process of student-developed teaching materials at UBD and to provide access of these materials to students and teachers in Brunei Darussalam.

**Theoretical framework**

In this paper the utilization of resources as a consequence of the above project will be examined as they are believed to be critically important in any teaching-learning process. The nature and quality of resources used could have a significant impact on the teaching strategy and instrumentally on the degree of success of the overall activity. Improving access to quality teaching-learning resources opens the door to educational innovation and may bring change and improve teaching in Brunei schools.

Since ICT resources are critically important in the teaching and learning process, it is felt that ICT materials developed by student-teachers need to be improved in terms of their quality so that it can be used by teachers and students at schools. The systems approach using the Dick and Carey Model (Dick, Carey & Carey, 2001) is adopted for the project because it is thought to be thorough, has built-in checks and balances, and is replicable. It is also one of the models often chosen to integrate educational technology products into the teaching-learning process. The model provides better specialty coverage in every aspect of the instruction with appropriate attention given. Thus, using this model the ICT materials would be continuously improved in terms of their design and development through more of on-going monitoring and evaluation. Collaboration is essential as it is centred around developing research partnerships between teachers, teacher educators, researchers and students.

**Purpose**

The main purpose of this research was to get information on practicing teachers’ views and preferences, availability and willingness to participate in the ICT resources-creating process of student-developed teaching materials at SHBIE, UBD and to provide access of these materials to students and teachers in Brunei Darussalam. Specifically, the paper addressed the following questions:

1. What are the ICT teaching resources that teachers prefer to use in their every day teaching?
2. What are teachers’ views of an ideal way of gaining access to UBD produced resources?
3. Are teachers in school willing to be consultants in developing teaching resources? If so, how long would they spend helping students develop these resources?
4. How can SHBIE support the Ministry of Education, schools and teachers in the use of technology for teaching and learning?

**Significance of the study**

It is believed that the data and information obtained from the project’s survey would give significant contribution to the use of technology in teaching and learning in Brunei Darussalam. It can bring about innovation in the teaching and learning across the curriculum. Furthermore it can bring added value to society—innovation which leads to added value over time. In can also be argued that improving access to resources for teachers in Brunei schools is an innovation by itself.

Two changes to the system of education in Brunei Darussalam can also be expected. One is to initiate greater involvement of practicing teachers in the resource-creating process that routinely goes on at Universiti Brunei Darussalam [UBD]. The second is to provide access to students and teachers in Brunei’s public education system to the products that are made by UBD’s educational technology and ICT students. Both these changes are small changes but they have the potential for profound impact in creativity as well as innovation in the educational system (Bollier, 2000). Essentially, there are many benefits that can be accrued from the changes. These changes are briefly described below.

**Teaching and learning with ICT**

Teachers emphatically are trying to integrate ICT into their teaching. However, successful use of ICT for teaching means involving students and teachers in the learning process in new ways. This calls for good instructional practices of using ICT. Zambliet (2003) suggested potential indicators of successful instructional practices of using ICT by examining factors such as the relationship between technology and instruction, teachers' familiarity with internet resources, teachers' competence in using technology, familiarity with constructivist and other developing pedagogical frameworks, teacher access to professional development, belief and attitudes toward technology.

In the light of a new notion of learning where students are actively engaged in the learning process through active construction of knowledge in a technology rich environment, an understanding of the relationship between technology and instruction is vital. Technologies have often been explored as catalysts for changing teacher practices and introducing a variety of network-based tools that can be an effective means for helping teachers develop a more student-directed, constructivist-learning environment. However, success with these technologies requires extensive training and professional development, on-site support, easy access to technology and strong school administrative support. In Brunei Darussalam, through the initiative of the Ministry of Education, the use ICT in schools is heavily emphasized. All the schools in the country are equipped with computers and computer labs. Some schools are also given additional notebooks and wireless facility for easy access to the world of knowledge outside the country.

As more ICT finds its way into classrooms, it is important for teachers to understand how ICT is being used and its relationship to students’ learning. ICT is seen as means of accessing information and supporting explorations and construction of knowledge. From a constructivist perspective, in constructing new knowledge, students select specific aspects of incoming information, organize the selected information in various ways such as by sequencing, classifying, connecting, and relating to form new factual and conceptual
knowledge and integrate new knowledge with prior knowledge. Learning process in this manner is essentially a mental activity when new knowledge is constructed as a result of this activity. Taking account of this view of learning entails teachers to adopt new teaching strategies to prepare students to become independent learners. ICT is a tool that may provide opportunities to introduce such strategies for learning. By using ICT, teachers can provide opportunities for the students to learn, to think critically and have discussions with their peers, which is supported by ICT. Thus ICT can be an agent of change and the appropriate use of this technology can make learning for students more interesting and enriching and prepare them for the demands of the workplace. Therefore, bringing ICT into classrooms gives new opportunities for delivering instruction in innovative ways and provides meaningful, authentic activities that can help the learner to construct understanding and develop skills relevant to solving problems.

Another important aspect of learning in constructivist approaches is collaboration. While students construct meaning from their own activities, they also communicate to their peers to test their personal construction. Through these interactions scaffolding may take place which result in students coming up with alternative perspectives. Thus collaboration brings people together to challenge, support, or respond to each other and hence build up a community of learners who share common values and a common understanding of purpose. Learning collaboratively in this manner is possible through technologies such as CD ROMs, DVDs and internet. Taking on a constructivist perspective and teaching in a technology-rich environment require teachers to give up a traditional view of teaching and learning. Teachers no longer assume the role of knowledge dispensers but rather assume the role of facilitators of student builder of knowledge. In the new role, teachers need to focus on helping students to structure information; to perform critical analyses; to relate information to problem-solving; and to build a total understanding of the important issues from fragments of information.

At present, the ways in which ICT are used in school classrooms includes word processing, tutorials, simulations, instructional games, spreadsheets, practising drills, solving problems and analyzing data. Teachers also use computers to create instructional materials, research for planning lessons and for communicating with colleagues. However, the use of the ICT by teachers is more likely when these technologies are available in classrooms. The availability ICT in classrooms can assist students in the learning process through gathering and evaluation of information, defining and solving problems and drawing conclusions. Technologies that may aid in the learning process include simulation software, CD-ROMs, DVDs, videodiscs, and multimedia/hypermedia. Despite the benefits of these technologies in teaching and learning, bringing ICT into classroom does not mean the problems of teaching and learning are solved. It does however challenge teachers to change their teaching methods to complement the new technologies. Cavanaugh (2003) states that for teachers to be prepared to teach in an increasingly global and technological society, they need new skills and attitudes. If students are to fully enjoy the benefits of the use of technology, teachers and students must change their roles. Teachers must give up their authoritative role to adopt a facilitative role while students must assume an active role in learning by setting their own goals, asking questions, reflecting and evaluating their own learning.
Multimedia CD-ROMs and DVDs
Recent technological development allows teachers to present curriculum materials in the form of multimedia consisting of audio, video, animation, still pictures and text-based materials, into a hyper-linked structure to promote human learning. According to Khine (2003), the use of multimedia in classrooms helps students to retain information longer and enable them to apply learned information in a new situation.

For teachers who decide to use multimedia for curriculum delivery instead of expository teaching, the curriculum materials must be made available to students on a specially designed interactive multimedia CD-ROM or DVD. The CD-ROM or DVD then must consist of multimedia-rich content and can be opened by any Web browser. This makes it easier for the user who is not required to install other application software. Knowledge bits are organised in different media format such as still pictures, audio, video clips, and Word and PDF documents. In addition, quizzes and practice questions are also included in the CD-ROM/DVD. These information and activities are linked by hypermedia applications. When students use the resources, they can set their own pace of instruction and work through the content at a rate commensurate with their own motivation and abilities. Therefore the resources allow students to engage in an active learning process in which students work to construct their own meaning and understandings.

The use of such multimedia resources to deliver curriculum has several advantages. Cheung and Lim (2000) offered several advantages of multimedia instructional materials. Firstly, students have control of their learning especially in terms of pace of learning, understanding of content and time accessing information. Secondly, multimedia presentation of information enhances recall and recognition abilities, provides real-world examples and reduces cognitive load for transfer learning.

Web-based learning
While multimedia CD-ROMs and DVDs enable students to learn curriculum materials within classroom and curriculum hours, web-based applications extend students learning beyond the physical boundaries of their classrooms and curriculum hours. In web-based learning curriculum materials are made accessible to students by making use of on-line web-based applications. In a review of web-base learning, Chang and Fisher (2003) described four uses of web-based applications. These are informational, supplemental, dependent, and fully developed use of the web. As informational use, the web is used for disseminating curriculum information such as about the courses, assignment descriptions, teachers, or entire course plans for the duration of the semester. In supplemental use students make use of on-line web-based learning applications for completion of part of the course or an assignment. It also could be used by students to look at curriculum materials by incorporating links to related sources on specific topics.

In dependent use of web-based application, students are encouraged to be active and collaborative learners. By using this approach of teaching most course materials exist on the web including course information, course content and course materials, additional learning resources and links to related sources. The mode of teaching used with this form of web-based application is normally a mixture of classroom teaching and on-line learning. The fourth use of web-based application is called fully-developed use. When the web is used in this manner, it covers all the earlier web applications namely, informational, supplemental, and dependent use of the web. Here the entire course is delivered via the
web, and students are fully learning the course materials on line. In this approach students and teacher may never meet face to face. However, teachers who intend to deliver the course on-line should develop comprehensive materials that focus on student-centred learning and provide flexible teaching and learning strategies.

*Teaching and learning using ICT in Brunei Darussalam*

The uses of ICT as maintained above reinforce Nicaise’s (1997) ideas for computers to support learning activities: exploration, manipulation and articulation of what they have learned (speculation, conjecturing, hypothesis testing, and reflection on what they did). Therefore ICT help teachers in Brunei Darussalam to support constructivist learning activities by modeling, coaching and scaffolding. Leong, Ganske and Zahari (2004) argued that making information and knowledge readily available not only transforms the work place, but also transforms education. It gives people an opportunity for greater involvement and communication—student to student within the classroom or across schools; student and teacher; and also teacher to teacher collaboration. Further they argued that ICT provide opportunities for students and teachers to build on each other’s work. Thus they believed ICT would fulfill the vision of a connected learning community, and enable universities and schools to build curricular resources up on their Web sites that can be accessible to all levels of education. The writers are taking that initiative at UBD to provide ICT resources for all schools in the nation.(Please see http://www.e-journalofeducation.com and http://shbie.wordpress.com) Teachers and students in Brunei Darussalam as well as outside of the country will also be able to access the resources freely. It is hoped that all primary and secondary school teachers, and students and their parents will be able to make use of these ICT resources in their own individual ways to enhance the quality of education, and more importantly to prepare students to live and work in an ICT world.

*Methodology*

A survey was conducted to get the data and information from 614 teachers in Brunei Darussalam. Of this sample 446 were primary school teachers while the remaining were secondary school teachers. The survey sought to obtain information specifically on the following aspects:

- Teachers’ names and contact information
- School subjects that each teacher teaches
- Teachers’ preferred resources
- Teachers’ accessibility to resources
- Teacher willingness to act as a subject matter consultant in resource-creating projects
Results

The data from the survey were analysed and the results are presented as follows.

Teaching resources
The first research question was to identify preferred ICT teaching resources used by teachers. The teaching resources were divided into three categories as shown in Table 1. Based on their ranking responses, teachers had high preference for power point, tests/quizzes worksheets, websites, stories and games as teaching resources. They had low preference for hot potatoes, web quests, posters, flash movies, case studies and cross words. Their preference for these teaching resources appeared to be due to familiarity and availability of ICT teaching resources. Furthermore they preferred resources which were easy to use than the more sophisticated ones.

Table 1  Preferred Resources Used by Teachers in Teaching

<table>
<thead>
<tr>
<th>Category A</th>
<th>Power Point</th>
<th>Flash movies</th>
<th>Hot potatoes</th>
<th>Excel Interactive</th>
<th>Websites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.27</td>
<td>3.17</td>
<td>3.00</td>
<td>2.75</td>
<td>2.66</td>
</tr>
<tr>
<td>Rank</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category B</th>
<th>Stories</th>
<th>Case studies</th>
<th>Role plays</th>
<th>Web Quests</th>
<th>Tests/Quizzes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.29</td>
<td>2.96</td>
<td>2.74</td>
<td>3.27</td>
<td>1.89</td>
</tr>
<tr>
<td>Rank</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>1</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Category C</th>
<th>Worksheets</th>
<th>Games</th>
<th>Crosswords</th>
<th>Puzzles</th>
<th>Posters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
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<td>2.65</td>
<td>2.60</td>
<td>3.02</td>
</tr>
<tr>
<td>Rank</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Access to resources
Teachers were asked their preferred accessibility to these resources. Three ways of accessing the ICT teaching resources were listed, namely by downloading from database at UBD, downloading from UBD website and copy of selected CDs from CD library at UBD. Figure 1 shows teachers’ preferences for accessing the ICT teaching resources. The results indicate that 35% preferred downloading teaching resources from UBD websites, 33% preferred copying CDs from UBD library and 32% preferred downloading from UBD database. The percentages indicate there was almost equal preference for accessing ICT teaching resources.
Consultancy
Collaborative effort between school teachers and SHBIE, UBD, can be put into practice effectively if participating teachers can be involved by asking them to act as consultants for UBD students in developing ICT teaching resources. Effective participation of teachers is important in a sense that a school is a learning site and a heartland of teaching tasks where the use of ICT in regular teaching practices requires overall teachers support. Teachers were asked therefore if they would be willing to be the consultants, how long they would be prepared to assist students in developing these resources. Furthermore, teachers’ feeling towards school-UBD partnership was also asked. Figures 2, 3 and 4 show their responses to these questions. Figure 2 shows that 25% of teachers were willing to act as consultants.

Figure 1  Accessing teaching resources
Figure 2  Willingness to be consultant to UBD students

When asked whether they would be willing to spend time for any project in developing teaching resources with SHBIE students, Figure 3 indicates their responses. Although 38% of the teachers did not respond how long they would spend, yet almost 30% indicated that they would be willing to take up the challenge to finish the project as long as it took while 27% would spend only one hour and 5% would spend 2 hours in a single project. These responses were encouraging as they seem to suggest that a large percentage of teachers would be willing to offer their expertise in developing ICT teaching resources produced by UBD students.
Confidence, high motivation and commitment derived from a sense of shared ownership and responsibility are universally important. The next area covered the aspect of teachers’ attitudes towards the School-UBD partnership. Figure 3 shows teachers’ attitudes towards this partnership. Figure 4 indicates that 35% and 20% of the teachers were enthusiastic and supportive of the partnership respectively between school and UBD. This means that a total 55.5% of teachers were positive about the school-UBD partnership. However, there were also about 29% of teachers who had mixed feelings about partnership between schools and UBD. On the other hand, only 6% of teachers indicated that they had no time to get involved in developing ICT instructional materials. These findings suggest that teachers feel positively about school-UBD partnership.
Discussion

Basically the main aims of the project were to initiate greater involvement of practicing teachers in the resource-creating process of student-developed teaching materials at UBD and to explore the accessibility of these ICT teaching resources to students and teachers by means of a resource database concept in Brunei Darussalam. In order to achieve these aims, information of teachers’ background and their preferences about ICT were obtained through a survey. The information obtained includes their schools, subjects taught, ICT teaching resource preferences, access to ICT resources, willingness to act as consultants, time for pre-service student teachers in SHBIE, attitudes towards UBD-school partnerships and the resource database concept. The results of the survey indicated that a majority of teachers had high preferences for familiar ICT teaching resources such as power point presentations, quizzes, websites and games. However, resources like hot potatoes, flash movies, and posters were least preferred by teachers in their teaching. It is believed that the availability of these technologies and having the skills in using them would enable practicing teachers to integrate more ICT in their classrooms. For this reason it was thought that teachers would be the most appropriate resource persons for pre-service student teachers in SHBIE. Thus questions on their willingness to act as consultants, time for pre-service student teachers in SHBIE, attitudes towards UBD-school partnerships and the resource database concept were asked. Although they responded positively, a large proportion of teachers responded with reservation. The reasons for their reservation possibly were due to lack of exposure to ICT and they had little knowledge about ICT. Those who responded positively about the UBD-school partnerships were willing to act as...
consultants and spend time developing the ICT resources with SHBIE’s pre-service student teachers.

School teachers’ opinions of the ICT resources on ICT materials which had been developed by pre-service student teachers in SHBIE were sought through a workshop specifically to examine and analyse the ICT resources and ICT materials during SHBIE annual conference in May 2007. Based on their observations on the try-outs of these materials, the teachers believed that these materials would benefit them and their students in schools. The benefits of using these materials include a change of teaching methodology from teacher-centred to student-centred, less time for lesson preparation by teachers, lessons would be interesting and exciting and improve students’ understanding. However, the teachers were of the opinion that some of these ICT resources needed to be improved in terms of their overall presentation and content particularly by having more animation, video clips and clearly labeled diagrams.

The outcomes of this survey highlighted some of the fundamental issues that need to be addressed in the successful implementation of ICT and its usage in schools in Brunei Darussalam. Generally, there is a high percentage of teachers who were unsure of using ICT in their teaching. This group of teachers possibly have little training and guidance in ICT. Thus they may have negative perceptions of ICT and were unwilling to change their belief about ICT. For these teachers, there is need for them to undergo awareness courses in ICT. On the other hand there were teachers who were familiar with ICT, but they still lacked the knowledge and skills in the use of sophisticated technologies. For these teachers, it is important for them to upgrade their ICT knowledge and skills as they were more likely to adopt ICT in their classroom practices. On the other hand, there were teachers who used instructional technology as a means for intrinsic enhancement in teaching. They are today known as the adaptors of ICT who are continuously innovating their teaching pedagogies by introducing the latest technologies into classroom teaching.

The technology savvy of young student teachers complements well with pedagogic expertise of experienced teachers in enriching technology use in teaching and learning. The collaborative processes are in turn supported by faculty members from SHBIE in the courses that they teach, and everyone is happily blogging away educationally into the future. This augurs well for Brunei and the education community, especially with recent improvements in wireless broadband internet access.

**Conclusion and recommendations**

Social, economic, and technological changes of the past decades are making education and training for all more crucial than ever. Brunei provides free education so that all children receive equal educational opportunities. This education system provides children with the necessary knowledge and skills for evolving market places and sophisticated living environments, and to prepare citizens for lifelong learning. To meet these challenges, Brunei Darussalam through the Ministry of Education has made a concurrent effort on expanding access, improving internal efficiency, promoting the quality of teaching and learning, and improving system management. The strive for quality education is regarded as the main instrument for social, political and economic development of a nation. Thus the strength, security and well-being of the country rest on the quality of education
Education has therefore continued to be a great asset to many as well as a steady source of manpower supply for the national economy where education is seen and accepted as an effective instrument for success. Therefore, it is very essential to recognize that teachers are indispensable for achieving our educational aspirations and that teaching and learning through ICT would improve the quality of education in Brunei Darussalam. Thus it is important to bring ICT into classrooms. This is only possible when teachers are adapters of new technologies.

This paper has shown that building and strengthening the personal relationships between SHBIE staff, student teachers and school teachers in the collaboration of developing ICT teaching resources is an element for success. The project has changed the balance between SHBIE staff, school teachers and student teachers as well as between theoretical work and practical training. This challenges the traditional roles of teachers and student teachers. The focus is now on students' learning and the relationship between theoretical studies and life in the classroom. The main concern is then to build strong social networks which comprise SHBIE staff, school teachers and pre-service teachers. These human networks are the foundation for the development of ICT resources and successful integration of ICT in teaching and learning.

New technologies have changed the teaching profession from teacher-centered, lecture-centered instruction to student-centered interactive learning environments. Therefore, it is important for teachers to change their mind-set. In this regard, designing and implementing successful ICT is only possible if SHBIE assumes a leadership role in the transformation of education in the swirl of rapid technological changes.

References


The mismatch between science teachers’ beliefs and classroom practices

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Abstract

A major trend in science education reform is the emphasis on inquiry-based learning over and above transmissive-based instruction. Paradoxically, the modes of instruction in many pre-service teacher education institutions remain largely transmissive, driven by pedagogies grounded in the behaviourist theory of learning, and since research evidence indicates that teachers teach the way they were taught, the extent to which Bruneian science teachers employ inquiry-based instructions in their classrooms served as the impetus for the study reported in this paper. The aims were to solicit science teachers’ understanding and practices of inquiry-based instructions, and compare these with students’ perceptions of their teachers’ actual classroom practices. The ultimate objective was to explore teachers’ explanations for the gap between what they believe they do and what they actually do in the classroom. Data was collected from 44 secondary science teachers and 200 secondary school students using questionnaires. The results revealed that teachers had poor understanding of what constituted inquiry-based teaching and were ill-prepared in terms of attitude and training to undertake such a mode of teaching in their classrooms.

Introduction

Inquiry has become a key word used to characterize good science teaching and learning. Proponents of inquiry-based science believe that students at all grade levels in every domain of science should have the opportunity to use scientific inquiry and develop the ability to think and act in ways associated with inquiry (Akgul, 2005). This entails asking questions, planning and conducting investigations, using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanation (National Research Council, 1999). Inquiry-based instruction is based on the constructivist theory of learning which purports that students learn best by being actively involved in their own learning (Glaserfeld, 1996). It is believed that teaching students the process of science including the abilities and understanding necessary to engage in
scientific inquiry enable them to construct their own knowledge (National Research Council, 2000). This in return will enhance students’ creativity and problem solving skills which are two of the many attributes now perceived globally as essential goals of education for the 3rd millennium.

The plethora of changes taking place in science and technology, in society and in the economy has led to efforts by nearly all countries worldwide to transform education in the sciences. For more than 350 years, a major goal of science teaching has been to prepare students for a career in science. Science teachers and educators have generally held a disdain for science goals related to work in general (Hurd, 2000). This view is now changing. For example, a Workforce Readiness Act passed by the United States House of Representatives recommended “developing or adapting curricula and instructional materials which incorporated generic workplace skills (National Research Council, 1999).

In a speech to the nation in 2003, His Majesty the Sultan and Yang Di-Pertua Negara Brunei Darussalam said “National Education should provide a dynamic, forward looking educational programme to provide knowledge and skills required by industry and services without ignoring values”. He also called on policy makers to “prepare curriculum with the objective of inculcating a life-long learning culture, so that the Bruneian society is well educated” (Ministry of Education, 2007). Such a curriculum, he opined should aim at enhancing pupils’ creativity and problem solving skills.

The education in science being sought today should be one that connects students with the conditions of life in the 21st century. Today’s complex society requires people who are capable of analyzing and responding to issues in a constantly expanding knowledge-based world. In order to achieve this goal, science educators suggest that the classroom must be transformed into an environment that encourages students to go beyond memorizing facts into taking initiative and responsibility for their own learning (Albert, 2000; Gibbson & Chase, 2002). Such demands have rejuvenated interest in inquiry-based learning. Inquiry-based learning provides students with opportunities to reflect on questions, and analyze the enormous amount of information that characterizes the complex technological society of today (Cuevas, Lee, Hart & Deaktor, 2005). Science inquiry encourages the development of problem solving, communication, and thinking skills as students pose questions about the natural world and then seek evidence to answer their questions. According to the National Research Council (2000), the ability to question, hypothesize, design investigations and develop conclusions based on evidence gives all students the problem-solving, communication and thinking skills that they will need to take their place in 21st century world.

Context and statement of problem

Following the Sultan’s speech, the Brunei Ministry of Education has designed a new curriculum - Sistem Pendidikan Negara (SPN21) to come into effect in 2009. Translated in practical terms, the new curriculum calls for inquiry teaching at all levels of schooling, as opposed to the currently practiced transmissive method.

To engage in scientific inquiry students need teachers who not only believe that inquiry-based teaching is the best instructional approach to support their students learning, but also students need teachers who are confident in their ability to teach using inquiry-based learning.
based approaches (Damnjanovic, 1999). Unfortunately, White and Frederiksen (1998) reported that many teachers do not fully understand the inquiry process or do not have confidence or the time to develop new teaching strategies geared to developing students’ understanding of the inquiry process. One reason for this may be due to the fact that modes of instruction in many pre-service teacher education institutions remain largely transmissive, driven by pedagogies based on the behaviorist theory of learning. At the Universiti Brunei Darussalam for example, students pursuing B.Sc Education and B.Ed General Science programmes are taught science content courses (which account for 65% of the degree requirements) in the Faculty of Science where science is taught as a content not as a process. And since research evidence indicates that teachers teach the way they were taught, the determination of the extent to which Bruneian science teachers are conversant with inquiry-based instruction was the main reason for this study. The aims were to solicit science teachers’ understanding and practices of inquiry-based instruction, and compare these with students’ perceptions of their teachers’ actual practices. The ultimate objective was to explore teachers’ explanations for the gap between what they believe and what they actually do in the classroom.

Methodology

Data was collected from the forty four science teachers in secondary schools in Brunei Darussalam. The teaching experience of the participating teachers ranged from one year to over fifteen years. The selection of teachers for the study was largely governed by their availability and willingness to be involved in the study. The 200 students involved in the study were from eight classes in two schools, and were not necessarily taught by the same teachers involved in the study. A four-part questionnaire was used to collect data from the teachers. The questionnaire was developed over a period of three years and was used in several pilot studies before being finally adapted for use in this study. It was validated by a number of science education specialists and shown to be reliable using the Cronbach Alpha coefficient test ($\alpha = 0.947$) using SPSS.

Section A of the questionnaire, dealt with personal details of the teachers, and elicited information concerning years of teaching experience, classes being taught, gender, and areas in which in-service training would be most welcome.

**Questionnaire for Science Teachers**

This research study is being carried out to help ascertain the in-service needs of secondary science teachers, in preparation for the introduction of the new SPN 21 system of education. Your participation is greatly appreciated.
Section B
We wish to find out what you as a teacher think about your own teaching. On a scale of 1-5, please circle your response to each statement. If you wish, you can give reason(s) for your choice of answer.
1 = Always, 2 = Often, 3 = Not sure/Cannot tell, 4 = Seldom 5 = Never.

Statements:
1. In most lessons, I do all the talking.
   Reason(s):
   __________________________________________________________
   1 2 3 4 5

2. I often help students to see the connection between new ideas and what they have learned previously in class.
   Reason(s):
   __________________________________________________________
   1 2 3 4 5

3. In my class I allow students to discuss their ideas with each other
   Reason(s):
   __________________________________________________________
   1 2 3 4 5

4. I spend a lot of time following the textbook.
   Reason(s):
   __________________________________________________________
   1 2 3 4 5

Section C
Below are a number of statements about inquiry-mode of science instruction. Please tick (✓) the appropriate box for each statement. Each statement can be classified as one of the following:
True (definitely describing inquiry-based instruction)
False (definitely describing non inquiry-based instruction)
Neutral (applicable to any form of instruction)

<table>
<thead>
<tr>
<th>Inquiry-based instruction involves:</th>
<th>True</th>
<th>False</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Students evaluating data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Students reflecting on their work</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3. Students taking paper-and-pencil tests</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Students listening to teacher lecture</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5. Students writing reports</td>
<td></td>
<td></td>
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</tbody>
</table>
Section D
Please indicate whether the following factors currently influence your use of inquiry-based instruction. SA = Strongly Agree, A = Agree, UN = Uncertain, D = Disagree, SD = Strongly Disagree.

| 1. I had adequate pre-service preparation | SA | A | UN | D | SD |
| 2. My self-confidence is sufficiently strong | SA | A | UN | D | SD |
| 3. Inquiry based instruction requires too much preparation time. | SA | A | UN | D | SD |
| 4. Inquiry based instruction requires too much teaching time. | SA | A | UN | D | SD |
| 5. If I use inquiry based instruction most of the time, I will not be able to complete the teaching syllabus. | SA | A | UN | D | SD |

If given the opportunity, in what areas would you like to receive further training?
____________________________________________________________________
____________________________________________________________________
_________________________________________________

Thank you so much for your participation in this research project.

**Figure 1** Sample of questions contained in questionnaire

Section B of the questionnaire, consisting of twenty items, concerned teachers' behaviours and teaching practices. Ten of the items describe an inquiry mode of teaching and the other ten describe a transmissive mode. In answering the questions the teachers were evaluating their own classroom performance. The students were also asked to complete this part of the questionnaire about their teachers.

Section C of the questionnaire, consisting of eighteen items, concerned teachers' perceptions of the characteristics of inquiry based teaching. Teachers were awarded one mark for a correct conception and zero for an incorrect conception about inquiry teaching.

Section D of the questionnaire, consisted of seven items, and elicited information from the teachers concerning their preparedness and motivation to undertake inquiry type teaching, based on the educational environment in which they operated in their school.

**Results**

Data from Section A revealed that of the forty four teachers who completed the questionnaire thirty four (77%) were female, seven (16%) were male while three respondents omitted to state their gender. Twenty six (60%) of the teachers taught only lower secondary science in Forms 1-3 while eighteen (40%) taught science, pure or combined, in Forms 4-5.
A graph drawn with data from Section B comparing the students and teachers responses is shown in Figure 2. For Question B1 (Mean Scores 2-2.5) the students and teachers seem to agree that the “teacher does most of the talking in a science lesson”. The reasons that the teachers give for this state of affairs were… “often the students are unwilling to respond… the students are shy to speak up… in theory lessons we have to talk.” For Question B10 (Teachers mean score 2.61 while students’ mean score was 1.7) the students felt that the teacher very often said, “You’d better learn this thoroughly because it will be in the next exam”, much more in fact than the teachers were aware of saying it. The reasons that the teachers give for making this response are… “Brunei’s assessment system is still 100% exam oriented and so I cannot avoid this scenario… I do it just to make them afraid and so they learn what the lesson was all about…I do this only if an exam is coming soon.” In the students’ questionnaire they were not asked to give reasons for their own responses.

In Question B13 the students and teachers were pretty much in agreement that “the teachers tried to complete the syllabus each week.” Some teachers commented here that “there are too many topics to be covered but that this was definitely what they tried to do… often having to give extra classes in order to keep up and make the students understand.”

The mean responses for students and teachers to Question B16 show a marked difference (3.0 for the teachers and 2.3 for the students). These are in reply to the statement, “in most of the lessons the teacher does the talking while the students listen and take notes.”

Some teachers maintained that in classes of over 30 students this was the only way to teach. Others agreed that this was not a good way to teach. The adventurous teachers had taken to using Power-point but they still did most of the talking.

On Section B the overall mean of the mean scores should be 4.00 -5.00 for both teachers and students to concur that inquiry based teaching is predominant in their science classrooms. The mean of means in this study for teachers and students was considerably lower:

Teachers’ mean of means = 3.5, Students’ mean of means = 3.29.

These scores seem to imply that neither the teachers nor the students believe that inquiry-based science is the predominant form of instruction in their classrooms.

Section C of the questionnaire was only answered by the teachers themselves. This section consisted of eighteen statements about science teaching related to, or bearing no relation to, inquiry-based teaching. A teacher knowledgeable about inquiry-based science teaching could score a maximum of 18 marks on this section. The mean score for the forty four teachers in the sample was 8.4 on 18, or 47%.

Section D of the questionnaire attempted to measure the preparedness of teachers in terms of training and attitude, to undertake inquiry-based teaching. The maximum score possible was 35 marks on this section. The mean score for this group of 44 teachers was 18 out of 35 or 51%.
Discussion of results

The data from Section A of the questionnaire given to teachers, some of which is displayed in Table 1, reveals that the vast majority of the science teachers in the sample were young, relatively inexperienced female teachers, and they taught science at the lower secondary level. Most of them indicated that they would welcome further training especially in ICT, and some requested classroom management and student psychology courses. Many young teachers in Brunei experience discipline problems to begin with in their teaching careers, and science teachers are no exception. The researchers have observed on visits to schools that lower secondary classes tend to be large, and that there is insufficient laboratory equipment to enable pairs of students to perform experiments. As a result larger groups of more than five students operate as a group, and this often leads to noise and indiscipline in the laboratory. A teacher getting frustrated with undisciplined students, as have some of our student teachers, may abandon laboratory practicals in which students investigate altogether, and opt to give demonstrations instead. Thus one of the principal elements of inquiry-based teaching is abandoned by teachers because of discipline problems and a lack of resources.
The mean score for the responses to each statement in Section B, for the teachers, for the students in school A and the students in school B are shown in Table 1 below.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Teachers</th>
<th>Students A</th>
<th>Students B</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>2.14</td>
<td>2.59</td>
<td>2.61</td>
</tr>
<tr>
<td>B2</td>
<td>4.30</td>
<td>4.25</td>
<td>4.16</td>
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<tr>
<td>B3</td>
<td>3.82</td>
<td>3.96</td>
<td>3.90</td>
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<tr>
<td>B4</td>
<td>3.07</td>
<td>3.68</td>
<td>3.34</td>
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<tr>
<td>B5</td>
<td>2.93</td>
<td>3.01</td>
<td>3.24</td>
</tr>
<tr>
<td>B6</td>
<td>4.02</td>
<td>3.74</td>
<td>3.43</td>
</tr>
<tr>
<td>B7</td>
<td>4.02</td>
<td>3.89</td>
<td>4.18</td>
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<tr>
<td>B8</td>
<td>3.77</td>
<td>3.40</td>
<td>3.62</td>
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<tr>
<td>B9</td>
<td>3.91</td>
<td>3.31</td>
<td>3.22</td>
</tr>
<tr>
<td>B10</td>
<td>2.61</td>
<td>1.72</td>
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<tr>
<td>B11</td>
<td>2.89</td>
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<tr>
<td>B12</td>
<td>3.75</td>
<td>2.99</td>
<td>2.61</td>
</tr>
<tr>
<td>B13</td>
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<td>2.17</td>
<td>2.23</td>
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<tr>
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<td>4.09</td>
<td>3.61</td>
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<tr>
<td>B20</td>
<td>4.64</td>
<td>4.31</td>
<td>3.70</td>
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</tbody>
</table>

Table 1 Mean responses to statements in Section B

A cursory inspection of the results in Table 1 reveals many areas of agreement between students and teachers about what was going on in the science classrooms in this survey. When scores are low for one group, they are low for every group, and when they are high they are high for every group. Generally speaking the teachers scores are higher than those of the students. This implies that the teachers believe there is more inquiry-based teaching going on in the classroom than do the students. When the mean scores of teachers and students were correlated using the Pearson Product Moment Correlation Test the results obtained were in the range 0.84-0.96 (significant at the 0.01 level of confidence). The correlation coefficients indicate a high level of agreement between students and teachers about the areas in which inquiry-based instruction is either taking place, or not taking place, in the schools.. As has been mentioned earlier, a mean score of 4-5 would have meant that a high level of inquiry-based activities were taking place in the classes involved in this survey. A mean score of 3.5 from the teachers themselves, about their own teaching, implies that a less-than-high-level of inquiry based teaching is taking place, and the students rate it lower again with a mean score of 3.2-3.3.

The responses to Section C of the questionnaire (mean score 47%) which concerned knowledge and understanding of inquiry-based teaching indicated that the teachers did not
have a very comprehensive grasp of what inquiry-based teaching entailed. Unless something can be done to improve this knowledge and understanding, inquiry-based teaching will never get off the ground in Brunei classrooms and laboratories.

The responses from Section D of the questionnaire (mean score 51%) show that a sizeable proportion of the teachers in this sample were not prepared in terms of training or attitude to undertake inquiry-based teaching. This may in part have been due also to other factors such as large classes, discipline problems, a shortage of laboratory equipment and little or no help from a trained laboratory assistant.

Conclusions
To summarise what this research seems to be indicating for the sample of teachers and students involved in the study:

1) A high level of inquiry-based science teaching is not taking place in classes according to the teachers’ ratings. The students concur with this and their rating is lower again than the teachers.
2) The teachers’ understanding and knowledge of what constitutes inquiry-based teaching is poor.
3) The teachers’ preparedness to undertake inquiry-based teaching is poor in terms of perceived training and attitude.

References


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