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Process Inquiry: Analysis of Oral Problem-Solving Skills in Mathematics of Engineering Students*

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This paper presents another effort in determining the difficulty of engineering students in terms of solving word problems. Students were presented with word problems in algebra. Then, they were asked to solve the word problems orally; that is, before they presented their written solutions, they were required to explain how they understood the problem, and to give the processes they wanted to use in order to obtain the answer. Responses of students for each word problems would be noted. Discussions were recorded so that all responses were accounted for. Using NEA (Newman's error analysis), student's problems on reading, comprehension, transformation, and process skills can be determined by the teacher before the encoding of the solution is done. Also, the teacher directly addresses whatever misconceptions are made by the student in the process as well as of other students who are thinking the same way. More than 70% of the errors found were comprehension and transformation errors. Thus, students were given remedial classes to minimize their comprehension and transformation errors.

Keywords: engineering mathematics, oral problem-solving skills, difficulties

Introduction

From 1995 to 2011, the IEA (International Association for the Evaluation of Education Achievement) that has been conducting the TIMSS (Trends in Mathematics and Science Study) reported that Filipino students had poor performance in mathematics.

In fact, the 1999 and 2007 TIMSS reports provide very revealing results. The 1999 TIMSS reports indicated that Filipino students' performance in mathematics was 29% lower than the international mean (UP—NISMED (University of the Philippines—National Institute of Science and Mathematics Education), 2000). Almost 10 years later, in 2007 TIMMS advanced report, almost the same observation was noted when the Philippines ranked last among the 10 participating countries (2008 TIMSS advanced international report).

This condition of mathematics education in the country was clearly highlighted in the 2009 National Education Testing and Research Center of the Philippines report. Among other subjects, it pointed out that Filipino students have not reached mastery in mathematics.

For a country like the Philippines where mathematics has been recognized as a major factor in national

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development, these findings have posed several issues concerning the teaching and learning of mathematics in the country. Thus, national policy-makers and educators have expressed concerns how students learn mathematics.

One of the many areas explored to address this concern is to find out what misconceptions students have and where they take place in the process of solving a mathematical word problem. Through an oral examination with the use of NEA (Newman's error analysis), teachers would be able to identify what errors students commit, where they occur and what strategies teachers need in teaching mathematical word problems (Newman, 1977; 1983).

Literature Review

Lester and Kehle (2003, p. 510) defined problem-solving as an activity that involves the students' engagement in a variety of cognitive actions including accessing and using previous knowledge and experience.

Hence, it is understood that students who are looking for a solution to a given problem must think consistently with the contexts and content, among others. Non-routine problems are believed to have given opportunities for students to develop higher-order thinking in the process of understanding, exploration, and application of mathematical concepts (Polya, 1973).

Since it is a process, it uses different forms of knowledge that lead to the goal of solving the problem. According to Mayer (1982; 1987), such knowledge consists of the following: (1) linguistic and factual knowledge; (2) schema knowledge; (3) algorithmic knowledge; and (4) strategic knowledge.

This knowledge is necessary when a person attempts to answer a standard, written mathematics problem. Newman (1977; 1983) argued that any person wanting to arrive at the correct answer must go through a number of successive hurdles, such as reading, comprehension, transformation, process skills, and encoding.

A number of studies have indicated that difficulties in solving word problems lie not only in one stage but in two or more stages. For example, the study of Kaur (1995) found that: (1) the lack of comprehension of the problem; (2) the inability to translate the problem into mathematical form; and (3) the lack of strategy in solving the problem, were problem-solving difficulties that Singaporean students experienced.

Similarly, Marinas and Clements (1990), Ellerton and Clements (1996), and Singhatat (1991) have noted a large proportion of errors first occurred at the comprehension and transformation stages. In fact, they reported that approximately 70% of errors made by Grade-7 students on typical mathematical questions were at the comprehension or transformation levels.

Meanwhile, the same researchers found out that reading (decoding) errors accounted for less than 5% of initial errors and the same was true for process skills errors which were mostly associated with standard numerical operations (Ellerton & Clarkson, 1996).

However, there are those who have attributed problem-solving difficulties to the problem-solvers' cognitive and affective abilities. Schoenfeld (1985) suggested four aspects that affect one's performance, namely, mathematical knowledge, knowledge of heuristics, affective factors that affect the way the problem-solver views problem-solving, and managerial skills connected with selecting and carrying out appropriate strategies.

On the one hand, Lester (1994) expressed that difficulties experienced during problem-solving could also be caused by the problem-solvers' characteristics, such as traits, dispositions, and experiential background.

In fact, Lee (2001) enumerated these difficulties, such as: (1) the lack of experience in defining problems,

a tendency to rush toward a solution before the problem has been clearly defined; (2) the tendency to think convergently; and (3) the lack of specific domain-specific knowledge.

Kaur and Yap (1996; 1997; 1998) likewise believed that students did not lack any effort in attempting the problems, but they appeared to lack motivation and confidence in attempting unfamiliar problems.

For McGinn and Boote (2003), there were four primary factors that affected perceptions of problem difficulty: categorization, goal interpretation, resource relevance, and complexity. They suggested that the level of difficulty of the problem depended on problem-solvers' perceptions of whether they had suitably categorized the situation, interpreted the intended goal, identified the relevant resources, and executed adequate operations to lead toward a solution.

As one of the many implications of these studies, questions have been raised on whether too much emphasis is placed in schools on basic arithmetic skills, and not enough on the peculiarities of the language of mathematics and on the characteristics of the learners (Clements & Ellerton, 1992).

Paying attention to this concern, one established method employed in identifying students' errors and the stage they occur is the NEA. Prackitipong and Nakamura (2006) have explored the procedure proposed by Newman (1983) and noted that it can be conducted through oral interviews or examinations.

Oral retelling has long been recognized as a strategy for improving students' comprehension. However, a few used it to address mathematical misconceptions (Gambrell, Kapinus, & Koskinen, 1991).

Through oral retelling, students would be able to share their experiences and thoughts in solving word problems in mathematics without being forced to answer them under time pressure. Hence, documenting these oral testimonies during word problem exercises greatly yields significant data on what their errors are and where they occur.

It must be emphasized that linguistic issues in children's understanding of problems is important (LeBlanc & Weber-Russell, 1996). Some even say there is a blend of linguistic skills and practical knowledge involved in solving word problems (Fuson, Caroll, & Landis, 1996).

Countryman (1992) offered an explicit explanation: Words are instruments that facilitate thought. But word problems can be difficult for children to comprehend, because the language of word problems is different from the language they use in describing their own problems and experiences.

For Askew (2003), language provides a vehicle for rich classroom discussions and assist teachers and students to appreciate the power of mathematics in making sense of their world. Thus, oral testimonies are said to get into what was, is, and will be the students' appreciation, understanding, and application of mathematics in their lives.

Methodology

Participants

One hundred fourteen students (70 men and 44 women; 68 fourth year students and 46 fifth year students) with B.S. (bachelor of science) in ECE (electronics engineering) from the College of Engineering and Architecture of WVCST (Western Visayas College of Science and Technology), Iloilo City, Philippines participated in the study. They were enrolled in ECE 130 and ECE 330, both subjects have a descriptive title "Review of Mathematics and Allied Subjects", under the same professor. All speak the Hiligaynon language but had taken and studied Filipino and English languages. Some of them can also speak other dialects, such as "Kinaray-a" and "Sina", both are native dialects of Panay Island where Iloilo City is located.

Materials

This study used non-routine word problems in Algebra. They were categorized as “easy”, “moderate”, and “difficult” questions based on the number of steps a participant has to perform in answering a particular question. A total of 10 word problems consisting of four, three, and three “easy”, “moderate”, and “difficult” questions, respectively were given to the participants through a PowerPoint presentation. Algebra topics included were: Prime Factorization, Digit-Number Problem, Remainder Theorem, Theory of Equations, Rate-Time-Distance Problem, Inequalities and Order Axiom, Mixtures, Fractions, Ratio and Proportion, Sum, Square, and Cube of a Binomial, Combinatorics, Arrangements, Factoring, Logarithm, Laws of Exponents, and other basic concepts. Table 1 presents the topic included in each word problem raised and its corresponding category.

Table 1

Topics Included in Every Question

Question number	Topic	Category
Q1	Prime factorization	Easy
Q2	Digit-number problem	Easy
Q3	Remainder theorem	Easy
Q4	Theory of equations	Easy
Q5	Rate-time-distance problem	Moderate
Q6	Inequalities and order axiom	Moderate
Q7	Mixtures, fraction, ratio, and proportion	Moderate
Q8	Sum, square, and cube of a binomial	Difficult
Q9	Combinatorics and arrangements	Difficult
Q10	Factoring, logarithm, and laws of exponents	Difficult

Instructions for the Randomly Selected Students

The instructions for the randomly selected students are as follows:

(1) Kindly read each question clearly;
(2) Briefly explain (orally) what the problem is all about;
(3) Also, explain how you would obtain the answer(s) by mentioning the processes you want to use;
(4) You can likewise mention specific formulas, methods, concepts or principles as well as assumptions you need to establish in order to support your processes/procedures;
(5) After you are done with the questions, you are required to pass the encoded solutions.

Procedures

Just before the period, participants were asked not to get any notes, books, pens, and papers nor write in the air while the experiment was going on. Also, directions on what to do during the period were cleared and discussed with the participants. Since the participants came from two year levels, the projected questions were shown in two periods. The first period was shown on Monday for the fifth year students during their class in ECE 130 and the second period was shown the following day for the fourth year students during their class in ECE 330. Students in the first period were told not to share whatever they have seen in their period in order to have secrecy in the questions.

Also, before the period starts, students were in groups. Students’ previous performances in quizzes were the basis for grouping. Random numbers were generated using the MS (Microsoft) Excel based on the number of students in that period. Some students in the lower group were then chosen using these random numbers.

They were separated from the class and accommodated in another room to answer the same questions individually, one at a time.

Using an LCD (liquid crystal display) projector, each question in all categories was flashed one after the other. With each question, students were asked to solve the word problem orally. Any student may volunteer to read the question and then answer it orally. He/she will tell the class if he/she understands the problem or not. If he/she understands the problem, he/she will retell what the problem is all about, what is asked, as well as any related concepts and principles that may be used in solving the problem. He/she may propose a solution to the problem, saying the translation of the word problem into a mathematical expression or equation. Then, some manipulations may follow. If he/she does not understand the problem, he/she will tell what things, words, phrases, or statements does he/she find confusing. Other students may agree or disagree with his/her answers. The professor will then ask another student to give his/her thoughts and opinions regarding the word problem. After several attempts of the students, the professor will stop the discussion. The next problem will then be flashed and the same process will happen.

In the whole of the two periods, discussions made by the professor as well as responses of students were recorded both using manual listing and a video camera. An alternative camera (Webcam) was used, so that other behaviors inside the classroom will be accounted for.

After the presentation, each student was given a copy of all the questions asked in the presentation. They were also asked to make a written solution in separate sheets of paper and have to submit their papers with solutions before the end of the period.

Data gathered, such as the video of the discussions and responses as well as the manual listing were analyzed using NEA. Errors were classified into five: reading, comprehension, transformation, process skills, and encoding. A tally sheet was made by the researcher to make the classification and categorization easier to interpret. If a student made an error in comprehension in a problem, the researcher will then mark the comprehension part of that question. That means that the students' first error starts in that part. Errors were then tabulated to show a more meaningful thought.

NEA

The Newman's procedure was employed to classify and categorize students' errors (Prackitipong & Nakamura, 2006). This procedure has many aspects which are described as following:

(1) Reading: Does the student know how to read the question?

(2) Comprehension: Does the student understand the question?

(3) Transformation: Can the student select appropriate mathematical representations, operations, and procedures?

(4) Process skills: Can the student perform mathematical calculations accurately?

(5) Encoding: Can the student represent the answers appropriately?

In this method, there are two kinds of difficulties that hinder students from reaching the correct answers in the process of problem-solving:

(1) Problems of fluency in linguistic and conceptual understanding corresponding to the level of simple reading and understanding meaning of problems;

(2) Problems in mathematical processing consisting of transformation, process skills, and encoding answers.

Results

A total of 132 errors were found in the students' oral responses to word problems after using the NEA. Table 2 summarizes the type of errors committed, its frequency, and percentage distribution. It shows that the most number of errors were on transformation, which accounted for almost 50% (47.69%) while the least number of errors were on reading with almost 4% (3.85%). One significant observation to note is that reading and encoding errors are still possible despite the fact that the participants were already in their fourth and fifth years of study.

Table 2

Composition of Errors

Error	Number of errors	Percentage (%)
Reading	5	3.85
Comprehension	32	24.62
Transformation	64	47.69
Process skills	24	18.46
Encoding	7	5.38
Total	132	100.00

Table 3 presents the percentage distribution of the type of error students committed in 10 word problems. It reveals that at least 45% of the errors students made in six out of the 10 given questions were on transformation: Q1—69.2%, Q2—46.2%, Q3—53.8%, Q4—76.9%, Q6—61.5%, and Q8—53.8%. Furthermore, it can be observed that the next prevalent type of error made was on comprehension. It accounted for at least 8% to 62% of errors committed in all word problems.

Table 3

Errors in Every Question Categorized Using NEA (%)

Error	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Reading	-	-	-	-	-	15.4	-	-	15.4	7.7
Comprehension	23.1	30.8	7.7	7.7	30.8	7.7	61.5	15.4	46.1	15.4
Transformation	69.2	46.2	53.8	76.9	38.5	61.5	30.8	53.8	23.1	23.1
Process skills	-	23.1	23.1	7.7	30.8	15.4	7.7	7.7	15.4	53.8
Encoding	7.7	-	15.4	7.7	-	-	-	23.1	-	-

However, one interesting result to highlight is that almost all types of errors could be made in all word problems given. That is, a student is likely to commit an error not due to the topic included but to the problem-solving process.

On the other hand, Table 4 presents the words, phrases, and statements that students found confusing in each word problem. It is important to mention that a number of students did not understand well these words or phrases in spite of having taken, studied, and passed English courses.

When asked about the topics or concepts and principles related to the questions as well as the methods, they were going to use to arrive at the solution, the participants responded the following: logarithms, long-division of polynomials, substitution, permutation, inequalities, trial-and-error, quadratic equations, linear functions, factoring, decimals, synthetic division, distributive property using laws of exponents, remainder theorem, prime factorization, positive integer, roots of polynomials, completing the squares, three equations—three unknowns, elimination method, and even specific formulas.

Table 4

Confusing Items in the Questions Presented

Question	Words, phrases, and statements
Q2	Five-digit positive integer
Q7	Mixing of colors to produce another color Parts of blue and green, parts of blue and violet
Q9	Over peg A is worth one point Peg If all three rings land on pegs If the rings will be released one at a time or at the same time

Equally important as the quantitative results are the observations recorded during the study period. The researcher noted that students who did not have comprehension skills read the particular question more than thrice before attempting to answer it. After that, they were observed to have repeated some words from the word problem until they gave up computing or giving the correct answer. Some would even laugh when asked about their answer.

Moreover, it was evident that some students preferred to answer the word problems by writing their solutions than explaining the process they applied to arrive at the correct answer. Perhaps, this was due to the fact that they were shy to answer when they were taped-recorded. In fact, students' responses on papers show lesser errors committed compared to the ones they made in a face-to-face interview.

Discussions

This study identified students' errors and the stage they occur in solving word problems using the NEA. This was carried out through the oral retelling method, which proved to be an indispensable tool in determining students' difficulties and experiences in word-problem-solving.

Among others, one significant research finding is the high proportion of errors made on the transformation stage that accounted for almost 50% of the total number of errors committed. In fact, at least 45% of students' errors in six out of the 10 given questions were on the transformation stage. Furthermore, it was noted that the second most prevalent type of error made was on comprehension stage that made up at least 8% to 62% of errors committed in all word problems.

This is in agreement with the findings of Marinas and Clements (1990), Singhatat (1991), and Ellerton and Clements (1996) who have noted a large proportion of errors first occurred at the comprehension and transformation stages. They likewise reported that approximately 70% of errors made by Grade-7 students on typical mathematical questions were at the comprehension or transformation levels.

Considering all variables, the high percentage of errors in comprehension and transformation levels suggests that students have considerable difficulty in understanding and developing appropriate mathematical representation of word problems.

Kaur (1995) echoed the same concern when he found out that Singaporean students experienced at least three problem-solving difficulties: (1) lack of comprehension of the problem; (2) inability to translate the problem into mathematical form; and (3) lack of strategy in solving the problem.

Such difficulties are very evident when students' errors were classified into categories by algebra topics. Students have not related well to basic topics taught at elementary level like prime factorization, inequalities, mixtures, fractions, ratio and proportion, and operations on binomials as shown in the 69% and 23% of errors

made at the transformation and comprehension levels, respectively in Q1, Q6, Q7, and Q8.

Thus, basic to one's performance in solving a word problem are mathematical knowledge (Schoenfeld, 1985), experiential background (Lester, 1994), and categorization (McGinn & Boote, 2003).

Another important finding to highlight is reading and encoding errors are still possible despite the fact that the participants were already in their fourth and fifth years of study. Although they made up only at most 10%, committing errors in reading and encoding stages is very crucial since they are at the beginning and end of the problem-solving process as Newman (1977; 1983) emphasized. Thus, these types of errors could have a trickle-down effect in obtaining the correct answer.

A closer look at the given questions revealed that reading errors were highly recorded in Q6, Q9, and Q10. That is, many students could not answer them simply, because they did not know how to read the words or mathematical symbols included in such questions. In fact, Table 4 enumerates words, phrases, and statements that students found confusing.

As to errors committed in encoding stage, they substantially made up at least 8% to at most 23% of the total errors made in Q1, Q3, Q4, and Q8. Topics included in these questions are prime factorization, remainder theorem, theory of equations, and binomial operations.

Clearly, language comprehension plays a very crucial role in the problem-solving process. As what LeBlanc and Weber-Russell (1996) pointed out, linguistic issues in children's understanding of problems are important. Fuson, Caroll, and Landis (1996) even asserted that solving word problems involves blend of linguistic skills and practical knowledge.

It was also found out that most participants were able to identify the topics, concepts, and principles related to the questions raised as well as the solutions that they had to apply. However, they relatively failed to convert this knowledge when highly needed as shown in the high proportion of errors made on transformation and comprehension stages.

This failure may be due to the fact that problem-solvers' cognitive and affective abilities affect their performance. Lester (1994) considered the problem-solvers' characteristics like traits, dispositions, and experiential background as determinants of difficulties experience during problem-solving.

Lastly, students' behavior during the study period deserves a closer examination. They were noted to have shown comprehension difficulties, impatient attitude towards problem-solving, and preference on written exams over oral ones. Literature cited shows that the lack of experience in defining problems, especially the tendency to rush toward a solution before the problem has been clearly defined, is among students' difficulties in problem-solving (Lee, 2001).

On the other hand, attitude towards problem-solving is a factor to deal with as shown in the study of Kaur and Yap (1996; 1997; 1998) who underscored that students did not lack any effort in attempting the problems but they appeared to lack motivation and confidence in attempting unfamiliar problems.

To put it explicitly, McGinn and Boote (2003) suggested that the level of difficulty of the problem depended on problem-solvers' perceptions of whether they had suitably categorized the situation, interpreted the intended goal, identified the relevant resources, and executed adequate operations to lead toward a solution.

Preference on written exams over oral ones might be due to the fact that oral retelling is new to the students. Assessment of mathematics performance and other related measures in the Philippines are usually done in written form. Thus, students subjected to oral exams are relatively shy and fail to answer every question posed spontaneously.

The use of NEA, through the conduct of oral retelling in addressing mathematical misconceptions, has gained worldwide significance. The present study has explored the possibilities on using oral retelling as a method. Evidently, students' errors were identified and the stage where they occurred was made known.

Recognized as a strategy for improving students' comprehension, oral retelling offers good ways of knowing the peculiarities of the language of mathematics and on the characteristics of the learners (Clements & Ellerton, 1992). Indeed, it is a method that utilizes language at its core, which provides a vehicle for rich classroom discussions and assists teachers and students to appreciate the power of mathematics in making sense of their world (Askew, 2003).

Conclusion

Mathematics problem-solving errors of engineering students reveal that misconceptions occur at different levels. As Newman (1983) suggested, it must be categorized into five levels, namely, reading, comprehension, transformation, process skills, and encoding. Results showed that most errors committed were at the comprehension and transformation levels. Perhaps, the English language adds to the difficulty of the word problems, even though the Philippines are known to be an English-speaking country. Countryman (1992) explained that words are instruments that facilitate thoughts. However, word problems can be difficult for children, because the language of word problems is different from the language they use in describing their own problems and experiences (Kliman & Richards, 1992).

With many students to be handled, professors must devise a mechanism not only to help students learn but to know exactly what their misconceptions are.

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Development and Validation of Teaching Practice Evaluation Instrument for Assessing Chemistry Students' Teaching Skills

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The study was designed to develop and factorially validate an instrument for measuring teaching practice skills of chemistry student-teachers in University of Nigeria, Nsukka. Two research questions guided the study. The design of the study was instrumentation. All the chemistry student-teachers in the Department of Science Education, University of Nigeria, Nsukka, involved in teaching practice in November 2011 formed the population for the study. No sampling technique was used as all the population formed the sample for the study. The instrument known as TPEF (teaching practice evaluation form) was developed. It was used to collect data for answering the research questions. The instrument was face validated and subjected to factor analysis using rotated component matrix to establish the construct validity. FL (factor loading) range of 0.35 and above (Meredith, 1969) was used for the extraction of the valid items. Internal consistency reliability coefficient of the instrument was established using Kendall's coefficient of concordance. The result of the analysis shows that TPEF was valid and reliable. It also shows that there was agreement among the raters. Based on these findings, the educational implications were discussed and recommendations made including that teachers in tertiary institutions should use this instrument in assessing chemistry student-teachers during their teaching practice due to its validity and reliability in assessing teaching practice skills in chemistry.

Keywords: factorial, validation, teaching practice, evaluation, chemistry student-teachers, human resources, education and universities

Introduction

Vision 20-2020 of the Federal Government of Nigeria is seen as a pragmatic step take to guide the nation's course of scientific and technological development towards making Nigeria one of the best 20 world economies by the year 2020. Nigeria cannot achieve this without developing her human resources. This is because there must be relevant manpower to harness natural and human resources. Education is the best instrument for achieving the above mentioned goals. It is, therefore, very important that quality teachers should be prepared for this crucial role of human capital development. No wonder teaching as a profession is receiving recognition all over the world. The abilities of teachers are crucial determinants of the quality of education in any nation. Also, incompetent teachers may not help in training the youths to meet the challenges of modern life, hence, the technological growth of the nation suffers. The National Policy of Education (FRN (Federal Republic of

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Nigeria), 2004) stipulated that, no educational system can rise the quality of its teachers. Therefore, teachers ought to be sufficiently prepared to meet the modern demands of the teaching and learning processes.

Historical development of teacher education in Nigeria dates back to the colonial era when there was no specific institution for the training secondary school teachers (Mgbako-Ezennia, 1992). What existed were only institutions for preparing primary school teachers. As these primary school teachers with experience were promoted to Grade 1 they were sent to secondary schools to teach. Later, science graduates from colleges of arts, science, and technology and universities were posted to secondary schools to teach chemistry without prerequisite professional training. Presently, the National Policy on Education (FRN, 2004) stipulated that only graduates from faculties of education in universities are qualified to teach chemistry at the secondary school level.

Secondary school education constitutes a crucial stage in the preparation of manpower for technological and scientific advancement (Mgbako-Ezennia, 1992). Coupled with unemployment rate in the nation, the secondary school products must be guided and equipped with entrepreneurial skills and attitudes needed for self-employment. Chemistry is an important science subject that has much influence in enhancing entrepreneurial skills and attitudes (Ezeudu, 2008a; 2008b). Its importance in other fields of life cannot also be overemphasized. The obvious questions to be answered are: Are the methodological skills acquired by the chemistry teachers enough to successfully implement the national policy on education so as to produce youths that can push this nation forward technological and be self-sustained in life? Is Nigerian chemistry teachers' preparation able to produce highly personality and skilled teachers needed for effective teaching of chemistry in the secondary schools? Are the chemistry teachers prepared emphasizing quantity rather than quality and making a living rather than making a life? This latter question is very crucial because many people move into the teaching profession for the sole reason of making a living. Colleges of education and faculties of education of universities should prepare teachers with right attitudes, values, skills, and personalities needed for effective performance in the teaching profession. Since it is obvious that without quality teachers, the goals of the National Policy on Education (FRN, 2004) cannot be achieved and the Vision 20-2020 will not be actualized, then there is the need to look into the evaluation format used to assess chemistry student-teachers. This will ensure that quality chemistry teachers will go to the secondary schools to teach. It is, therefore, in order to produce quality chemistry teachers that this paper sought to develop and factorial validates TPEF (teaching practice evaluation form) for assessment of teaching practice skills of chemistry student-teachers.

Chemistry student-teachers in universities do their teaching practice in secondary schools with the sole aim of preparing for the teaching profession. Teaching practice occupies a very important position in teacher education programme in universities in Nigeria. Prior to the teaching practice exercise, students do micro-teaching as a course work. Also, they must have been taught how to write lesson notes and lesson plans. Micro-teaching is videoed to enable student-teachers self-evaluate their performances and progress. On posting, student-teachers firstly familiarize themselves with the schools and the principals. They are then assigned to classes. They then see the class teacher who will give them the scheme of work to be covered within the stipulated time. They learn from the class teachers, information about the ages of the students, specific problems of the students, abilities of the students, textbooks to be used, teaching aids required, and the timetable to be followed.

The student-teacher now prepares his/her lessons. This is where all that he/she learned theoretically are placed into practice. He/she must learn to write a good lesson plan that must involve the students, must be

interesting, putting effectively the teaching methods, teaching strategies, and instructional aids within the specified time. In preparation, he/she must make efforts to plan how to take care of individual differences of the students, giving assignments. The next stage is the teaching in the classroom and this is the teaching practice stage. This stage has steps. With appropriate comportment and the use of clear voice and appropriate languages, the student-teacher goes through introduction, presentation, assessment of his/her lesson, gives class work and assessments and marks them. He/she learns to draw back and evaluate his/her chalkboard writings and the visibility of his/her teaching aids to the students at the back of the classroom. The evaluation of the lesson would provide information to his/her success of the lesson, i.e., whether the specific objectives are achieved. Classroom teaching is not the only job of a teacher and so student-teachers should be trained by other teachers in the field in other activities which will prepare them for the future job ahead. Firstly, they should learn to be in school for a whole day. They should take part in all activities of the school like conducting morning assembly, sports/games, maintenance of chemistry laboratory, library, class register, and other boards. They should be involved in the preparation of timetable, sports, school clubs like debates, science quiz, etc.. They should pick up responsibilities of being a class teacher or day master which will involve activities during prep time. They should learn to prepare question papers for examinations, conduct examinations, mark the scripts, compile results, and enter marks in the students' report books.

As the student-teachers grow through experiences, they are visited by supervisors. The supervisors observe their lesson plans, give pre-supervision discussions that are meant to relax, create friendly environment, and give professional guides to the student-teachers. The supervisor now observes the student-teachers in the classroom noting the punctuality, introduction, presentations, evaluations, application of these (teaching methods, strategies, and aids), the composure, clarity of voice, the dress, the students' interest, the interaction of the students, the use of the chalkboard, and the attainment of the objectives. The supervisor not only evaluates the teaching during the lesson, but also guides and counsels the student-teachers. After the classroom teaching, the supervisor meets with the student-teachers for an exit interview involving a feedback in the whole exercise. The supervisor identifies the problems confronting each student and helps in solving them.

It is the evaluation of the teaching practice by the supervisor that motivates the researcher to develop and factorially validate an instrument for evaluating teaching practice of chemistry student teachers. Actually, there are evaluation forms available at the colleges of education and faculties of education of the universities but to the researcher's knowledge there is non-specifically made to evaluate chemistry student-teachers.

Instrument development is one of the essential processes of educational measurement and evaluation (Nworgu, 1992). This work is an instrumentation research which aims at developing an instrument for measuring the behavour of chemistry student-teachers while on the teaching practice. Some researchers have developed and validated some instruments. Ugwu (2009) developed and validated an instrument for the assessment of process skills acquisition in practical chemistry. Ezeanya (2004) developed and preliminarily validated a CAT (chemistry achievement test) for senior secondary schools. Most of these instruments were developed from chemistry content but none was done on the teachers' preparation.

Statement of the Problem

Teaching practice is an activity which aims at preparing quality teachers. It is very necessary for prospective teachers to grow in the profession. It provides the opportunity for student-teachers to grow in the profession. Because of these vital role played by the teaching practice in the preparation of quality teachers,

it becomes necessary that an appropriate format for the evaluation of chemistry student-teachers should be developed and validated. The need also arises, because to the researcher's knowledge, there is no evaluation form specifically developed for the chemistry student-teachers. Most teacher training institutions in Nigeria do not engage in micro-teaching for their students. Some do not video-filmed them and allow the student-teachers to grow through their own evaluation. The consequences of these are the responsibilities of the supervisors to see to their acquisition of professional skills are enormous. Above all, teaching practice score contributes to the overall score for graduation in the university. It carries a lot of load which is six credits and this is one of the highest credit loads. The supervisors are not serious and no particular guide has been used. Some scorers are meticulous while others do not go for supervision but give marks from their office. Considering the importance of teaching practice to the overall teaching career of students and its importance in human capital development, the researchers considered it necessary to develop an instrument that will guide supervisors to assess students' appropriate behaviors and uniformity. This work, therefore, sought to develop and factorially validate an instrument for evaluating teaching practice skills for chemistry student-teachers in universities in Nigeria.

Research Questions

The research questions are as follows:

(1) What is the construct validity of the instrument—TPEF developed?

(2) What is the inter-rater reliability coefficient of the instrument—TPEF?

This is an instrumentation research design, because it aims at developing and validating an instrument for assessing teaching practice skills of chemistry student-teachers in universities in Nigeria.

The area of the study is University of Nigeria, Nsukka, Enugu State, Nigeria. The choice of this area is proximity to the researchers and for effective control of the raters.

The population of the study consisted of five chemistry student-teachers in the Department of Science Education, University of Nigeria, Nsukka, involved in teaching practice in November, 2011.

For the sample and sampling technique, all the student-teachers (as mentioned in the population) were used for the study and so there was no sampling technique adopted.

The instrument for data collection was TPEF which was developed by the researchers. The researchers went through the existing teaching practice forms used in assessing teaching practice in universities and drafted the instrument. The researchers took the instrument to some experienced chemistry teachers in higher institutions, some experts in science education, and some measurement and evaluation experts who gave some advice and made some comments on the instrument. Their comments helped to restructure the TPEF.

The instrument was trial tested on five chemistry student-teachers in the Department of Science Education, University of Nigeria, Nsukka doing the teaching practice in May 2010. Five lecturers from science education rated the students using TPEF during the teaching practice. The scores of the lecturers were used to establish the validity of the instrument and the inter-rater reliability coefficient of the instrument.

The data collected were analyzed based on each research question. Research question 1 was answered using factor analysis while Kendall's coefficient of concordance was used to answer research question 2.

Results

Research question 1: What is the construct validity of the instrument—TPEF developed?

Table 1

Summary of Factor Analysis of the Items of TPEF and Factor Loadings

		Rotated component matrix[a]		Component			
		1	2	Impure items	Complex items	Total No. of items selected	Total No. of items not settled
Teacher's personality	Item 1	0.499	0.072	-	-	3	-
	Item 2	0.633	0.230				
	Item 3	0.142	0.473				
	Item 4	0.053	0.409				
	Item 5	-0.149	0.669				
	Item 6	-0.023	0.787				
Preparation	Item 7	-0.027	0.666	-	-	6	-
	Item 8	0.462	0.330				
	Item 9	0.573	0.296				
	Item 10	0.075	0.488				
Presentation	Item 11	0.542	0.060	1	-	11	1
	Item 12	0.280	0.695				
	Item 13	0.604	0.273				
	Item 14	0.625	0.282				
	Item 15	0.448	0.292				
	Item 16	0.417	0.157				
	Item 17	0.818	0.068				
	Item 18	0.182	0.338				
	Item 19	0.139	0.403				
	Item 20	0.250	0.596				
	Item 21	0.370	-0.013				
	Item 22	0.757	-0.056				
	Item 23	0.527	-0.084				
Class management	Item 24	0.505	0.401	-	1	3	1
	Item 25	0.615	0.049				
Communication skills	Item 26	0.178	0.322	2	-	-	2
	Item 27	0.276	0.326				
	Item 28	0.141	0.778				
Evaluation	Item 29	0.433	0.214	-	-		
Total				3	1	25	4

Notes. Extraction method: Principal component analysis; Rotation method: Varimax with Kaiser normalization; [a] Rotated Component Matrix is one of the ways of running factor analysis. It is done by subjecting your scores to computer for analysis.

It is important to note that:

(1) FL (factor loading) range used in selection is 0.35 and above (Meredith, 1969);

(2) Items without any FL up to 0.35 is considered factorial impure and not selected;

(3) Any item with FL of 0.35 and above on more than one factor is considered factorial complex and not selected.

Table 1 shows the summary of factor analysis of which rotated component matrix shown in Appendix. From Table 1, a total of three items were impure, one item was complex, and 25 items were selected.

A total of 25 items were selected for having FL of 0.35 and above. Items 18, 26, and 27 were not selected being factorial impure and item 24 was not selected for being factorial complex. Thus, four items were not selected.

Research question 2: What is the inter-rater reliability coefficient of the instrument—TPEF developed?

Table 2

Kendall's Coefficient of Concordance Showing the Summary of Inter-rater Reliability Coefficient of TPEF

(1)

Rank	Mean rank
Item 1	19.20
Item 2	18.10
Item 3	15.52
Item 4	13.88
Item 5	13.98
Item 6	14.94
Item 7	10.70
Item 8	12.80
Item 9	9.88
Item 10	13.38
Item 11	15.84
Item 12	12.40
Item 13	15.80
Item 14	15.58
Item 15	11.10
Item 16	16.12
Item 17	20.54
Item 18	12.14
Item 19	14.32
Item 20	13.90
Item 21	12.10
Item 22	15.20
Item 23	16.58
Item 24	15.52
Item 25	14.42
Item 26	17.08
Item 27	18.14
Item 28	16.58
Item 29	19.26

(2)

Test statistics	
N	25
Kendall's *W*[a]	0.839
Chi-square	97.209
df	28
Asymp. sig.	0.072

Note. [a] Kendall's coefficient of concordance.

From Table 2, the Kendall's coefficient of concordance was 0.839. This is high indicating that there is agreement among the raters, and therefore, the instrument has score reliability.

Discussion

As shown in Table 1, the factorial validity (FLs) of the 25 items of TPEF ranges from 0.35 and above. This is an indication that the 25 items are valid to evaluate teaching practice skills of chemistry student teachers in tertiary institutions in Nigeria. This is in line with Meredith (1969) who recommended a FL of 0.36 and above as minimum for accepting any item as valid. This, therefore, implies that the items of TPEF are adequate and representative of the various constraints of chemistry student-teachers in respect to teaching practice skills. It means that skills acquired by chemistry student-teachers during the teaching practice can now be identified and scored.

The results of this study have shown that TPEF has high inter-rater reliability coefficients, and therefore, reliable and can be used to measure teaching practice skills. As shown in Table 2, the overall inter-rater reliability coefficient of all the factors of TPEF is 0.839. These values indicate that there is agreement in the scoring pattern of the five different scorers. This implies that teachers can use TPEF in scoring teaching practice skills of chemistry student-teachers without differences in their scores. In other words, the use of this instrument will help teachers score students on the skills acquired and the level of acquisition thereby finding out the extent of attainment of the goals of the teaching and invariably the effectiveness of the technique used. The inter-rater reliability coefficient of this instrument is considered adequate enough for use by teachers to effectively score chemistry students-teachers during the teaching practice without much difference in their scores.

Conclusion

The following conclusions are drawn from the findings of the study:

(1) The 25 items of TPEF were found valid for assessing chemistry student-teachers on teaching practice skills acquisition;

(2) The inter-rater reliability analysis of TPEF using Kendall's coefficient of concordance (*w*) indicates that TPEF has inter-rater reliability index of 0.839 indicating that there is agreement among the raters.

Educational Implications of the Findings

The findings of this study showed that the 25 items of TPEF are valid constructs with respect to skill acquisition of chemistry student-teachers during the teaching practice. This implies that the instrument has construct validity with respect to teaching practice skills and so can measure the skills exhibited by these students to an appreciable degree. It means that the skills exhibited by chemistry student-teachers can be identified and scored.

The implication to teachers is that when assessing skills exhibited by chemistry student-teachers, the teachers' choice of assessment instrument should be guided by the ability to the instrument to assess not only the product but the process that is involved in achieving the product, identifying and scoring the skills exhibited by the practicing teachers. This quality inherent to the instrument will help teachers to identify and score the skills exhibited by the student-teachers to an appreciable level of accuracy.

The fact that TPEF has high inter-rater reliability coefficient implies that they are consistent and reliable in measuring skills exhibited by chemistry student-teachers during the teaching practice. This, therefore, implies that teachers can adopt this instrument for uniformity and reliability of their results. Teachers should also learn the skills of developing instrument for evaluation knowing the importance of valid and reliable instrument.

Recommendations

Based on the findings of this study, the researchers recommend that:

(1) Teachers in tertiary institutions should adopt this instrument in assessing their chemistry student-teachers during their teaching practice;

(2) A training workshop could be organized for teachers in tertiary institutions on how to use the instrument to rate chemistry student-teachers during the teaching practice;

(3) Further studies should be done in other institutions where chemistry students are trained to develop instrument to assess their teaching practice skills.

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Appendix

Department of Science Education,
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Teaching Practice Evaluation Form for Chemistry Students

Name of student: ---------- Reg. No.: ----------
Programme area: ---------- Year of study: ----------
School: ---------- Subject: ----------
Class: ---------- Topic taught: ----------
Duration: ---------- Date: ----------
Course code: ----------

Instruction

1. Observe the student-teacher and the pupils carefully during the lesson and complete this evaluation form while the lesson is going on by putting tick in the space at point which most closely indicates your view of the student-teacher's performance.

2. Score only those numbered in alphabets.

Scoring Guide

S/N		1	2	3	4	5
1	Preparation					
a	Statement of objectives					
b	Adequacy of the content					
c	Synchronism of specific objectives & evaluation					
2	Presentation					
a	Introduction					
b	Development of lesson					
c	Teaching skills illustrated					
d	Use of chalkboard					
e	Utilization of teaching skills					
f	Effectiveness of teaching skills					
g	Effective organization of chalkboard					
h	Knowledge of the subject matter					
i	Questioning skills					
j	Use of instructional materials					
k	Class participation					
l	Student-teacher interaction					
3	Class management					
a	Class arrangement					
b	Class control					
c	Stimulation and motivation of students' interest					
d	Reinforcement of pupil's responses					
4	Communication skills					
a	Use of appropriate language					
b	Voice clarity					
5	Evaluation					
a	Suitability of assessment					
b	Attainment of stated objectives					
6	Teacher's personality					
a	Appearance					
b	Comportment					

Total score: ----------

Signature student-teacher: ----------

Comments: ----------

Supervisor's comments: ----------

Supervisor's name: ----------

Signature and date: ----------

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Explore Elementary Teachers' Professional Knowledge of Guiding Science Fair Product by Using Different Instruction Model*

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This research is about using two different instruction models, "theory course combine with sample introduction" and "theory course combine with case method teaching", to instruct elementary teachers on how to guide the science fair product in two courses (16 and 12 teachers in each class) and observe their guiding tactics after the instructed classes. The results show that: (1) Elementary teachers who have taken "theory course combine with sample introduction" course consider that: (a) Introducing the samples can let them clearly understand the process of how to guide students to do their science fair project; and (b) Following the description sample to make their science fair project topic, extend these topic form original science courses, draw the conception map and flow table, handle the scientific experiment, and then teach students to be familiar with the content of science fairs project; (2) In-service teachers who have chosen "theory course combine with case method teaching" course consider that: (a) Case-method teaching helps them understand the contents of the curriculums; and (b) It provides them models to observe and imitate. With such an increase of awareness, knowledge transference had been brought out. Thus, professional knowledge would be promoted. Both teachers who have accepted these courses had hiatus when guiding students to develop their product: (1) Teachers is inadequately comprehending the basic scientific theory of subjects of their science fair project; (2) Scientific verification is not scientificalness; (3) Verify facts which are already known; and (4) Be careless about the control variable.

Keywords: instruction of elementary science fair, professional knowledge, case method teaching

Introduction

Rationale and Importance of This Study

The ISEF (International Science and Engineering Fair) has been held for 62 years. The Taiwan national primary school science fair has been held by the National Taiwan Science Education Center for 51 years. Science fair is an important annual event in science education circles.

Daab (1988) probed current status of American primary science fairs, and found that teachers often view science fairs as an optional homework and fail to provide students enough instruction. It might due to the deficiency of professional knowledge and enthusiasm.

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What professional knowledge should teachers have when they guide science fairs? Most teachers believe that scientific basis, ability to comprehend and use different teaching strategies, and ability to understand and evaluate students are the characteristics and abilities one shall have while instructing science fair (Lu, Chiang, & Hsiung, 2009).

In the process of teacher education, most institutions offer curriculums about teaching strategies, skills, assessments, and so on. For the lack of experience, many in-service teachers fail to promote professional knowledge. Classroom discussions and trial teachings are not enough to help them accomplish it, and models are needed. Thus, advisory channels are essential, such as Websites, manuals, workshops, and experienced teachers (Fredericks & Asimov, 1990; Shaffer, 2000; Shaw, Cook, & Ribelin, 2000).

Overall, in this research, we probe into the teaching lessons of instructing elementary school teachers to guide their students to finish a science fair product. We use two models, "theory course combine with sample introduction" and "theory course combine with case method teaching", to teach and observe all the teachers who have taken the class and compare the differences of their professional knowledge between both instruction, for example: Does the case method teaching provide in-service teachers and recruit a chance to combined theories with reality?

Research Objective

The main purpose of this research is to observe the difference of elementary teacher's professional knowledge after taken two different classes. The research questions are: (1) Is the elementary teachers' professional knowledge different if they have taken two different instructing model classes? (2) After taken the classes, what different behaviors will they have when designing primary science fair?

Literature Review

Strategies of Instructing Science Fair

Most teachers believe that scientific basis, ability to comprehend and use different teaching strategies, and ability to understand and evaluate students are the characteristics and abilities one shall have while instructing science fair. The strategies most teachers used when they instruct science fair are inquiry teaching method, problem-based learning model, and cooperative learning (Lu, Chiang, & Hsiung, 2009).

Inquiry teaching is totally different from didactic instruction. Students are the protagonists of learning activities. While inquiring, they have ample opportunities to announce, discuss, and operate. Through the experience similar to scientific research, students learn knowledge, attitude, and skills (Chen, Jiang, Lin, & Wang, 2001). Hsiung and Yang (1996) proposed four elements of problem-solving model as presenting situation, goals, limits, and rules. Wang (1997) suggested providing vast basics training and well-designed curriculum to make students problem-solving experts. Hilke (1990) viewed cooperative learning as a systematic way, through teamwork, students achieve the goal. As a team, everyone should exert his ability and help each other. D. W. Johnson, R. T. Johnson, and Holubec (1998) indicated that cooperative learning is a systematic and structured teaching strategy which fits for any grades and domains.

The Importance of Case Method on Education

The verb "case" is widely used in education. Zhang (2001) defined teaching case as "descriptions of real events which includes characters, stories, difficulties, and problems. And, it reports all situations and involvers

by multiple viewpoints. So, it can be applied to analyze, discuss, make decisions, and to solve problems".

In the process of teacher education, using real events as cases would provide in-service teachers and recruits a chance to combined theories with reality. Teaching cases also emerge the problems and difficulties which could be encountered on scene (Gao & Cai, 2001). However, some cases show other solutions, and provide in-service teachers an alternative way which is more efficient and brings out more efficacy (Bencze, Hewitt, & Pedretti, 2009; Shulman, 2004).

Methodology

Research Design

First, the author interviews the professor to understand instructing model, "theory course combine with sample introduction" and "theory course combine with case method teaching", then applies participant observation to joint both instructing courses, to understand how the professor practices her course, and how in-service teachers promote professional knowledge.

As the first model, classes of "theory course combine with sample introduction", the professor presents theory course of guiding a science fair, such as explaining the definition of lectures, the advantages of awarded works, the standard experimental procedures, and so on. Then, professor shows plenty of science fair examples for teachers to observe.

Second model, the professor combines her theory course with case method teaching and gives in-service teachers' worksheets matched with teaching case films. Theses worksheets could be viewed as portfolios which reveal the learning behaviors. In-service teachers complete the worksheets at class and the professor leads discussions to clarify their thoughts and to criticize the strategies and processes showed in the film.

Researcher records the whole course by recording classroom video and contrasts with worksheets and science fair schemes designed by in-service teachers (triangulation). To analyze all the data to inspect how in-service teachers learn and produce their work, the features of their behavior would be revealed.

The second part of research is to analyze science fair schemes designed by the in-service teachers, by so, to understand how they design their works, what their instructing strategies are, and if their works have any relations to what they learned before.

Participants

The professor has been instructed in-service teachers to instruct primary science fair for 20 years. This time the professor opens up two courses, one of it had 16 in-service teachers attend the class and use "theory course combine with sample introduction" as instructing strategies, which lectured on science fair samples; the other had 12 in-service teachers attend the class and use the "theory course combine with case method teaching" instructing strategies. Both of the classes are divided into four groups and designed primary science fair schemes of different subjects (physics, chemistry, biology, and applied science).

Research Tools

Teaching case films. Eight films produced by experienced teachers reveal the process of how experienced teachers instruct primary students to make science fair. Films have been evaluated by CIPP (context, input, process, and products) mode (Lu et al., 2012).

Instructing science fair worksheets. These eight worksheets are designed by the professor and they are

matched with instructing science fair. By worksheets, in-service teachers make their own learning record, which allows researcher to analyze what they learned (content validity built by two science professors and one experienced teacher).

Classroom video record. Researcher films the whole course and documents the discussions between the professor and in-service teachers.

Data collection and analysis. Researcher jumps in the scene to mark, count, and integrates in-service teachers' behaviors by "participant observation" and "discourse analysis". Then, on the basis of course content, researcher analyzes the worksheets written by in-service teachers. By "cross-reference" different data, researcher generalizes some conclusions.

During data processing, researcher follows grounded theory and seeks to find out threads of different data to compile and code them all. Then, through repeated comparison and verification, the results would be generalized.

Results

Exploring the Professional Knowledge Between These Elementary School Teachers After Taking Two Different Instructing Model Classes

Comparing professional knowledge by using instructing science fair worksheets. Researcher tries to use the instructing science fair worksheets to compare teacher's professional knowledge in both classes and analyze the result shown in Table 1. The researcher finds that teachers who accept "theory course combine with case method teaching" class, the score of professional knowledge is higher than "theory course combine with sample introduction" class.

Table 1

Result of Analyzing the Professional Knowledge Using Instructing Science Fair Worksheets

How to guide students to create subjects of their science fair project	Average scores of "theory course combine with sample introduction" class	Average scores of "theory course combine with case method teaching" class
1. How to develop proper subjects	3.9	4.4
2. How to collect literatures	4.0	4.3
3. How to guide students to construct research structure	3.7	4.3
4. How to design research hypothesis	3.6	4.3
5. How to arrange experimental procedures	3.5	4.4
6. How to control the variables of experiment	3.5	3.9
7. How to guide students to prepare oral presentation	3.6	4.6
8. How to write science fairs report	4.0	4.5

Exploring the difference of teachers' professional knowledge after accepting different instructing model. ***How to develop proper subjects.*** Teachers in "theory course combine with sample introduction" class think that the idea way of setting the science fair subjects is to extend it from science teaching materials, which can combine the regular curriculum and the science fair project and give consideration to both academic and extracurricular activities. But six of them worry about the lengthy discussion might consume valuable times and delay handing in the science fair report.

The case teaching film provides eight principles: (1) acquiring subjects from students' ideas; (2) deciding research orientations by literatures; (3) safety first; (4) considering the limits of space and time; (5) budget; (6) students' ability; (7) interesting and scientifically significant; and (8) converging and then spreading. All in-service teachers approved "converge and then spread" and were going to instruct students by this principle. During the class discussion, only eight (67.0%) agreed to acquire subjects from students' ideas, another four said: "In order to submit the report on time, we have to decide subjects for students. Before the lengthy discussion depletes our time".

How to collect literatures. According to the content and sample introduction in "theory course combine with sample introduction" class, three-quarters teachers find their science subject literatures on-line and analyze the literature for student to do the science fair literature discussion. The other quarters of teachers choose to let students surf on Internet for science fair literature by themselves, then discuss in class and turn the literature into useful information.

In teaching case film, the experienced teacher teaches students to ponder the key words of the topic and search literatures by them and then underline the key points of those literatures to dig out new key words. At the same time, by teamwork, both the theoretical basis and research orientation are more definite. After watching teaching case film, all in-service teachers agree the strategies performed in the film, and they are going to imitate that. All in-service teachers believe that experienced teachers' strategies are efficient, with other principles mentioned in case teaching film, such as collecting data from multiple sources and with different positions, selecting literatures according to credibility and prescription and corresponding to students' ability, it would be exhaustive.

How to guide students to construct research structure. In "theory course combine with sample introduction" class, all teachers introduce science fair based on the examples that had learn in class. They use conception map to arrange experimental procedures and think that using conception map is a great method, but teachers require to practice, otherwise, the effect might be reduced; conception map can also match and extend the teaching materials, suitable in both ways.

In teaching case film, the experienced teacher brings students to national science fair on summer vacation. Taking many awarded works as examples, he expounds how to construct research structure. Nine (75.0%) in-service teachers agree and are going to follow this strategy. Another three (25.0%) indicate that under current system, only school time and summer vacation can be used to inspect national science fair. And it is not feasible. First, a primary science fair team includes students from different classes, and it is hard to find an occasion without affecting regular course; Second, by schedule, science fair schemes must be submitted before May, so it is impossible to inspect national science fair on summer vacation.

Exploring Different Behaviors of Designing Primary Science Fair After Taking Different Instructing Models

"Theory course combine with sample introduction" class. When these elementary school teachers guide their students to make science fair project, teachers tend to probe into subjects which its cardinal principle seems readily comprehensible, but complicated in fact. In order to study rich in content, teachers extend the subject and make it huge. Without enough science literature discussion, these subjects became hard to complete its experimental operation after proposing science experiment or hard to achieve the purpose of the

experiment. Sum up 16 elementary school teachers' (four groups) deficiency and behaviors when guiding students to develop science fair product, researcher describes the concrete conditions in Table 2, in which "The demonstration is inadequately scientific proven" shows the most.

Table 2

Deficiency and Behaviors When "Theory Course Combine With Sample Introduction" Class's Teacher Designing Science Fair Products

Category of deficiency	Appear times	Behaviors feature's concrete description examples
1. Unclear about the basic theory of their science fair subject	9	Biology examples: Subject: Horrible fluorescent agent Investigate the impact of fluorescent agent to biological growth. Because the science literature isn't enough, lead to the final result of experiment cannot verify the impacts.
2. The demonstration is inadequately scientific proven	20	Chemistry examples: Subject: What can paper be When testing capillary phenomenon on different materials, should have quantitative the data, rather than just showing pictures.
3. Experiment variables were poorly controlled	10	Physics examples: Subject: Chimney effect When recording the temperature in experiment, moving the thermometer out of housing model might loss temperatures and make a large experiment error.
4. Verify facts which are already known	3	Applied science examples: Subject: Block sounds The children already know that the more barrier material sounds meet, sound insulation is better, which needs no proof again.

Table 3

Deficiency and Behaviors When "Theory Course Combine With Case Method Teaching" Class's Teacher Designing Science Fair Products

Missing classification	Appear times	Behaviors feature's concrete description examples
1. Unclear about the basic theory of their science fair subject	3	Physics examples: Subject: Lightning sports car—nozzles impair speed of the sports car A sports car with the nozzle, the other has not, cannot prove if the nozzle will affect the speed, without enough science literature.
2. The demonstration is inadequately scientific proven	9	Chemistry examples: Subject: Trouble gone—the natural hair dye studies The result of hair dye is affected by pH, should be designed to quantify the observations, just showing pictures.
3. Experiment variables were poorly controlled	5	Biology examples: Subject: The water overlord—damselflies life history Using "biological observation table" to record damselflies life history, because the recorded time intervals too much, cannot complete description effectively.
4. Verify facts which are already known	1	Applied science examples: Subject: Power out—the effective way of mixing two kinds of power The children already know that wind power generation is friendlier to environment, which no need to proof again.

"Theory course combine with case method teaching" class. When these teachers guide students to do science fair projects, they follow the guideline of "Finding a small title in big question first, then make a mountain out of a molehill". After teachers guide students to search for information on the internet by using keywords, use tables to plan their science experiment equipment, experiment records, and apply pictures or photos in their science fair report. But some deficiency also occurs in the process when 12 elementary teachers

guide their students. The example is shown in Table 3, in which "The demonstration is inadequately scientific proven" shows the most.

Conclusion and Suggestion

Conclusion

Elementary school teachers, attending the "theory course combine with sample introduction" course, guide their students to develop a science fair project. But most of them draw up their science fair guidance plan by following the sample description. Like subjects of the science fair project, although this topic is extending from the science courses that students have had learn, instead of letting students raise the topic, teachers tend to lay down it. Then, teachers search it on the Internet for scientific literature, draw a conception map or flow table of scientific research, handle the scientific experiment, and then teach students to be familiar with the content of science fairs project, in order to quickly complete the cross form the lessons.

The profession in-service teachers, learning from theory course with case method teaching, obtained "3G": (1) guiding students to develop proper subject by "converge and then spread" and other seven principles; (2) guiding students to collect literatures by keywords; and (3) guiding students to construct research structure by inspecting science fair. In-service teachers agree that teaching case films provide them models to boost learning migration. Thus, professional knowledge would be promoted.

Both teachers who have accepted these courses had hiatus when guiding students to develop their product: (1) Teachers is inadequately comprehending the basic scientific theory of the topic of their science fair project; (2) Scientific verification is not scientificalness; (3) Verify facts which are already known; and (4) Be careless about the control variable.

Suggestion

Sharing the case teaching films to more teachers should be helpful to promote teachers' professional knowledge.

Administrations at all levels should encourage teachers and students to inspect science fair, provide supports, and exclude the deadline problems.

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A Conceptual Framework for Assessing the Impacts of GIS on the Motivation and Achievement in Geography Among Underachieving Students of Smart School in Sabah, Malaysia

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In 1988, the integrated secondary school curriculum was introduced as a continuation of the curriculum changes introduced in the primary school. These changes have impacted geography subject in the secondary school. Geography becomes a compulsory subject for lower secondary and elective subject at the upper secondary school level. As a result, fewer schools in Malaysia offer geography at this level. Consequently, students in upper secondary school level are shying away from studying geography and the percentage of students who pass the exam is declining each year. Unlike Malaysia, geography is getting more attention in developed countries and has become a key subject at both the primary and secondary levels. As a result, GIS (geography information system) was widely accepted and implemented in the secondary school geography curriculum. Numerous scholars have reported that the use of GIS as a teaching tool has had a positive impact on students' engagement and motivation to learn geography. However, GIS has not yet been introduced to secondary school geography in Malaysia with reason of ability, lack of substantive research into the capacity of GIS to support and motivate students to learn geography. Therefore, the aim of this study is to determine the effectiveness of GIS promoting students' motivation, engagement, and achievement in geography. This article presents a conceptual model based on an extensive review of literature in a related area for assessing the impact of GIS on the motivation and achievement.

Keywords: GIS (geography information system), motivation, achievement, framework

Introduction

Government of Malaysia has established a Multimedia Super Corridor project in 1996 to make the country as ICT (information technology and communication) hub of the region. In line with this, one of nine key strategies outlined in the Eighth Malaysia Plan (2001−2005) is to develop the national ICT field and expand the use in all sectors of the economy (Malaysia Economic Planning Unit, 2001). This initiative is based on the belief that there will be growing demand for computer literate workforce as well as professionals in ICT (Lee, 2000). As part of this initiative, the Malaysian Government established a Smart School Project in 1999 and School Computerization Program in 2002. The main objective of this project is to emphasize the use of

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technology tools as an important aid in learning and teaching. Computers are the main instruction. However, the integration of ICT in teaching is given greater priority in Bahasa Malaysia (Malay language), science, mathematics, and English subjects. In contracts, geography remains as “dry” subject with little use of technology and is taught with conventional teaching method (Abdul Hamid, Mohmadisa, Mohd Faris, & Mohamad Suhaily, 2006).

Unlike Malaysia, geography is getting more attention in developed countries and has become a key subject at both the primary and secondary levels. As a result, beginning in the early 1990s, GIS (geography information system) was widely accepted and implemented in the secondary school geography curriculum. For example, in 1990, United Kingdom introduced GIS in geography teaching (Bednarz, 2004). It was also adopted in the Netherlands 2003 (Korevaar & Van Der Schee, 2004) and in Turkey 2005 (Aladag, 2010). However, the Malaysia Ministry of Education was not interested in integrating GIS in geography education on the reason of lack of ability, human resources, and ICT facilities. Therefore, this study was to identify the strengths and weaknesses in an effort to integrate GIS in geography teaching in smart schools which is well-known for the most complete schools with sophisticated ICT equipment in the country.

School Geography Curriculum Reforms in Malaysia

The history of geography education in Malaysia is unique. Geography subject was first introduced in Malay vernacular school in 1927. The geography curriculum was “British Empire-centered” and students were taught of map drawing, chief tows, rivers, and industries in each country by the method of memorizing the facts. Geography education was officially introduced in primary and secondary English school in 1928. The curriculum emphasized more on geographic term, map reading, map drawing and geographic region on five continents (Wong, 1977).

According to Khatijah (1989), in 1936, Malay vernacular and English schools received their second curriculum to synchronize and structure the standard of pupils’ cognitive development and their experience. However, geography education in Malaysia halted in the period of the Second World War, during the Japanese occupation and Malayan emergency (1948−1960).

Geographical education curriculum in Malaysia has been reviewed again in 1956 by the committee, which was comprised of teacher training college lecturers, educational administrators, and teachers. The primary school curriculum remained from the pre-war syllabus. On the other hand, secondary school received greater attention through local geography, topographical map work, weather observations, and physical geography. A review of the effectiveness of the 1956 curriculum led to the 1964 geography syllabus. It also emphasized logical progression and introduction to both local and regional geography and map work. In 1979, primary school geography was revised and drafted based on the concept of spatial organization of geographical phenomena and societal pressure in a national context. At the same time, conceptual thinking of spatial orientation in geography was introduced in lower secondary school.

In line with national development and the vision to produce the creative, innovative, and knowledgeable human resources, Malaysia Ministry of Education has revamped primary school curriculum in 1982. The new curriculum was introduced in schools in 1983 and provided greater emphasis on the acquisition of basic skill and knowledge through various learning activities (Lee, 2000). Significantly, geography as a discrete entity was eliminated and integrated with “Alam Dan Manusia” (local study) was designed to integrate science, history, geography, civic, and moral. This subject was introduced in primary school with four standard students.

The integrated secondary school curriculum was introduced in 1988 as a continuation of the curriculum changes introduced in the primary school. This new curriculum gave greater emphasis to the integration of teaching process across the curriculum. These changes also influenced geography in the secondary school context (Abdul Hamid et al., 2006). Geography becomes a compulsory subject for lower secondary school students who were formally assessed in the government examination for the Form 3 students (Penilaian Menengah Rendah). However, at the upper secondary school level (Forms 4 and 5) geography becomes an elective subject. As a result, fewer schools in Malaysia offer geography at this level (Habibah & Vasugiammai, 2010). The same situation occurs at the pre-university level. Consequently, students in upper secondary school and pre-university level are shying away from studying geography (Nordin Sakke, 2006).

Secondary school geography curriculum has been revised again in 2002. The new curriculum implemented in 2004 places greater emphasis on creativity and critical thinking skills. The curriculum content has changed and has been divided into three parts. Namely, Part A (geographical skills), Part B (physical and human geography), and Part C (local study). Part C is a new element introduced to the students. Students need to conduct research on a local area based on the concepts and knowledge taught in class. Nevertheless, these curricular changes have not been able to attract students to learn geography (Katiman Rostam, 2005).

Smart School Project in Malaysia and Geography Education

For the past two decades, ICT components and multimedia-based learning are widely applied in the classroom (Beuschel, Graiser, & Draheim, 2003). This has provided inspiration for the Malaysian government to establish Smart School Project (locally known as Sekolah Bestari). The main goal of this project is to provide more interactive teaching facilities and teaching materials to improve the teaching quality and students learning outcome in schools (Malaysia Ministry of Education, 2006). A total of 89 schools were involved in a pilot program (Malaysia Ministry of Education, 2004a; 2004b; 2006). There are three categories of smart school under this project. Namely, the new smart school, a state smart school, and remote smart school.

The new smart schools are supplied with high-tech ICT equipment while a state smart school with a medium level and remote smart school with a minimum level of technology and equipment. Each student in the new smart schools is provided a personal laptop. While the smart schools in remote areas are supplied with PC (personal computer) in the computer lab. Malaysia Ministry of Education also provides laptops to all teachers involved in the pilot project to facilitate and implement computer technology in the classroom (Rohana, 2006; Malaysia Ministry of Education, 2008). Various types of interactive learning material have been introduced into primary and secondary school in Malaysia. This includes CD-ROM, browser-based teaching, and learning materials, such as online tutorials available through the web portal (Azizah & Hanita, 2005). In line with this, the Malaysia Ministry of Education has collaborated with several private companies to develop interactive software.

Through this collaboration, Malaysia Ministry of Education managed to develop 1949 interactive courseware (Malaysia Ministry of Education, 2008). However, the coursework developed was only involving key learning subjects in the school such as Bahasa Melayu (Malay language), English, science, and mathematics. Thus, it can be concluded that the introduction of the smart school project in Malaysia does not have any positive impact on the curriculum and methods of teaching geography in Malaysia. Nevertheless, geography has become what students perceive to be a “dry” subject with little use of technology (Habibah & Vasugiammai, 2011).

Integrate GIS in Geography Education

GIS is one of the information system used to store, display, analyse, and manipulate data related to space. Recognising the importance of GIS in geography education, several developed countries around the world have taken innovative steps to incorporate GIS in primary and secondary geography curriculum. According to Bednarz (2004), United State was one of the first countries to use GIS in education. In 1990, United Kingdom introduced GIS in geography curriculum (Wiegand, 2007) and fully utilized to support teaching primary and secondary school students (Fargher & Rayner, 2012). In 1998, Singapore has also taken initiative steps to introduce GIS as an important teaching tool for teaching geography at the secondary school and junior college level. This was followed by Netherland 2003 and Turkey 2005 (Aladang, 2010).

In Malaysia, GIS is successfully used in various fields. These included areas, such as engineering, environment, crime mapping, real estate land use, and politics. Most of the universities in Malaysia, namely, UTM (University Technology Malaysia), USM (University Science Malaysia), UKM (University Kebangsaan Malaysia), UMS (University Malaysia Sabah), and UITM (University Technology Mara), are widely using GIS in their research and offering as major subject to students. However, GIS has not been embraced by Malaysia's education system and absence from the geography curriculum in primary and secondary school context (Habibah & Vasugiammai, 2010). Nevertheless, researchers continued to explore its potential (Abdul Hamid et al., 2006). Most of the research focused on the educational potential of GIS and the obstacles to its implementation (Mohd Faris, 2006). Thus, it has inspired researchers to undertake research on integrating GIS in teaching geography in the classroom. For instance, Vasugiammai (2005) has conducted studies of using GIS in local study and followed by Umah Devi (2008). Unfortunately, the findings of this research were not able to convince the Ministry of Education and Curriculum Department of Malaysia to embrace GIS within in geography curriculum.

GIS and Motivation

The impact of students' motivation in school on learning outcomes is a major field of study in education (Mclnerney & Ali, 2006). In geographical education, there have been a number of studies conducted to investigate the impact of motivation on students' achievement (Chionh & Fraser, 2009; Aydın & Coşkun, 2011; Kaya, 2011). As an extension to this study, various studies were conducted to investigate the effectiveness of using ICT to enhance students' motivation to learn geography recently (Tuzun, Yilmaz Soylu, Karakus, Inal, & Kizilkaya, 2009; Yazici & Dermirkaya, 2010; Vos, Meijden, & Denessen, 2011; Santos, Perez Sanagstin, Hernandez Leo, & Blat, 2011). Interestingly, all the findings from the studies suggested that ICT significantly influences their motivation to learn geography.

Continuous development of technology has introduced GIS as a novelty and exciting tool in geography education. However, few quantitative studies have been conducted to study the effectiveness of GIS on students' motivation (Keiper, 1996; Kerski, 2000; West, 2003; Milson & Earle, 2008). These studies proved that GIS has positively influenced on students' motivation to study geography. The most-recent research was from Aladag (2010), using quasi experiment with primary school students in Turkey, reported that GIS supported lesson has a positive effect on students' motivation towards the geography lessons. However, none of these studies utilized mix-method design to reveal the effectiveness of GIS supported lesson on students' motivation to study geography. Thereby, this research will introduce a new method in research of the effectiveness GIS tool on students' motivation to learn geography. In addition, Theobald (2006) argued that motivation changes are an

internal circumstance which affects the nature of an individual's behavior. Therefore, using a single method will ignore other aspects underlying motivated behavior. Thus, the use of mix method and triangulate design in this study can result in well validated and substantiated finding on students' motivation. Furthermore, it also reduces the intrinsic a bias that might occur with single research method.

In Malaysia, there was research examining a pivotal GIS in geography education. However, these studies were not comprehensive. Among the aspects investigated, they included potential and resources that can be utilized to provide an attractive learning environment in geography class (Umah Devi, 2008; Habibah & Vasugiammai, 2010). Consequently, this study will add new value and input to the study on the implementation of GIS in geography education in Malaysia.

GIS and Achievement

The rapid development of ICT has provided new ideas for teachers to utilize various ICT tools to enhance students' achievement in geography. Several studies have also been carried out to examine the effectiveness of ICT tools on students' achievement (Shin, 2006; Marina, 2009; Miler & Roberston, 2010; Park & Kim, 2011). The findings of these studies demonstrated that the utilization of ICT enhances students' achievement in geography. The introduction of GIS in geography also provides alternative ICT tools to be used in teaching geography to enhance students' achievement. And researchers began to evaluate the effectiveness of GIS in geography education. Jenner (2006) has reported that GIS teaching tools help students to engage in the more difficult task and enhance their achievement. Similar findings were also reported by Wiegard (2007). However, little has been written about the effect of GIS with underachieving students in primary and secondary school. Consequently, Aladang (2010) proposed that further research could be focused on underachieving students.

In Malaysia, there are a number of studies which highlighted the positive impact of ICT on students' achievement in Geography (Habibah & Arumugam, 2005; Sidin & Mohammad, 2007; Othman, 2007). There is also growing interest of researches on the implementation of GIS in Malaysians geography classrooms. For example, study by Vasugiammai (2005) among Form 2 students on the topic of developing area in Kepala Batas, Malaysia demonstrated that students were excited and easily understood the concept of patterns and population distribution. Another study by Umah Dewi (2008) with Form 1 students demonstrated an improvement in the post-test scores in a topic dealing with mountain landscapes. Unfortunately, none of these studies focus on underachieving geography students, which are more being concerned by the Malaysian Ministry of Education to enhance their achievement in Sijil Pelajaran Malaysia (Malaysian Education Certificate). The review of the Malaysia research literature revealed that there is a lack of research on the impact of GIS-based learning of underachieving students in geography, especially in smart schools, none of which fully utilize ICT in teaching and learning activities. Therefore, this study needs to be carried out to fill this gap and strengthen the evidence regarding the importance of GIS in the study of geography in Malaysian secondary school.

A Conceptual Framework for Assessing the Impacts of GIS on Motivation and Achievement

Review of literature has shown that the use of ICT and GIS in teaching enhances students' engagement and motivation to learn geography (Keiper, 1996; Kerski, 2000; West, 2003; Milson & Earle, 2008). In addition, studies by Tuzun, Yilmaz Soylu, Karakus, Inal, and Kizilkaya (2009), Yazici and Dermirkaya (2010), Vos, Meijden, and Denessen (2011), and Santos, Perez Sanagstin, Hernandez Leo, and Blat (2011) revealed that motivation enhance students' achievement in geography. However, none of these studies focus on

underachieving geography students and are applied mix-method research in their studies. Thus, this study will be conducted to fill the studies gap on the impacts of GIS on students' motivation and achievement based on the conceptual framework which is illustrated in Figure 1.

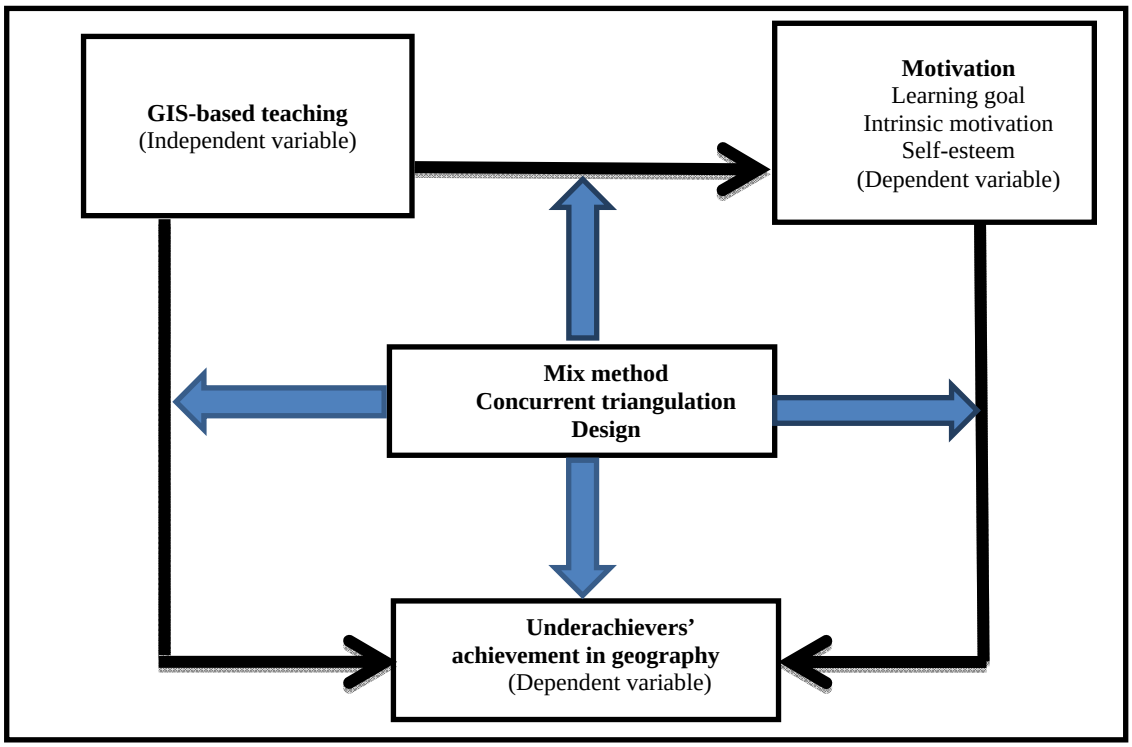

Figure 1. Conceptual framework.

Figure 1 shows that this study focuses on the impacts of GIS-based teaching on motivation and achievement among underachievers' geography students. GIS-based teaching is the independent variable and the motivation and achievement are dependent variable. Figure 1 also shows that this study centered on concurrent triangulation mix-method design to study the effects of GIS on students' motivation (learning goal, intrinsic motivation, and self-esteem), motivational effects on students' achievement and impact of GIS on students' achievement. Based on this design, the quantitative and qualitative data collection is concurrently happening in one phase of the research. The quantitative data will be collected through non-equivalent quasi-experimental design and 20 multiple-choice pre- and post- test questions while, qualitative data will be collected through observation and interview. The collected data will be analyzed separately and the findings will be compared and triangulated in an interpretation section.

Conclusion

The aim of this paper is to provide a comprehensive conceptual framework to assess the impact of GIS on motivation and achievement in geography among Malaysian underachieving students. The paper also acknowledged the reform of school geography curriculum and brief history of smart school system in Malaysia. Research has shown that GIS has positively influenced on students' motivation to study geography. In addition, there are a number of studies, which highlighted the positive impact of GIS on students' achievement. However, an extensive literature review found little research utilized the mix-method design to reveal the effectiveness of

GIS supported lesson on students' motivation and achievement. Furthermore, the review of the Malaysia research literature revealed that there is a lack of research on the impact of GIS-based learning of underachieving students in geography. Therefore, a conceptual framework based on the literature related to this study has been proposed. This study is currently in progress where quasi-experimental design, observation, and interviews will be used to support the validation of the framework. Further research should be conducted using this framework in different educational course to examine the result for proper validation.

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The Attitude of Lecturers Towards Visually Impaired Students: A Case Study of One of the Universities in the Limpopo Province in South Africa

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This article presents the attitude of lecturers towards the visually impaired students in one of the universities in the Limpopo Province. First, it is argued that the experience of a visual impairment by a student has a greater effect on the strategies and methodologies used for instruction than on the curricular content to which the student is exposed. Specialized instructional strategies facilitate the visually impaired students' successful participation within regular education classrooms. The degree of specialized intervention needed depends upon the intensity of the students' impairments. Despite the fact that the university has each year been registering students who are visually impaired, there is no indication that staff members are being trained to handle these students. Both qualitative and quantitative findings from interviews with visually impaired students, HODs (heads of departments), and deans/directors of centers suggest that lecturers found teaching visually impaired students is a problem, because they were never trained to teach visually impaired students and that the institution should employ a permanent specialist in teaching visually impaired students and create a resource centre for them. This paper examines some of the concerns that the visually impaired students encounter and raises questions about how they learn and how they are being taught.

Keywords: visually impaired, technological and special aids, infrastructures, specialized intervention

Introduction

The term visual impairment covers deficiencies ranging from partial sight to blindness. An individual who is virtually handicapped, her/his ability to see is affected, hindered, or completely lacking. This shortcoming has a serious implication for the learning event, personally development, and progress towards self-actualization. The partially sighted are those who can read bodies of large print and who need magnifying devices. A partial sighted person has sufficient functional visual efficiency in such measure that vision rather than touch or hearing can be utilized as a chief avenue of learning. These visually impaired students, more often than not need a lot of support in academic institutions. According to Taylor, Sternberg, and Richards (1995, p. 1), the cost of educating a student in South Africa is very high. Teaching exceptional students is a challenging, rewarding, and sometimes frustrating endeavor. Through research and continued teaching, we are constantly discovering more and more about the characteristics, capabilities, and educational needs of exceptional students (Taylor, Sternberg, & Richards, 1995, p. 1). In this case, although

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students who are visually impaired are enrolled, it is the responsibility of these students determined by their specific disability to make sure that they learn under conditions of normal students. The problem is that when this university was established, no great thought was given to the teaching of visually impaired students. The followings are some of the problems which are seen as impediments in the teaching of the visually impaired students in tertiary institutions.

Educational Consideration

Kirk, Gallagher, and Anastasiow (1993, p. 364) noted that vision is a continuous source of information. People without sight have to rely on their other senses for information and all the other tasks the vision performs for us. Hallahan and Kauffman (1991, p. 315) agreed that we should educate visually impaired students in the same general way as sighted children. The main difference is that visually impaired students will have to rely on other sensory modalities to acquire information. They go on to say that students with little or no sight would possibly require special modifications in four major areas: Braille, use of remaining sight, listening skills, and mobility training. The first three pertain directly to academic education, particularly reading and the last refers to skills needed for everyday living (Hallahan & Kauffman, 1991, p. 315). It is important to have lecturers who have acquired higher qualification on special education in order to help visually impaired students in general education classroom. Without experts in education modifications, the learning for visual students could be difficult.

Resources

A number of institutions in developed countries have flexible regulation systems. They allow their lecturers to provide notes to their students on computer disk for the blind and the partially sighted students and those whose lecturers are not word-processed may agree to make their notes available (Students Support Service, 2002, p. 1). The provision of resources has to do with the ever-changing world of technology. This obviously makes it very difficult for the disadvantaged institutions.

Technological and Special Aids

In recent years, a technological explosion has resulted in new electronic devices for the use of visually impaired individuals: (1) Optacon; (2) Kurzweil reading machine; (3) VersaBraille; (4) Cranner abacus; (5) Chisanbop; and (6) Synthetic (Hallahan & Kauffman, 1991, p. 328).

For this reason, lecturers who are trained in the use of these devices are needed.

Infrastructures

A number of institutions in developed countries, especially Scotland, have dedicated resource centers for visually impaired students where all or most of the equipment are housed (Students Support Services, 2002, p. 18). Unfortunately, this is not the case in disadvantaged institutions. These institutions cannot even afford some of the basic necessities for teaching the normal students. Consequently, in view of the problem faced by the visually impaired students at one of the historically black universities in the Limpopo Province, it was the aim of the this study to gain an understanding of how the visually impaired students are being educated and how staff members are coping to handle these students.

The Role of the University

A university function is mostly efficient, when the necessary human and material resources are available.

There is no point in setting up a university and then starving it of the necessary means of support (Matiru, Mwangi, & Schlettle, 1995, p. 22). But, there is a lack of awareness in the student population. Students have a right to know and understand how they can help visually impaired students if necessary. They should be campaigns, which would be able to highlight the needs of visually disabilities (Kirk, Gallagher, & Anastasiow, 1993, p. 376). Researches indicate that blind and partially sighted students reported that they could be tape lectures, but the lack of awareness by the lecturing staff of the need to make sure that all written material used during the lectures were clearly referred to by lecturers verbally. Many visually impaired students stressed the need to have access to the same equipment both on campus and at home in order to work effectively (Student Support Services, 2002, p. 3).

The Role of Lecturers, Students, and Other Professionals

The first year at any university is very difficult for everybody and particularly for the visually impaired students. According to Chauke (2002, p. 4), the college initially believes that special attention should be given to visually impaired students, due to their disability, however, the visually impaired students do not think they are treated differently. Visually impaired students proved their concerns wrong through their performance and contribution in class during lectures and discussions. They, however, need:

> (1) Qualified lecturers to teach them;
> (2) Meetings with lecturers and the department to ease their problems;
> (3) Lecturers to stimulate their interest and to awaken their motivation;
> (4) Sponsors to fund their instructional media;
> (5) Lecturers who are prepared for them and who will select the correct teaching strategies and instructional materials.
> (Gravestock, 2001, p. 1)

The Constitution of South Africa has abolished any form of discriminations. As result of this, anybody who qualifies to be admitted at a university should be admitted regardless of his/her physical condition, religion, gender or even background. Having said that, it means that the university should prepare itself fully to accommodate any students with special educational needs. Preparations must be both physical (buildings and materials) and human (staff must be trained to deal with these students). The study from which this paper emerged was therefore designed to find out:

(1) The problems facing the visually impaired students at one of the universities in the Limpopo Province;
(2) To investigate the strategies that can be used to solve some of these problems.

Research Design

This study used the quantitative and qualitative approach. Quantitative approach was also employed, because it gave a positive form of enquiry of research and search for facts (Mouton & Marais, 1994, p. 155). Qualitative approaches were used, because the procedures are not strictly formalized (Mouton & Marais, 1994, p. 156). Qualitative research was also employed, because it carries out the interpretive frame of the research and it gives us the production of meanings. The questionnaires were distributed amongst 20 lecturers at university and the interviews were conducted with 20 visually impaired students and also six HODs (heads of departments), deans, and directors of centers at the university were the respondents in this study.

Research Strategy

The case study was used as a strategy of collecting data, because we are concerned with investigating and interpreting certain attributes, characteristics, and behavior patterns of visually impaired students at a university. A certain university in the Limpopo Province has been investigated and few visually impaired respondents were also investigated (Behr, 1988, p. 110).

Research Instruments

An interview schedule was designed to qualitative data and this was done on a face-to-face situation (Behr, 1988, p. 150). Most case study interviews are of an open-ended nature, in which you can ask key respondents for the facts of a matter as well as for the respondent's opinions about events (Yin, 1994, p. 84). Semi-structured interview questionnaires for visually impaired students and HODs, deans, or director of centers, in order to get the in-depth of the information and the problems within them. The quantitative approach was also followed, because the close-ended questionnaire was also used to collect data from lecturers.

Findings

Findings indicate that the teaching of visually impaired students at one of the universities in the Limpopo Province is beset with a number of hurdles which have particular implications for the learning of the visually impaired students in tertiary education. Findings pertaining to this study are as follows.

Findings Pertaining to Lecturers

The following are findings pertaining to lecturers:

(1) Lecturers indicated that to teach visually impaired students is a problem, because they were never trained on how to teach the visually impaired students and that the visually impaired students should be provided with counseling and that their problems should be solved as quickly as possible;

(2) Lecturers were bound by the constitution, which does not allow them to chase the visually impaired students away, because they have the rights to learn and the university registers them;

(3) There is no special administrator who deals with the problems of the visually impaired students in respect of resources used by the visually impaired students, for the arrangement of tests and examinations and providing links with the library for the blind and counseling the visually impaired students academically;

(4) There is no special room for Braille for the visually impaired students;

(5) Lecturers have not been trained to teach the visually impaired students;

(6) Provision must be made to facilitate proper education before students are accepted into the university and that students should be under rigorous orientation before commencement of lectures and that lecturers should exercise patients when working with visually impaired students.

Findings Pertaining to Visually Impaired

The visually impaired students provided the data that brought the following findings:

(1) Most visually impaired students indicate that the university should employ the permanent lecturers who can deal with visually impaired students;

(2) Lecturers needed to be informed that they have visually impaired students;

(3) They also indicated that lecturers should visit other institutions, which deals with disabled students,

such as special schools, other historically white universities which have enough experience in dealing with visually impaired students;

(4) They complained about the non-availability of learning equipment in the university;

(5) There were no workshops for lecturers and students.

Findings Pertaining to HOD's, Deans, or Director of Centers

The findings pertaining to HODs, deans/directors of centers are indicated as follows:

(1) Research on this aspect is not enough and a lot still needs to be done;

(2) Specialists in the teaching of the visually impaired students have not been employed;

(3) Equipment for the visually impaired students is not enough;

(4) There is no budget specifically set aside for the visually impaired students;

(5) No study material in Braille is available in the library.

Conclusions

On the basis of this study, it was indicated that:

(1) Lecturers were never trained to teach the visually impaired students which they perceive as a burden in terms of teaching and others feel that it is not their responsibility as they were never trained to teach the visually impaired students in their training at the university;

(2) There are no specialist lecturers who can teach the visually impaired students and due to the lack of experience, most lecturers do not consider where the visually impaired students sit during lectures and very few consider the circumstances of the visually impaired students;

(3) The HODs, deans, or directors of centers do not have special budget for the visually impaired students and they do not think about the visually impaired students when they employ academic staff who will take into consideration the improvement of resources for both sides.

In view of the findings indicated above, the following recommendations are stemming from the research:

(1) Lecturers need to be trained in the teaching of the visually impaired students. This could be done by formal training in the teaching of the visually impaired students and also by in-service education;

(2) Specialist in the training of the visually impaired students needs to be employed, so that they can champion the teaching of the visually impaired students at the university;

(3) HODs, deans, and directors of centers need to be trained to create a special budget for the visually impaired students. This budget will ease the problems facing the visually impaired students. Equipment for the visually impaired students, lecturers/specialists in Braille, workshops and counseling for the visually impaired students can be provided for in this budget.

When lecturers see teaching the visually impaired students as a problem, the visually impaired students are in danger of hating education, and therefore, destroy their future. The fact that there is a shortage of equipment for the visually impaired students shows how the university has silently rejected the visually impaired students. It is not fair for the visually impaired students to negotiate everything, whilst other students are provided with what they need without negotiation. It is the wish of researcher that the concerns raised in this study will in future provide for better and effective methods of teaching the visually impaired students at the university.

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Physics and Everyday Life—New Modules to Motivate Students*

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The question "how to improve the interest of students to study physics" has been discussed in the author's previous papers too. Within the framework of the project, the author prepared various new interdisciplinary projects to demonstrate how inventions in physics are used in everyday life. Now, about one year later, the author found out that students were most addressed with the modules physics and crime scene investigation physics in the kitchen, as usually with non-traditional simple experiments. The aim of this paper is to introduce the modules and discuss possible reasons of this situation.

Keywords: physics, modules, interdisciplinary, motivation

Introduction

The framework educational programme for basic and high school education is based on a new education strategy, stressing the application of acquired knowledge and skills in practical life. It is important that the programme promotes the educational autonomy of schools as well as teachers' professional responsibility for the outcomes of the educational process. The programme offers a broader range of obligatory optional subjects for the development of pupils' interests and individual potential.

The educational area humans and nature includes a range of topics associated with the study of nature. It streams pupils to learn the tools and methods for a deeper understanding of natural phenomena and natural laws. It also gives them the necessary foundation for a better understanding and use of contemporary technology and helps them better orient themselves in everyday life. The aim is to help students to learn asking questions "how?", "why?", and "what will happen if?" and to seek to answer them, to explain observed phenomena, to seek out and solve cognitive or practical problems, and to use their knowledge of the laws of natural processes in order to predict or influence them.

Science educators have focused much energy on developing high-quality curricular materials that science educators will adept them. The adoption is problematic, the process is complicated and the majority of teachers is not able to use the advantages of new materials. Misunderstanding of basic phenomena leads to developing negative attitudes towards science.

The task of the research activities can be formulated: How can we change the course to promote students

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understanding and motivation in physics.

The questions are: how to change the course content, what instructional methods can be used, how to teach problem-solving, and how to create the relation to the outside world.

Strategy of our projects was based on the outcomes of the research of the Department of Didactic of Physics, Charles University Prague, project No. 2E06020 and findings of David Pritchard and Analia Baranttes (2009) and the works of Renata Holubova (2011a; 2011b).

Research Focus

It was found that there are some subjects in physics of low preference, on the other hand, some subjects are interesting for students. Low preference has subject molecular physics, waves, about molecules and atoms. On the top of interest are subjects, such as optics, astrophysics, sound, and energy. Students are interested in problems of how mobile phones works and why a steel boat can float and questions about the universe. Lack of interest were shown to information about eminent physicist living in the Czech Republic, how can be physical problems described with mathematic formulas?

It is very important that how the problem is presented by the teacher in the beginning of the lesson, motivating can be the formulation of an unexpected conclusion.

As documented earlier (Jeřábek & Holubová, 2011), solving numerical tasks is the most boring activity during physics lessons. On the other hand, what most motivating are experiments that students are doing by own and using computers and the Internet in physics lessons. It was also found out that the structure of physics lessons is still mostly the same—The main part in most lessons is the presentation of the teacher. About 70% of lessons contain revision, and about 50% of lessons of the first part of the lesson are followed by solving tasks. More common (about 50%) are now demonstrations of the teacher and about one third of lessons contain experiments performed by students. Video and the Internet are used rarely.

The aim of this research was to prepare new modules for teaching and learning physics with the focus on problems related to common life, modern technology and findings, and the own activity of students.

The list of these modules is presented as follows:

(1) Hands on experiments;

(2) Nanotechnology;

(3) Electronics;

(4) Physics experiments with dataloggers;

(5) Physics and forensic;

(6) Physics in the kitchen.

All these modules were offered to secondary and high schools in Moravia. School classes had the opportunity to come and learn the theory and do some experiments in laboratories at the Department of Experimental Physics or teachers of the department were prepared to visit schools and present the modules directly in the classroom.

From all these modules, the author mostly presented physics in the kitchen, physics and forensic, and hands-on experiments. In the next part of the paper, the first two modules will be shortly described.

Physics in the Kitchen

The module has two parts. In the first one, some information about devices in the kitchen is given—How the fridge, the microwave own, and the inductive cooker work. Some facts from the history are mentioned too.

The second part consists of experiments. As most interesting experiments were found: the CD in the microwave, a water balloon, or soap in the microwave. What found useful is the possibility to measure the speed of light in the microwave and show some properties of standing waves (See Figure 1).

Figure 1. Physics in the kitchen—experiments.

Physics and Crime Scene Investigation

Forensic science includes many areas of study, such as criminalistics, engineering science, and pathology and biology. The most reliable application of physics is when biomechanical analysis is used to explain injury mechanism, such as how an injury may have occurred. It is very important that the application of the free fall mechanics which originates as a result of mechanical interaction of the system “human and surrounding”. Another topic, very interesting for students, is dactyloscopy. In this topic, various experiments can be done. Students can use the dactylographic suitcase and investigate the crime scene. Students learn the fingerprint patterns—arches, loops, whorls, and compounds. The students learn factors that affect the quality of latent prints (amount of fat and water, temperature, humidity, and exposure to sun) (See Figure 2).

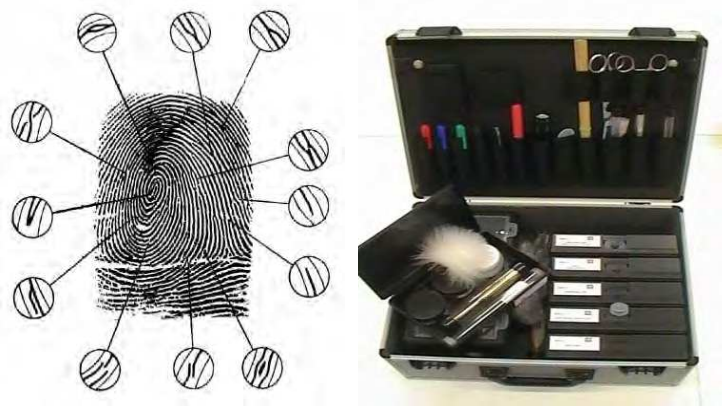

Figure 2. Fingerprint and fingerprinting suitcase.

One topic among the forensic scene investigation in schools is leading in curiosity—the forensic entomology. The forensic entomologist estimates the postmortem interval based on the age of the insect present. This entomological-based estimation is most commonly called the “Time Since Colonization”. The forensic entomologist can use a number of different techniques, including species succession, larval weight, larval length, and a more technical method known as the accumulated degree hour technique which can be very precise if the necessary data are available. The insects recovered from decomposing human remains can be a valuable tool for toxicological analysis. Toxicological analysis can be successful on insect larvae because their

tissues assimilate drugs and toxins that accumulated in human tissue prior to death. This topic demonstrates interdisciplinary relations—physics, biology, chemistry, and geography.

Methodology of Research

The outcome of this research was based on PER (physics education research), known as a field of research focused on understanding how students think about physics and how to teach physics more effectively. Over the last few decades, researchers in PER have made enormous advances in understanding how students learn physics most effectively and in developing teaching methods that apply this understanding to achieve improved student learning. That to find the answer of the research question “why the modules mentioned above” was chosen most often. This problem could be studied by using different research methods.

To get research data, the method of an interview was chosen. An interview is one of the methods of collecting data. The main characteristic of this method is that a researcher is asking questions of one person, or a group of participants. Because of the number of students, the author used a semi-structured interview. The questions were focused on topics of interest of the subject, difficulty to understand the problem (unknown terminology), interdisciplinary relations, relation to everyday life, and gender.

The interviews were recorded through the use of handwritten notes. Secondary school students (15 pupils), high school students (21 pupils), and nine teachers were interviewed. The students were representatives of their classes that took part in the presented modules.

Results of Research

From all new modules, most interesting and amusing for students are hands-on experiments (see Figure 3). That module was realized at the author’s department and repeatedly at schools—The author was invited not only to secondary schools but also to high schools. The most important characterization of that module, as mentioned in interview, was the own activity of students—All experiments they did by their own. The other two modules that students found as interesting and motivating were physics in the kitchen and physics and forensic science. The most important aspect was the relation to everyday life and curiosity. From the teachers’ point of view, most interesting was the module nanotechnology. The module offers a lot of information that cannot be found in textbooks. The other interesting module was physics and forensic science. Only one high school used the module electronics.

Figure 3. Hands-on experiments.

Conclusion

Main outcomes of the research can be summarized as follow. Students' preference is the relation of physics to everyday life, when the relevance and utility of physics to their lives and careers were demonstrated. They will not study new topics but they will see how the knowledge in physics can be used in real world. In all steps of education, it is important to show the application of physics in everyday life, how staff works.

Most interesting and most important are achievements of skills useful for life—That is why hands-on experiments are so popular.

What can be done by the educational change—The curriculum, teachers, and the structure must be changed. The amount of new material presented during physics lessons is far more than a typical student can learn and understand. In lessons, there is not enough time for application, experiments, and discussion. It is necessary to teach interesting—This is one of the reasons, because modules presented by instructors of the Department of Experimental Physics were more interesting for students then when the topic was presented by their own teacher. It is important to understand that students are not interested in various topics, because at the actual age, they are not important for them. Students do not like mathematisation of problems—In the modules mentioned above, there was no mathematics (only the formulas for speed of light and the free fall of a point of mass). When the modules contain a lot of demonstrations and experiments, the relation to common life is taught, then students are interested in the topic. According to this research so as to PER, the best way to teach physics is through "interactive engagement" methods, hands-on activities with application to everyday life, and the opportunity to discussion with other students and teachers.

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A Supervisor's Roles for Successful Thesis and Dissertation

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The success of a thesis or a dissertation for a graduate student relies upon the roles of their supervisor. The student not only needs to be equipped with the knowledge, but also be able to manage others and external factors at the same time. The journey during the period of conducting research is mixed with various tasks. Five supportive roles of a supervisor involving the supervision system are specific technical support, broader intellectual support, administrative support, management, and personal support brings about the output of the study. A supervisor's roles for successful thesis and dissertation is reported by using the survey on graduate students in the universities in Thailand probing for the current practices of supervisor and the expectation of student towards the supervisor's roles. The reflection from the students' perspective can help develop relationship between supervisor and student for undertaking a successful thesis and dissertation.

Keywords: supervisor's roles, thesis and dissertation, graduate study

Introduction

The world in the 21st century is so demanding. There is greater struggle among people to be more qualified, knowledgeable, changeable, and adaptable to the situations. The competitiveness among the group of people, individuals, and organizations is taking place in order to make themselves and their organization survive and to be successful in their goal. As the world is changing rapidly everyday, it leads to the adjustment in social system, value, attitude, and economy. Some good things in the past of last century never exist anymore. With the change in social system, people tend to have less face-to-face interactions. At the same time, a new form of social network of interaction between people is taking place, this online interaction is rapidly increasing worldwide. The youth in the 21st century are called as digital citizens who reflect the sense of development, while the human value, morale, and relationship are shifting down. The 21st century skills require the next generation learner to decorate themselves with such learning and innovation skills as creativity and innovative, critical thinking and problem-solving, and communication and collaboration (Kay, 2010). The outstanding ability of a learner who is competent in the 21st century skills will keep themselves abreast of updated on learning and adjusting to change. With the 21st century skills, people are classified to get high wage, high skill, and to be able to move up on the economic ladder.

Thus, it is essential to be a learner in the 21st century as all business settings and all fields of works in this competitive era demand qualify staff. The need in studying for further degree in the field related to their work is increasingly demonstrated. The goal of studying in graduate level is not only for the degree or certificate, but also for creating new knowledge in the field of their interests. Most of graduate students enter the program with certain notions due to experiences gained along the way of their careers while some want to fulfill their needs

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with the very high ambitious goal but yet very abstract ideas.

Factors to Success in Thesis and Dissertation and the Roles of a Supervisor

To achieve the master degree and doctoral degree, a graduate student must complete his/her own research called "thesis for master degree" and "dissertation for doctoral degree" depending upon the rules and regulations of an institute. After the student has completed his/her coursework, there will be time for conducting a research project. The student is assigned to work with a supervisor in order to undertake a research with quality process for the best possible output as an excellent thesis or dissertation. The expectation of having a smooth running period and ending up the project with the best output is not as easy as one thinks. Like a marriage, the feelings of happiness, sadness, sorrow, and some other feelings occur. Remember to set up your goal only to graduate, there is nothing to stop you. In dealing with the supervisor, graduate students of master degree and doctoral degree programs must concern some factors enabling successful thesis and dissertation. The factors can be reviewed in very broad ideas as the followings (Rugg & Petre, 2007):

> Factor 1: Management: As with marriage, both student and supervisor have to make an agreement to work together. The time of management on meeting, deadlines, and goals has to be set as a master plan. It is the responsibility of both the student and the supervisor to work on it and trust each other;
>
> Factor 2: Administrative support: A student also needs help for acquiring funds and other resources. Sometimes, many regulations and some administrative difficulty within the school or university may be an obstacle of the research progress. Then, the supervisor should be the one who provides support and helps the student to overcome that problem;
>
> Factor 3: Specific technical support: The skill that needs to be trained for example—skill in using the specific software, searching the relevant literature, using the library, providing contacts with the researcher in the field, structuring the thesis and dissertation, and training in critical reading—all of these skills should be assisted by the supervisor;
>
> Factor 4: Broadening intellectual support: It is very important to help student to have an ability to develop his/her critical thinking and discussion by providing or guiding to the high-level knowledge and the specialist in the field of study. These skills could help student while presenting and defending the thesis and dissertation;
>
> Factor 5: Most of all such personal support as emotional support, motivation, encouragement, giving advice, listening to the personal issues can improve the work and relationship. Student and supervisor are working under trust, love and care that will create magnificent masterpiece.

These five factors can also be reviewed as the roles of a supervisor (Rugg & Petre, 2007; Wisker, 2008, 2005). The roles of a supervisor are professional roles. The supervisor concurrently may act in many roles as a coach, teacher, friend, colleague, trainer, good role model, and guide. Coaching the skills builds trust and understanding between the student and the supervisor (Robertson, 2009). The specific skills of a student should be trained by the supervisor and the specialist. Beside coaching and training, the supervisor also acts as a good role model who listens and guides the student to achieve the goal. The master plan for conducting research can be illustrated as a cycle of research (Wisker, 2008) as the stages of ideas−plan−activities−assess and evaluate−ideas−re-plan−activities−assess and evaluate. The cycle that moves on each stage is accumulated with experiences of previous stages of cycle as confirming and reflecting for the new knowledge. A study on the students' persistence in a distributed doctoral program in educational leadership in higher education (Ivankova & Stick, 2007) mentioned that the feedback from an academic advisor is beneficial and helpful for a student to succeed in his/her thesis and dissertation. Furthermore, a good supervisor requires the leadership skills: a mixture of three-skill approach (Northouse, 2010)—technical skill, human skill, and conceptual skill—to help a student in producing the best outcome.

Current Practices and Expectations

The survey reflected the current practices of the supervisor and the expectations of the student towards the roles of supervisor. The survey questions were asked to find the practices of supervisor and the expectations of student towards supervisor's practice. Thus, the 25 questions were created by using the five factors of supervisor's roles. Then, the quantitative data were evaluated from a five-point rating scale, which resulted with a mean score higher than 4.00 which means the supervisor mostly often does and the student mostly often expects the supervisor to do. The first set of the results show the current practices of supervisor that often does only three items as show in Table 1.

Table 1

Current Practices of Supervisor

	Role of supervisor	Mean
1	Guide on structuring the thesis and dissertation	4.30
2	Make student feel more confident when working with the supervisor	4.11
3	Agree to have the goal together	4.07

Meanwhile, the second set of the results, the quantitative data were evaluated from five-point rating scale, presented the mean score higher than 4.00 which means the student mostly often expects the supervisor to do. The results show the expectations from student toward the supervisor's roles, 15 demands express as show in Table 2.

Table 2

Expectations of Student toward Supervisor's Roles

	Role of supervisor	Mean
1	Make student feel more confident when working with the supervisor	4.59
2	Guide on structuring the thesis and dissertation	4.52
3	Agree to have the goal together	4.48
4	Listen to student problem	4.41
5	Enforce and help student to overcome the obstacles	4.41
6	Guide student to gain high level of knowledge	4.37
7	Give student an emotional support	4.30
8	Set up the plan/manage time with students' agreement	4.30
9	Guide to read related documents and researches	4.30
10	Provide the experts and researcher related to the field of study	4.26
11	Meeting schedule and contract set up based on students' agreement	4.26
12	Train student to present and defend	4.26
13	Aware of deadlines	4.19
14	Guide/direct student for the research publication	4.19
15	Train student how to think critically	4.15

As for the results, the first three items from both current practices and the expectations seem to be the same items. So, students need a leader who keeps them on track and makes them feel confident. The supervisor's roles are critical, the success of the student depends on supervisor's ability to tell the student the truth and respond to what needs to be done. The supervisor should know the strengths and weaknesses of the student. At the same time, the supervisor should know how to provide relevant documents, experts, advice, and emotional support, and allow the student to learn self-motivation to reach all of their goals.

Conclusion

As the foundation of an original idea of academic advising, it can be applied to the roles of supervisor, the vital idea concerned for student "personal" development. Thus, the concentration for academic advising is designed to facilitate "total" development for each student (Winston, Miller, Ender, Grites, & Associates, 1984). Meanwhile, the goal of being a good supervisor is aimed to help student as advisee to complete in the thesis and dissertation. Thus, the supervisor's roles take effect not only the successful of student thesis and dissertation, but also the whole development of the life of student.

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Web-Browsing Competencies of Pre-service Adult Facilitators: Implications for Curriculum Transformation and Distance Learning

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The study investigated the Web-browsing competencies of pre-service adult facilitators in the southeast geopolitical zone of Nigeria. Survey design was adopted for the study. The population consists of all pre-service adult facilitators in all the federal universities in the southeast geopolitical zone of Nigeria. Accidental sampling technique was used in selecting 234 pre-service adult facilitators. The instrument for data collection was a four-point scale questionnaire titled "WEBCQ" (Web-browsing Competencies Questionnaire). WEBCQ consists of 43 Web-browsing competencies. The reliability coefficient of the instrument was established by using Crombach Alpha which came up to 0.78. Two research questions and one null hypothesis guided the study. Mean and standard deviation were used to answer the research questions, while *t*-test statistics was used to analyze the null hypothesis. The findings of the study showed that the pre-service adult facilitators have Web-browsing competencies to an average level and that male adult facilitators have significantly higher competencies than their female counterparts. Based on the findings, some recommendations were made which include that the country just like most developed nations should embrace the innovative distance learning in the form of online learning, e-learning, virtual classroom, and online counseling knowing that most of the current pre-service facilitators have average Web-browsing competence.

Keywords: Web-browsing, pre-service adult facilitators, distance learning, counseling, curriculum transformation

Introduction

A fundamental issue all over the world today is education for all. The concept of education for all, according to Tahir (2005), is a direct political response to pressures emanating from the public, human rights organizations, and international organizations that realize the symbiotic relationship between education and good governance as well as the respect for human rights and dignity. Among the various interest groups that have continued to advocate for and support the universalization of access to education is the NNCAE (Nigerian National Council for Adult Education). Adult education was defined by UNESCO (United Nations Educational, Scientific, and Cultural Organization) in Nzeneri (2008, p. 9) as:

> The entire body of organized educational process, whatever the content, level, and method, whether formal or

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> otherwise, whether they prolong or replace initial education in schools, colleges and universities as well as in apprenticeship, whereby persons regarded as adults by the society to which they belong, develop their abilities, enrich their knowledge, improve their technical or professional qualifications or turn them in a new direction and bring changes in their attitudes or behavior in the twofold perspective of full personal development and participation in balanced and independent social, economic and cultural development.

Adult education activities cut across programmes like adult literacy, extra-mural studies, continuing education, distance education, vocational education, extension education, and community education among others. In the vocational education aspect of adult education, there is need for vocational and personal/social information aspects of counseling services to enable the adult students to cope with both the course content and learning situation after many years outside school and learning environment. Counseling, according to Makinde (1988) in Onwuasoanya (2008), is a service designed to help an individual analyze himself/herself by relating his/her capabilities, achievement, interest, and mode of adjustment to new decisions that he/she has made or has to make including engaging in adult education, ways of succeeding in the programme, and possible and available career opportunities. It is a learning process designed to increase adaptive behaviors and decrease maladaptive ones. In effect, it brings out those qualities in individuals that conform to the norms of society, while discovering the anti-social tendencies in them (Austine & George, as cited in Onuigbo, 2005). Counseling also aims at empowering students to learn efficiently and independently, develop certain abilities to reason besides building a positive academic self-concept, and give the students the opportunity to internalize appropriate learning strategies that will enhance their success. This service which is a vital aspect of education can be rendered by professional and para-counselors which include pre-service adult facilitators. For effectiveness and success, they need browsing competencies to be able to source for and disseminate information to their students to enable them to cope with learning. The need to educate the adult members of the society cannot be over-emphasized, because when they acquire basic education, it elevates the socio-political situation of the nation. Those who provide adult education are described as adult educators or facilitators. The driving force to the innovative adult education programme today is distance learning. Several studies in distance education have found that teacher quality was the most influential factor in predicting the success of students in an online course (Rice, 2006). Takur (2005) asserted that one of the strategies of meeting the needs of the distant learners is to assist the learners to become familiar and comfortable with the delivery technology and to prepare them to resolve technical problems. To this end, pre-service adult educators or facilitators ought to be technology compliant. Technology is one of the most essential foundational areas of curriculum planning in the 21st century (Wiles & Bondi, 2011). Hence, the curriculum and even the society at large are being transformed by computers and other aspects of ICT (Information and Communication Technology) like the Web among others.

ICT and Web-Browsing Competencies

ICT is increasingly becoming important in education and in adult education as well. Researches into the integration and use of ICT in education have provided substantial and convincing evidence of its positive impact in teaching and learning (Cox, Abbott, Webb, Blakely, Beauchamp, & Rhodes, 2003). Similarly, researches have shown that both in-service and pre-service teachers are in favor of using ICT in and out of class activities (Gulbahar, 2010). Researchers have also shown that pre-service teachers in developing countries are gradually acquiring ICT competencies (Ofoegbu & Asogwa, 2011).

Gender differences in ICT competencies have equally been widely reported. Olalere (2005) stated that computers are usually linked with mathematics and thus the vast majority of computer teachers are males. In contrast, Ezeugbor (2008) reported no significant difference in the ICT competencies of male and female lecturers. Similarly, Ude (2010) reported that there is no significant difference in the ICT competencies of pre-service teachers of University of Nigeria by gender.

The use of ICT in teaching and learning is an already accepted innovation in many developed and developing nations. In the higher education arena, there are shifts in the views of what education is for, with a growing emphasis on the need not only to enable and support the acquisition of knowledge and information, but also to develop the skills and resources necessary to meet up with social and technological changes, and to continue learning throughout life (Sheard & Carbone 2008). The move includes student-centered approaches and virtual classroom. There is, however, the need to develop strategies for maximum utilization of this innovation.

One of the most important aspects of ICT that is actually driving education is the Web otherwise known as the WWW (World Wide Web) which is a computer-based network of information resources that combines text and multimedia. The information on the WWW can be accessed and searched through the Internet, a global computer network. For effective participation in the current innovative open and distant learning programmes, facilitators should possess Web-browsing competence, because the Web is the core of the technologies of open and distant learning. These competencies ought to be acquired in the process of university education and they include eight major levels, namely:

Level 1: Understanding the Concept of WWW/Internet and Also the Benefits

The student should understand that when computers are connected together they form a network and that the Internet is a global network of computers; the WWW also consists of hyper-text documents linked together and can be accessed using a browser.

The student should be aware of the benefits available through the use of the WWW, such as:

(1) Instant availability of all kinds of information from all over the world;

(2) Information available from educational institutions from all over the world, including course materials;

(3) Access to other specialized Websites for news and entertainment among others.

The student should be aware not only that information can be shared over the Web, but also that the browser is a tool that can be used to access and navigate through the Web and the URL (Uniform Resource Locator) is an address to navigate the Web.

The student should know that a URL is a unique identifier required to identify and access different Websites and also be familiar with the format of a URL, and they should be able to open the browser and do quick launch, use the desktop icon and start menu.

Level 2: The Student Can Access a Location on the Internet by Typing Its URL and Can Navigate Using the Browser's Basic Functionality

The student can type a given URL in the address bar and access the site:

(1) The student can navigate the Web using the browser buttons ("Back", "Forward", and "Reload" among others);

(2) The student should be able to identify and understand the status bar, open a new window or a new tab and enter another URL in it.

The student should understand the concept of a homepage:

(1) The student should understand that the browser may or may not be set to a default page known as the homepage;

(2) The student should understand that the homepage may be changed if required and also be able to change the homepage.

Level 3: The Student Should Be Aware That Data of Different Types Are Available on the Internet and Should Be Able to Identify and Use the Components of a Webpage

(1) Web menus: The student should be able to navigate through a Website using its menu, understand the concept of home for the Website, using its own links ("Back", "Forward", and "Back to top"), and also using the "Back", "Forward", and "Reload" buttons of the browser;

(2) Images: The student should be able to recognize images as part of a Webpage, and should identify which images are actually links and are therefore clickable, and will take them to a new page;

(3) Banners: The student should recognize banners and should know that they are clickable;

(4) Links: The student should know that links point to a new URL and clicking on a link will take them to a new page. The student should also be familiar with the two ways of opening new links (in a new window or in a new tab) and also know that some links can also point to other types of files that may be downloaded;

(5) Pop-ups: The student should be able to recognize useless popups, understand that some parts of the popup may be clickable and also be able to close them;

(6) Buttons: The students should be able to recognize and click buttons where required;

(7) Text-boxes: The students should be able to enter text in text-boxes;

(8) Drop down lists: Students should be able to select items from drop down lists;

(9) Combo boxes: Students should be able to select items from combo boxes;

(10) Video: Students should be able to play video content on the Web;

(11) Audio: Students should be able to play audio content on the Web;

(12) Animation: Students should recognize animation.

Level 4: The Student Should Be Aware of Search Engines and Should Be Able to Use at Least One (e.g., Google) Effectively

(1) Students should be aware of common search engine URLS, such as http://www.google.com and http://www.yahoo.com;

(2) Students can use appropriate keywords and get search results;

(3) Students can navigate results to access desired information;

(4) Students should recognize the list of search results obtained (may be on multiple pages);

(5) Student should be able to access any of the Webpages included in the search results, and navigate through the results;

(6) Can do advanced search using Google;

(7) They should understand the benefit of advanced search (i.e., know that the search can be narrowed down and targeted information can be obtained).

Level 5: The Student Can Reasonably Judge the Reliability of Different Websites and Be Able to Save and Print Data

Can differentiate the quality of content and the reliability of the retrieved information;

(1) Students should be able to identify personal Webpages and academic Websites;

(2) Students should be able to identify well-known news and information Websites (CNN (Cable News Network) and BBC (British Broadcasting Corporation));

(3) Students should be familiar with reliable and well-known Web services, e.g., Yahoo and Google;

(4) Students should be able to identify freely-hosted Websites by looking at the quality and number of advertisements and should then be careful in using information obtained from such Websites;

(5) Students should be somewhat familiar with domain names and know that reliable and established companies usually have their own domain names.

Level 6: The Student Is Able to Use and Manage the Information

(1) Can save data;

(2) Can save Webpages and images from Webpages (being aware that they may have copyrights and cannot be re-used);

(3) Can save documents, video and audio files from the Web;

(4) Can print information from the Web;

(5) Can print Webpages.

Level 7: Students Can Manage Frequently Visited Websites Using Bookmarks, Adjust Simple Browser Settings and Do Minor Troubleshooting (His/her Favorite Websites and Be Aware of Dangers)

(1) Ability to bookmark pages and also be able to categorize and manage bookmarked pages using bookmark manager;

(2) Can understand and change browser settings;

(3) Set and change homepage;

(4) Change appearance as desired;

(5) Locate and delete temporary files, cookies and history;

(6) Troubleshoot minor problems (identify and fix);

(7) Identify if connection to the Internet is disrupted and then re-connect, check if the network cable is connected and if the Internet account is functional;

(8) Identify if the typed URL is correct and fix it if there is a common problem like a space in the URL;

(9) Identify if a popup blocker is working and stop it or activate it as desired.

Level 8: The Student Should Be Aware of the Dangers of Web-browsing, and Should Be Aware of the Concept of Plagiarism and Copyrights

Dangers:

(1) Students should be able to identify and avoid dangerous Websites (virus);

(2) Students should be using the browser popup blocker;

(3) Students should be selective about subscription and giving out their email addresses and other personal information;

(4) Students should be aware of the presence of pornographic Websites and should take appropriate measures, so that they do not inadvertently access them;

(5) Should be aware that many downloads available (especially music) are illegal, may be virus-infected and should be avoided.

Ethics:

(1) Students should be aware of plagiarism and proper referencing procedures;

(2) Students should be aware of copyrighted and licensed materials and should be aware of how it should be used.

The Purpose of the Study

The purpose of the study was to identify the Web-browsing competencies of adult education pre-service facilitators. Specifically, the study:

(1) Determined the Web-browsing competencies of adult education pre-service facilitators in the federal universities in the southeast geopolitical zone of Nigeria;

(2) Determined the Web-browsing competencies of male and female pre-service adult facilitators in the federal universities in the southeast geopolitical zone of Nigeria.

Research Questions

The research questions are as follows:

(1) What are the Web-browsing competencies of adult education pre-service facilitators?

(2) What are the Web-browsing competencies of male and female pre-service facilitators in the federal universities in the southeast geopolitical zone of Nigeria?

Hypothesis

Hypothesis: There is no significant difference in the Web-browsing competencies of male and female adult education pre-service facilitators in the federal universities in the southeast geopolitical zone of Nigeria.

Methodology

The study is a survey of the Web-browsing competencies of final year adult education pre-service facilitators in the federal universities in the southeast geopolitical zone of Nigeria. The population consists of all final year pre-service adult facilitators in all the federal universities in the southeast geopolitical zone of Nigeria. Accidental random sampling technique was used to sample 234 final year pre-service adult facilitators. The sample consists of 39 males and 195 females. The instrument for the study named WBCQ (Web-browsing Competency Questionnaire) is a 43-item questionnaire developed by the researchers based on literature reviewed. The items were weighted on a four-point rating scale of “Excellently well” (EW—4 points), “Very well” (VW—3 points), “Moderately well” (MW—2 points), and “Not applied” (NA—1 point). WBCQ was face validated by three experts in educational technology, adult education, and measurement and evaluation. The reliability index of the instrument was determined by using Crombach Alpha which was 0.78. Copies of the instrument were distributed to the respondents by the researchers and retrieved immediately on completion. Mean scores were used to answer the research questions and were calculated item by item. The interpretations of the means were based on the limit of real numbers: 3.50−4.00 (Excellently well), 2.50−3.49 (Very well), 1.50−2.49 (Moderately well), and 0.50−1.49 (Not applied). *T*-test statistic was used to analyze the null hypothesis at the significance level of 0.05.

Results

Research Question 1: What Are the Web-Browsing Competencies of Pre-service Adult Facilitators

Results in Table 1 show that the pre-service adult facilitators can carry out the entire Web-browsing

activities to some extent. They can perform items 5, 8, 9, 10, 11, 24, and 28 “Very well” and can perform the rest of the activities “Moderately well”. However, they cannot carry out any of the activities “Excellently well”. Again, there is none of the activities that they cannot carry out at all. Furthermore, the *SD* (standard deviation) of all the items is below 2.00.

Table 1

Mean and Standard Deviation of the Web-Browsing Competencies of Pre-service Adult Facilitators

S/N	Web-browsing competencies	*N*	Mean	*SD*	Decision
1	I can download files	234	2.29	1.01	MW
2	I can upload files	234	2.79	1.08	VW
3	I can type a given URL in the address bar and access the site	234	2.90	1.08	MW
4	I can navigate the Web using the browser buttons (Back, Forward, Reload, etc.).	234	2.99	0.97	VW
5	I can open a new window or a new tab and enter another URL in it	234	3.00	0.97	VW
6	I can change the homepage	234	2.85	1.11	VW
7	I can identify text on the Web	234	2.94	1.01	VW
8	I can identify images on the Web	234	3.46	0.81	VW
9	I can identify video on the Web	234	3.10	0.97	VW
10	I can identify sound on the Web	234	3.13	0.90	VW
11	I can scroll through a page and make use of Web menus	234	3.32	0.84	VW
12	I can scroll through a page and make use of Images	234	2.77	1.00	VW
13	I can scroll through a page and make use of Banners	234	2.38	1.01	MW
14	I can scroll through a page and make use of Link	234	2.50	1.09	VW
15	I can scroll through a page and make use of Popups	234	2.41	1.14	MW
16	I can scroll through a page and make use of Buttons	234	2.82	0.95	VW
17	I can scroll through a page and make use of Text boxes	234	2.77	1.01	VW
18	I can scroll through a page and make use of Drop down list	234	2.28	1.06	VW
19	I can scroll through a page and make use of Combo boxes	234	2.17	1.09	MW
20	I can scroll through a page and make use of Video	234	2.58	1.09	VW
21	I can scroll through a page and make use of Audio	234	2.63	0.94	VW
22	I can scroll through a page and make use of Animation	234	2.59	1.02	VW
23	I can use common search engine URLS	234	2.92	1.05	VW
24	I can use appropriate keywords and get search results	234	3.10	0.94	VW
25	I can navigate results to access desired information	234	2.86	1.02	VW
26	I can recognize the list of search results obtained (may be on multiple pages)	234	2.97	0.99	VW
27	I can access any of the Webpages included in the search results, and navigate through the results	234	2.64	1.15	VW
28	I can do advanced search using Google	234	3.12	1.04	VW
29	I can identify academic Websites	234	2.92	1.03	VW
30	I can identify well-known news and information Websites (CNN, BBC)	234	2.87	1.13	VW
31	I can identify freely-hosted Websites by looking at the quality and number of advertisements and should then be careful in using information obtained from such Websites	234	2.51	1.01	VW
32	I am familiar with domain names and know that reliable and established companies usually have their own domain names	234	2.47	1.07	MW
33	I can save Web data	234	2.83	1.09	VW
34	I can print Webpages	234	2.74	1.11	VW
35	I can bookmark pages	234	2.60	1.19	VW
36	I can manage bookmarked pages using bookmark manager	234	2.41	1.14	MW
37	I can set and change homepage	234	2.64	1.16	VW
38	I can locate and delete temporary files, cookies and history	234	2.79	1.01	VW
39	I can identify if connection to the Internet is disrupted	234	2.82	1.13	VW
40	I can re-connect the Network cable	234	2.56	1.14	VW
41	I can identify if the typed URL is correct and fix it if there is a common problem like a space in the URL	234	2.53	1.20	VW
42	I can identify if a popup blocker is working and stop it or activate it as desired	234	2.28	1.12	MW
43	I am aware of plagiarism and can carry out proper referencing procedures	234	2.55	1.13	VW

Research Question 2: What Are the Web-Browsing Competencies of Male and Female Pre-service Facilitators in the Federal Universities in the Southeast Geopolitical Zone of Nigeria?

Table 2 shows that male adult education facilitators with a mean score of 136.62 and *SD* of 11.78 have higher Web-browsing competency than female adult facilitators with a mean of 114.91 and *SD* of 27.11. The lower *SD* of males indicated that males are closer to the mean while the higher *SD* of the females indicated that they are far from the mean. The maximum score among the respondents was 167 while the minimum score was 43 and the total mean is 118.53.

Table 2

Mean Difference of the Web-Browsing Competencies of Male and Female Pre-service Adult Facilitators

Sex	*N*	Mean	*SD*
Male	39	136.62	11.78
Female	195	114.91	27.11

Hypothesis: There Is No Significant Difference in the Web-Browsing Competencies of Male and Female Adult Education Pre-service Facilitators

The hypothesis was tested using an independent *t*-test analysis of sex influence on pre-service facilitators' Web-browsing competencies as shown in Table 3. The analysis resulted in a calculated *t*-value of 4.90, $p < 0.05$ and degree of freedom = 232; sig. (2-tailed) = 0.000 with males having higher mean score than females. Based on this, the null hypothesis is rejected, hence, there is significant difference in the male and female pre-service adult education facilitators' Web-browsing competencies. Therefore, males are significantly more competent in Web-browsing than females.

Table 3

Independent Sample T-test Analysis of Sex Influence on Web-Browsing Competencies

Sex	*N*	Mean	*SD*	*t*	*df*	Sig. (2-tailed)
Male	39	136.62	11.78	4.90	232	0.000
Female	195	114.91	27.15			

Discussion

The study showed that the pre-service adult facilitators possess more than average Web-browsing competency. This is because they can carry out most of the Web activities "Very well". However, the result indicated that they cannot carry any of them "Excellently well". This is in line with the findings of Ofoegbu and Ude (2011) that the ICT competencies of pre-service teachers are to an average extent. This is also in support of the view of Rice (2006) that teacher quality is the most influential factor in predicting the success of students in an online course. Since the pre-service adult education facilitators have average Web-browsing competency, they may be influential in predicting the success of students in online course. Furthermore, the study showed that male pre-service adult facilitators have significantly higher Web-browsing competences than females. This finding may be attributed to Olalere's (2005) report that computers are usually linked with mathematics and the vast majority of computer teachers are males. It may, therefore, be deduced that the males who are more mathematically inclined should have higher Web-browsing competencies than their female counterparts.

Implications

The implications of the findings are that the adult facilitators are relatively ready to embrace innovative distance learning, vocational and personal/social counseling for adult education which is the situation in most developed countries. This is very important in a developing country like Nigeria where substantial number of adults is illiterates and need education and vocational and personal/social counseling based on their social, economic, political, and cultural stand to enable them to adjust fully to change and challenges in their lives and society. It is in adult education and guidance and counseling that the greatest emphasis is placed on life-long education as a process and agent of liberation, a tool for adjustment, for self and national development, for cultural awareness and integration, for conscientization or animation, and for group dynamism.

Conclusion

Web-browsing is an important competence for curriculum development and transformation in the 21st century. Much has happened, since the Internet became available to most people. This is because the delivery of information into schools, offices, and homes has become complex. The move is greater for transforming the curriculum towards distance education for the benefit of adult learners. Although access to distance technology has grown vigorously in most developed countries, Nigeria is gradually keying in. The indication is evident with the result of the study which showed that pre-service adult facilitators possess relatively average Web-browsing competence which they will display and use when they get into the field.

Recommendations

Based on the findings of the study, the following are recommended:

(1) Pre-service adult facilitators should be encouraged by their lecturers to acquire more Web-browsing competences during their training period so that they can reach the excellent level;

(2) The country just like most developed nations should embrace the innovative distance learning in the form of online learning, e-learning, e-counseling, and virtual classroom knowing that most of the current pre-service adult facilitators have average Web-browsing competencies and that practice will increase and perfect these competencies;

(3) Teacher education programmes should pay greater attention to adult education and counseling with emphasis on technology integration for improving the lives of adult learners;

(4) Female adult facilitators should be encouraged to acquire Web-browsing competences and equal opportunities should be provided to both sexes.

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A Theoretical Synthesis of Knowledge Sharing and Educational Leadership for Sustaining Learning Communities

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Knowledge is one of the crucial and dominant economic resources in order to obtain sustainable advantages in any community. The world is now shifting faster thanks to the advanced development of digital connectivity and increasing access to knowledge. Leaders of a community, society, or country must contemplate what factors concerned in the emergent era of valuable network that fosters learning communities. To some extent, learning communities benefit each individual member and the community as a whole as they generate economic prosperity as well as improve students' academic and social achievement. They even enhance interdisciplinary studies in higher education levels. Hence, it is of essence to have a strong learning community which requires all stakeholders to actively participate in sharing common values, beliefs, and knowledge in order to pass on their wisdom from generation to generation and embracing a strong sense of loyalty and belonging among themselves, so as to achieve together both individual needs and shared missions of the community. With the aim of sustaining a learning community, it necessitates synthesizing the creative mechanism of knowledge sharing with the application of authentic educational leadership that encompasses a process of influencing, sharing knowledge of new concepts, practices, ideas, insights, abilities, and values for personal development and of facilitating ongoing learning, communicating certain values and useful information for people's well-being in a community, enhancing academic progress, and inculcating sound awareness of continuous lifelong education. The purposes of this study through content analysis are to raise the awareness of the eminent power of sharing knowledge that requires a strong sense of educational leadership and to emphasize the significance of sustaining learning communities for the academic achievement of learners in particular and for the intellectual well-being of people in a community in general.

Keywords: knowledge sharing, educational leadership, learning communities, sustainable education

Introduction

Leaders in any community or circle are required to possess certain skills, abilities, and knowledge in mobilizing communities for a better change. Despite having mutual purposes or shared mission, only one person could not at all achieve leading a community to success. Rather strong commitment and devotion in actively sharing their knowledge and wisdom from members involved are determinants to sustainable learning communities. In the effective mechanism of knowledge sharing for a community to confer sustainable capacity, three critical determinants involve what content should be shared, in which context is conducive to learning and what expected roles members in a community should perform for the betterment of a whole community. In order to create a learning community, it necessitates to have shared emotions, values, and beliefs from its

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actively engaged members. All stakeholders are required to work in close collaboration with strong partnership in order to achieve a common purpose: sustaining learning communities. Nevertheless, essential resources in terms of human, physical, and financial factors are of the essence to success. In this study, content analysis was used as Krippendorff (2004) described it as one of the most important research techniques in social sciences. The data were created in terms of texts, images, and expressions for a content analyst to interpret and extract underlying meanings. Content analysis is regarded as an efficient method for public opinion research, tracking markets, political learning, and emerging ideas. This paper aimed to derive theoretical synthesized determinants by coalescing theories of knowledge sharing and educational leadership along with the core notions of learning community and sustainability, the findings of which could provide a fresh impetus for leaders in a community to drum up support and commitment from their stake-holding members for the determination of shared visions in creating sustainable learning communities.

Educational Leadership Towards Learning Communities

According to Bennis and Nanus (1985), leadership is a crucial instrument to develop visions that can mobilize communities for a better change. In the 21st century, there have been so many ongoing changes: the increasing intense of global competition, the rises of complexity and unprecedented changes, and the demise of hierarchy and position power, which all were creating new yet far-reaching challenges to all communities worldwide (McFarland, Senn, & Childress, 1994). In order to demonstrate leadership in a modern era, a leader requires such certain characteristics as vision, inspiration, strategic orientation, integrity, and organizational sophistication (Guthrie, 1990). Meanwhile, Bennis (1992) contended that true leaders to begin with should have four competences. The first attribute is management of attention by acquiring commitment with people. Leading a community to learn necessitates obtaining a great sense of commitment from all stakeholders. Management of meaning is the second quality that leaders should possess, which is carried out through the precise and concise communication of shared vision. Assuming a role of communicator leaders inherits certain challenges. Thirdly, trust and constancy are major determinants in reaching successful leadership. Lastly, management of self which requires leaders to know what their skills are and how they deploy them effectively.

In the context of knowledge sharing and sustaining learning community, stronger leadership abilities are highly needed (Razik & Swanson, 2001). Rather than focusing on leadership merely in terms of peripheral aspects (personality, traits, and goal attainment) or content (knowledge-possessed leader), it is more crucial to focus on the process of leadership that involves “an influence relationship among leaders and followers who intend real changes that reflect their mutual purposes” (Rost, 1991). Razik and Swanson (2001) also proposed that it is crucial to develop leadership capabilities through changes to the way future leaders and followers are to be educated. Thereby, the learning communities are of the essence to facilitate knowledge transferring among people in a community whereas to build up a strong bridge for passing on wisdom from one generation to another.

Referring to the development of learning communities, Schein (1992) also put forward that the leaders should possess the ability to share knowledge and support ongoing learning which are regarded as the most salient values of future leadership. The leaders of the future will be people who can lead and follow, be individualistic and team players, and most importantly, be perpetual learners themselves.

Referring to leadership values mentioned in the previous section, effective leadership is a process which involves ongoing learning, practicing, supporting, sharing knowledge, and communicating shared values

among leaders and followers. According to Owen, Hodgson, and Gazzard (2004), "Ongoing leadership requires freedom to develop in an environment that supports and guides thinking, emotional well-being, creativity, dialog, openness, trust, and responsibility" (p. 284). These values are regarded as the cornerstone of human development, which is also reflected in the missions of education in many countries. That is to develop people in all aspects, such as intellect, knowledge, morality, and integrity.

In synthesis of educational leadership theories, in line with the meaning of education defined by Thai National Education Act of B.E. 2542 (2003), educational leadership signifies a process of influencing, sharing knowledge of new concepts, practices, ideas, insights, abilities, and values for personal development and of facilitating ongoing learning, communicating certain values, and useful information for people's well-being, enhancing academic progress, and inculcating sound awareness of continuous lifelong education.

Knowledge Sharing Towards Learning Communities

Drucker (1995) stated that knowledge could be one of the most important dominant economic resources for a community to acquire competitive advantages. However, Brown (2000) simply concluded that knowledge brought about powerful intertwining forces: content, context, and community. It is important to realize what to share (content), where to disseminate (context), and who to carry out such processes (community). As Allee (2003) posited that, it is widely accepted that the world is now shifting faster due to advancement of digital connectivity and increasing access to myriads of informative sources. People in a community need to be active participants for their circles evolve sustainably. As Drucker (1995) emphasized that it was important to equip people with extensive knowledge so that a society or a community could move forward with sustainable strengths. Without the effective process of sharing knowledge, learning communities would be unable to grow and develop for the betterment of the future.

However, no matter how valuable knowledge is to be disseminated but without sharing or being explicitly made available fruitfully for people in a community or a society, such knowledge could be of valueless. Additionally, Shin, Holden, and Schmidt (2001) also demonstrated that the value chain of knowledge management requiring distribution, which functioned as a gate keeper whereby knowledge could be flowed out and shared among people throughout a community. It takes every individual to actively engage to a certain extent. Knowledge is not only a simple tool particularly for an individual to advance his/her career but rather a major driving force generally for the sustainable growth of a nation's economy as a whole. In order to achieve sustainability, leaders of a community, society, or country must be able to capture what variables and players involved in the emergent era of value network that fosters knowledge-sharing communities (Allee, 2003).

Probst, Raub, and Romhardt (2001) stated that knowledge is considered as a commodity, which is only transferred by the exchanges of people in a community. The value of knowledge depends on to what extent it is used and applied in a certain context for benefiting a group of people in a certain community. Knowledge sharing is a means used to educate individuals within a community. As it is believed that the sharing of knowledge turns isolated information or experiences into something valuable and is a critical determinant for a community to confer sustainable capacity (Gupta & Sharma, 2004; Probst et al., 2001).

Referring to a cycle or spiral with five sections of knowledge process by Gupta and Sharma (2004) based on the work of various theorists (Brown & Duguid, 1991; Denning, 1998; Huber, 1991; Kerssens-van Drongelen et al., 1996; Nonaka, 1994), knowledge sharing and dissemination are mechanisms that create linkage between individual to group for transferring knowledge and enable in-flowing and out-flowing of

knowledge evolving within a community.

According to Dixon (2000), there are five main types of knowledge sharing: serial sharing, near sharing, far sharing, strategic sharing, and expert sharing. Firstly, serial sharing occurs when knowledge (both explicit and tacit) is gained in one context and is then disseminated to the use in a different setting. Serial sharing involves regular meetings, monthly brief sessions, and so on. The second form is near knowledge sharing, which takes place where people who share explicit knowledge, generally routine, frequent, and similar when repeated, to others by various kinds of media. Far knowledge sharing, the third form, is the sharing of tacit knowledge among people, from which collaboration is developed. The fourth one is strategic knowledge sharing that concerns both explicit and tacit knowledge, which is used in infrequent and non-routine situations. Strategic sharing normally involves identification of key knowledge and also the collection and interpretation from knowledge specialists are sought, such as the knowledge required for corporate mergers and acquisitions. Finally, expert knowledge sharing occurs when explicit knowledge from experts is gained, because the knowledge that people have is limited.

According to Probst et al. (2001), it is undeniable that human beings are by nature knowledge sharers. They also highlighted that our natural inheritances to share knowledge have been regarded as crucial to a community. Just as innovation is important to early-aged societies, knowledge sharing has been vital in competitions at global and local levels as well as in organizational readiness. Simply concluding, knowledge sharing is a key to the innovation of a community.

Learning Communities Towards Sustainable Education

Learning communities have been defined in several ways and the concept of which is being discussed and practiced widely in educational circles. For a simple definition of a learning community, it refers to a group of people who have shared emotions, values, and beliefs and actively engage themselves in learning together from one another. The process of learning is undertaken through participation in “communities of common purpose” (Kilpatrick, 1999). According to Feldman (2000), educational theories and practices in the 20th century defined that era as the “century of individual” which demanded a learner to be a “lone seeker of knowledge” but the growing theory of social constructivism of Vygotsky (1978) realized the contribution of togetherness: learning from each other. The main characteristics of learning communities compose of synergistic interests and curricular content. According to Lenning and Ebbers (1999), active collaboration and strong partnership in learning communities develop and facilitate people to share knowledge and potentially create new knowledge for the benefits of the community as a whole. In educational setting, educators, teachers, students or even staff as they are regarded as crucial members in learning communities must value learning, work to improve curriculum and instruction, and focus more on the students’ sustainable growth (Peterson, 2002). Even though learning communities could evolve through strong participation and partnership of their members, they require sound leaders who thrive them to achievement. As Taylor (2002) proposed that it is of significance for leaders to foster learning communities by equipping people with human, physical, and financial resources including opportunities, so that trust, a shared culture and vision, could be viably built. Towards the 21st century, learning communities keep on evolving for the interest of the diverse needs of learners and the communities. Kilpatrick (1999) stated that learning communities shall involve stakeholders with shared purposes, collaborate on building up learning environment that is conducive to enhance capabilities of all members to share and create new knowledge. As Delors (1996) recommended, “Four mutually supportive pillars of learning as the

cornerstone of education for the 21st century", they are regarded as overarching concepts of sustainable learning paradigm: learning to know, learning to do, learning to live together, and learning to be. According to UNESCO (United Nations Educational, Scientific, and Cultural Organization) (2008), in order to develop education for sustainable development, there must be emphases on promoting learning processes: critical thinking, problem-solving, developing a holistic vision, systems thinking, and futures-oriented thinking. It is crucial for community leaders to help their members develop these skills; particular "linking-thinking" which could be practically employed in their real-life contexts. Participation, collaboration, and dialogue in educational processes are important determinants of sustainable education.

Self-sustaining Cyclic Triad: Learning-Leading-Living

A theoretical reflection on "cosmological models in which the universe follows infinite and self-sustaining cycles" (Steinhardt & Turok, 2007), sustainability of education is derived from the strong and continuous relationship among three key determinants: learning (content/knowledge sharing), leading (ongoing leadership) and living (learning communities) (see Figure 1). Aristotle once said, "For the things, we have to learn before we can do them, we learn by doing them". It is inevitable to accept that we need our learners to do and embrace explicit and tacit knowledge through experience. Nowadays, an emphasis on practical learning processes has been laid firmly as UNESCO (2008) urged educators worldwide focusing on critical thinking, problem-solving, developing a holistic vision, systems thinking, and futures-oriented thinking. These skills enable learners to "link" their knowledge and facilitate them to "think" critically through applying their learnt theories in real-life situations. In the effective sharing of "content (education and experience)", environment plays a major role to facilitate people in a community to acquire sustainable education successfully. Therefore, a "context" that is conducive to successful knowledge sharing requires active participation, collaboration, and dialogue among stakeholders in communities as a whole, particularly their leaders. A strong sense of an ongoing leadership could pave ways "to develop an environment that supports and guides thinking, emotional well-being, creativity, dialog, openness, trust, and responsibility" (Owen et al., 2004). These values, combined with integrity and morality education, contribute greatly to the quality development of learning community members. All in all, a leader needs to be fully aware of what to share, where to share it, and how to make the sharing achieved for thriving this cyclic triad to be dynamically self-sustainable.

Figure 1. Self-sustaining cyclic triad.

Conclusion

All stakeholders including educational institutions, public and private sectors in any communities need to be actively aware that their supports could contribute to the sustainability of their communities more or less. As members, they merely learn to share and develop their knowledge and wisdom actively and that could turn to be a powerful means for a community to evolve sustainably. Opportunities to learn and experience provided by public and private organizations are considered crucial learning factors for young generation to embrace practical knowledge and education, as they could learn from real-life experiences. For leaders, they are to provide a community with a strong and fresh impetus to determine shared visions, to develop an environment supporting creative dialogue, openness and build up strong commitment in creating sustaining education for people in a community.

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