Proposed Technology-Based Training Program For Mathematics Teachers In Higher Education

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Abstract: This descriptive study determined the level of application of technology integration in mathematics in selected private sectarian higher education institutions in the provinces of Batangas, Laguna and Rizal in terms of instruction, learning experience and faculty competence. It explored the strength and weaknesses of technology integration in terms of capabilities of the school, teachers and students. Respondents involved 142 education students major in mathematics and 24 mathematics teachers. Statistical tools were frequency, percentage, ranking, weighted mean and F-test. The study revealed that there was moderate level of competency and frequency of use of ICT hardware and software. The level of application of technology integration in teaching mathematics was high on instruction, faculty competency and learning experience of students. Despite such high level of ICT integration, teachers still need to undergo a type of training that will focus on technology-based instruction to maintain the high level of integration. Teachers need to be relevant and updated with the latest trend in technology for further enhancement of their competencies. Thus, a technology-based training program is proposed as an effective way to stimulate interest, cultivate the skills and maintain the level of proficiency of teachers and students required in technology-integrated teaching and learning mathematics.

Keywords: technology, training, mathematics, instruction, education

Introduction

Information and Communication Technology creates tremendous opportunities in many aspects including education such as web-based teaching and learning where these provide lots of benefits to both students and professors. In the Teacher Education Curriculum as cited by [9]Vrasidas (2001), inclusion of Educational Technology subject has been implemented in order to teach the potential teachers on the use of several technology systems in making instructional designs, in selecting appropriate media for use, in structuring learning activities and in employing sound pedagogical strategies for real life contexts. The pre-service and in-service teachers should be given opportunities and exposures on how to integrate technology into their teaching of mathematics for them to demonstrate the effective and appropriate ways of integrating technology into their classes. It was noted that one of the perennial problems for schools, teachers and students is that textbooks are increasingly expensive, quickly become outdated and physically cumbersome. A shift away from reliance on textbooks to the use of multimedia or online information offers many advantages including increased efficiency, improved accessibility and enhanced learning opportunities for students. They should be trained in the use of online content and should be encouraged to have access to computers. In the context of technology integration, different teaching strategies in the tertiary level particularly in mathematics instruction have been designed and implemented through the use of computer applications and programs by planning the technology-based curriculum and designing students' learning activities. Training of faculty on practical uses of technology with hands-on sessions had also been implemented by school administrators. It is believed that technology brings to the classroom real-life experiences over things that are impossible to be made available. The use of technology in education cannot be ignored for it facilitates learning and improve students' performance by creating, using and managing appropriate technology processes and resources. Teachers can enhance students learning with the use of technology and can teach more knowledge and have the many options when it comes for guiding students in their process of learning. Similarly, high-end instructional materials have been developed and used in teaching but as always, there is question on the level of technology integration and on the competency of faculty in using technology as well as on the learning experiences of students in technology-integrated pedagogical practices. Thus, technology that motivates students to engage in learning and technology-based curriculum for this matter should be made available. It is from this end that the researcher was challenged to look into the extent of application of technology integration in teaching of mathematics in selected private sectarian higher education institutions. The researcher assessed the extent of technology integration in the teaching of mathematics and its effectiveness. The findings of this study would serve as her benchmark in strengthening the mathematics curriculum and instruction with technology integration as an innovative strategy to be employed by teachers in their teaching of the subject.

Statement of the Problem

1. What is the profile of the mathematics teachers in terms of age, educational attainment and ICT-related trainings and seminars attended?
2. What is the level of competence of mathematics teachers in the use of ICT and to what extent is ICT used in mathematics teaching?
3. Does the level of competence and frequency of use of ICT vary significantly in relation to the personal and professional attributes of the faculty?
4. What is the extent of effectiveness of ICT integration in teaching mathematics in terms of instruction, learning experience and faculty competence?
5. What are the strengths and weaknesses of ICT integration in teaching mathematics in terms of capability of the school, mathematics teachers and students?
6. What faculty training program on technology-based mathematics instruction may be proposed?

Hypothesis of the Study

There is no significant difference on the competency and frequency of ICT use when grouped according to personal and professional attributes of the faculty.

Review of Literature

Roblyer (2003) stated that mathematics is important to the future of the students. Mathematics skills are developed from everyday life experiences long before they are formalized in the classroom. Students develop their mathematics skills according to their natural ability and learning style. Mathematics, for this matter, is the science of magnitude, number, shape, space, and their relationships. It involves handling of information, making of predictions and solving of problems through the use of a language that is both concise and accurate. Mathematics education fosters creative and aesthetic development, and enhances the growth of reasoning through the use of investigative techniques in a mathematical context. It is also concerned with encouraging the learner to be confident and to communicate effectively through the medium of mathematics. Teachers of mathematics view computers as an essential tool in teaching and consider them as an alternative to pen-and-paper tasks. There is a wide variety of computer applications available that offer opportunities for the development of problem-solving skills. In teaching mathematics, teachers may use calculator to enhance the thinking skills and appreciation of students more especially when there is application of computer software such as LOGO Writer, Cabri Geometry and Graph X which students can use to do mathematical investigations. The Internet also provides more uses for computer. CD ROMs and video tapes which are used on drill and practice, mathematics concepts and problem solving are other technology products developed based on the abilities, needs, experiences, conditions and interest of Filipino students [8](Ulep, 2000). [3]Ittigson (2003) on the other hand pointed out that integration of technology in teaching mathematics in the tertiary level is found to be essential and improves the way mathematics should be taught and enhances student understanding of basic concepts. Technology also promotes greater collaboration among students and encourages sharing of knowledge. It gives rapid and accurate feedback to students and allows them to focus on strategies and interpretations of answers rather than spend time on tedious computational calculations. Mathematics instruction with application of technology requires teachers' expertise in planning and creating instructional materials. The constructivist based instructional approach in teaching mathematics by [2]Confrey (2001),implies that teachers are expected to design instructional experiences in order for their students to construct new knowledge. In this kind of approach, mathematics teachers should learn to prepare technology-based instructional materials, utilize appropriate strategies and develop right attitude so that their students would consider learning clear and meaningful. With this, learners can gain knowledge of concepts and skills through the use of concrete devices and apply them in situations relevant to their daily living. But then individual differences must also be considered in this art of teaching. Technological resources like interactive website are always accessible. [4]Johnson (2011) cited that dynamic learning can start from downloading technological applications that will enable students to visualize scientific and mathematical concepts because it offers opportunity to bring ideas from abstraction to concrete examples like in Algebra, a slope is not simply a shape on the graph but may represent the movement of concrete real-world application. Integrating technology into mathematics teaching requires analysis and determination of tools and strategies that will help students master the curriculum standards. Technology can help learners compute, gather, investigate and symbolize numeric information. [1]Cenamo (2010) pointed out that technologies have been part of teaching and learning for centuries as types of technologies have changed over the years. In order to create a new kind of experience, effective technology integration which requires a simple introduction of computers and related technologies into the classroom can be done. New technologies make it easier to incorporate new learning theories and pedagogies such as active learning, knowledge construction, cooperative learning and guided discovery in the classroom. Students and teachers can be made free from mundane tasks for them to promote greater collaboration, more in-depth study and critical thinking skills through the use of technology. The lessons learned from online instruction according to [7]Teehankee (2002) can be achieved through careful planning and the faculty must be knowledgeable of this method of instruction. The most critical requirement in this kind of instruction is the establishment of rapport with the students and the maintenance of a learning community through the strategic use of communication. Educational software programmers and developers on the other hand build their products based on well-founded learning theories and pedagogies [5](Lucido, 2007). It was cited that teachers who seek to integrate technologies in the classroom should find technologies that best support the curriculum, teaching style and students' ability. When planning to integrate technology in mathematics teaching, teachers should examine examples of selected concepts with available technology resources and they should select appropriate technology to enhance students' learning opportunities. There are many forms of technology available for use in the classroom aside from computers like calculators, probe ware and handheld devices. Students can learn mathematics more deeply by using appropriate forms of technology.

Methodology

The study used the descriptive method of research which according to [10]Walliman (2005) is used to gather information using survey questionnaires and personal interviews to provide adequate, accurate interpretation and analysis of findings affecting the current status of concerns under investigation. The respondents involved in the study has a total population of 166, composed of 142 education students with mathematics as the major area of specialization and 24 teachers. No sampling was done considering the small number of private sectarian higher education institutions offering teacher education program and small number of students taking up mathematics as major subject. This study made use of survey questionnaire for teachers and students, interview, focus group discussion and documentary analysis. Frequency, Percentage, Ranking, Weighted Mean, F-test were used as statistical tools to treat the gathered data.

Significant Findings

1. Profile of Mathematics Teachers

Ten teacher-respondents were within the age bracket of 26–35, eight were within 36-45 and only one in each of the age-range below 25 years old, 46-55 and above 56 years old. Three teachers did not declare their age. One teacher-respondent had doctoral degree, six were with MA units, seven had earned doctoral units and eight were already MA degree holders. Only one teacher- respondent had attended the ICT related trainings and seminars.

2. Teachers' competency and extent of ICT use

Teacher-respondents had high level of competency on the use of hardware as reflected in mean of 3.50 while students' assessment on teachers' competency was moderate with a composite mean of 3.17. On software use, the composite mean of 3.10 from the teacher-respondents and 2.99 from student-respondents indicated a moderate level of competency. There was also a moderate level of competency on web use based on the composite mean of 3.47 from the teachers' assessment and 3.48 from the students' assessment. The extent of use on hardware was moderate based on the composite means of 3.32 from the teacher-respondents and 2.9 from the students. The extent of software use by the teachers was moderate with a composite means of 3.04 as assessed by the teacher-respondents and 2.66 from the student-respondents. The composite means of 3.30 and 3.0 from the teachers and student respondents respectively signified that teachers' frequency on web use was moderate extent.

3. Difference on the Level of Competency and Frequency of ICT Use in relation to Age and Educational Attainment of the Mathematics Faculty.

No significant difference was noted on the level of competency of mathematics teachers in the use of hardware and software with the Fc values of 0.410 and 1.287 respectively which led to the acceptance of the null hypothesis. Similarly, no significant difference was noted in teachers' frequency of use of ICT when grouped according to age as reflected in Fc values of 0.803 and 1.436, these results led to the acceptance of null hypothesis. When grouped according to educational attainment, there was no significant difference noted in level of competency in the use of ICT as manifested in Fc values of 1.527 and 0.577. Likewise, on the extent of use, the Fc values of 0.708 and 0.247 revealed no significant difference. The obtained values led to the acceptance of null hypothesis.

4. Extent of effectiveness of ICT integration

The average composite mean of 3.70 on instruction and learning competency and the average composite mean of 3.53 on faculty competency implied that integration of technology to mathematics instruction was effective to a high extent.

5. Strengths and weaknesses of ICT integration

The school was strong in providing relevant ICT resources but weak on allowing the use of computer laboratory. The teachers were strong on being aware of the relative advantage of using ICT in instruction but weak on basic ICT trouble shooting. The students were strong in understanding mathematical concepts in technology-based instruction but weak in having knowledge in the use of ICT resources as well as interest in attending technology-based mathematics instruction.

6. Proposed technology-based training program

The proposed technology-based training program is anchored on enhancement of teachers' skills and competencies in using ICT in order to handle technology-based mathematics instruction effectively.

Conclusion

Majority of the teachers are adults with master's degree. Only one has attended the training and seminar. Teachers have high level of competence in the use of ICT hardware, software and web in mathematics teaching. No significant difference was revealed in the responses of teachers regarding their competency on the use of computer hardware and software. Effectiveness of technology integration in mathematics based on instruction, learning experience and teaching competency is to a high extent. More teacher-respondents were found strong in the integration of ICT in mathematics. The proposed training program covers training activities to enrich the competence of the teachers in technology-based mathematics teaching. The researcher believed that the proposed technology-based training program for mathematics teachers is an effective way to stimulate interest, cultivate the skills and maintain the level of proficiency of teachers and students required in the technology-integrated teaching and learning of mathematics. This study would direct the school administrators, teachers and students to ensure that they will become more responsible technology users ready to confront future challenges that technology integration would bring about in the learning environment.

Recommendation

The proposed training program may be tried out to test the usefulness of its implementation. Access to the computer laboratory for the use in technology-based instruction may be studied through the strategic planning development where such concern may be covered. Revisit and evaluation may be done for the mathematics curriculum for possible integration of ICT use in the teaching of the subject for a more technology integrated learning environment. Teachers particularly those teaching mathematics may be provided further trainings on how to manage technical problems that can be met in the use of ICT instruction. Encouragement

among teachers for more possibilities in creating appropriate technology-based instructional materials to further motivate the students and enhance mathematics learning may be pursued. Emphasis on the integration of ICT in the general courses such as mathematics and other areas of discipline may be considered in the preparation and implementation of the Teacher Education Program. Studies of the same nature but in different discipline and venue may be conducted by other researchers.

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Wenona L. Ramos received the Bachelor of Science in Education in 1978, Master of Arts in Teaching Mathematics in 1998 and Doctor of Education major in Educational Management in 2012 at the Batangas State University, Philippines. During 1978-2016 she became Mathematics teacher and coordinator, head of ICT Department, and dean of the College of Education. She is now a guest lecturer in Batangas State University.

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