Exploring the use of technology in Mathematics teaching within Higher Education

Dr J. Naidoo

UKZN

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Introduction

* Exploring the use of responsive and innovative pedagogies is important in sustaining and improving mathematics teacher development at Institutes of Higher Education.

* Technological advancements have made their way into lecture rooms and the use of technology in lecturing is regarded as a responsive and innovative pedagogical tool.

* This study was located at one University in KwaZulu-Natal, South Africa.

* This study explored mathematics education lecturers' use of technology in teaching within Higher Education.

Research Methodology

* Ethical clearance was obtained from the research office of the participating university, additionally each participant was invited in writing to take part in the study.

* Each participant was provided with an informed consent form to peruse at their leisure moreover, participants were informed of their right to withdraw from the study without prejudice.

Data Collection

* Qualitative data was collected during the 2013 and 2014 academic year.

* A lecturer questionnaire, lecture observation schedules and semi-structured lecturer interviews were used to collect data.

* At least 3 mathematics education lectures taught by each of the five participants were observed.

* A semi-structured lecturer interview was used to gain an in-depth understanding of how technology was integrated within the mathematics education lectures.

Theoretical Framework:

* The study was framed by merging Shulman's (1987) PCK and Mishra & Koehler's (2006) TPACK frameworks.

* The lecturer questionnaire assisted in answering questions relating to each participant's pedagogical content knowledge (PCK) and technological pedagogical content knowledge (TPACK).

* Pedagogic content knowledge in mathematics education requires the merging of mathematics content and pedagogy.

* Technological pedagogical content knowledge epitomises how a lecturer integrates technology effectively within the classroom.

Data Analysis

* Thematic coding and grounded theory techniques were used for the analysis of the data.

* Common themes and ideas that emerged were recorded.

Findings

The findings revealed that the participants used innovative methods of integrating technology within the mathematics education lectures.

The findings also revealed that the challenges associated with teaching abstract mathematics concepts were alleviated through the use of innovative technological tools.

This study has implications for curriculum developers and mathematics education lecturers at Institutes of Higher Education.

Findings

* Saving time
* Alleviating challenges
* Making abstract concepts more comprehensible
* Access to information
* Protecting the environment
* Technology makes education more enjoyable
* Negotiating diversity
* Creating a sense of belonging
* Transforming teaching methods

Discussion

Saving time:

* Based on the lecturer interviews it was apparent that the use of technology based teaching activities saved time in the lectures.

* By using computer programmes to construct figures in mathematics prior to the lesson saves time during the lesson, these diagrams may also be used for lesson planning.

* It was evident from the lecture observations that the lecturers spent less time drawing complicated mathematics diagrams and spent more time on discussing the rules, proofs and procedures that ought to be followed to promote the effective teaching and learning of mathematics concepts.

Alleviating challenges

* It was evident based on lecture observations and lecturer interviews, the use of technology when teaching alleviated some of the barriers to the effective teaching and learning of mathematics.

* Some students were not familiar with certain concepts in mathematics due to the barriers created by the medium of instruction.

* The lecturers were of the opinion that the use of technology within the lecture room removed some of these challenges.

* Lecturers could use the internet to download pictures etc. to make the maths concepts easier to understand e.g. 3D shapes.

Making abstract mathematics concepts more accessible

* The participants were of the opinion that the use of technology based instructional tools supported them in making abstract mathematics concepts easier to understand.

* Complex concepts like solving the slope of graphs, limits of function, working with problems in differential calculus become easier to teach through the use of technology based teaching tools.

* These technology based teaching tools included the graphical calculator, computer software programmes and the smart board.

Access to information

* The participants agreed that access to information and research became easier through the use of technology.

* Very often during the lecture certain concepts and terminology came up that needed further clarification.

* Through the use of search engines and the internet the lecturer could easily download the latest updated information for clarification purposes.

* On many occasions the students used their cell phones in the lecture to access the internet.

Help in protecting the environment

* Due to the use of technology in lecturing, lecturers do not need to print copious notes.

* Lecturers rely on the use of Moodle to upload readings, assignments and past assessments for students to work on.

* Moodle is an Open Source Course Management System (CMS) used at the participating university. Moodle is license free Open Source software.

* It allows lecturers; trainers and administrators manage online learning and online training.

* Thus it was apparent that integrating technology within the teaching of mathematics at Higher Education Institutes saved paper and therefore protects the environment.

Technology makes education enjoyable

* Based on the lecturer interview transcripts and the lecture observations, it was evident that integrating technology within the lecturing process made the lectures enjoyable for both the lecturer and the students.

* It was evident that the students enjoyed the lecture and interacted freely when the lecturer used the smart board or touch screen technology.

* Integrating technology based tools in the lecture made the lectures more interactive and interesting.

* Based on the lecturer questionnaire, the majority of the participants agreed that integrating technology based tools during lectures assisted in gaining and maintaining the student's attention.

Creating a sense of belonging

* In order for students to actively participate within a learning milieu they need to feel as if they are indeed participants and not mere recipients.

* This engagement could include discussions revolving around activities, completing class and homework tasks and interacting with the lecturer to acquire knowledge.

* When lecturers include meaningful and relevant teaching and learning experiences they create a sense of belonging.

* Students want to participate because they feel as if they belong to this community of practice.

* Many participants indicated that their students were more accepting of technology based teaching methods since they could identify with technology and they could also assist the lecturers at times if there were some technical issues.

* The participants created a learning milieu where the students felt that they belonged and could discuss their thoughts and ideas without fear of being ridiculed.

Transforming teaching methods

* The participants transformed their teaching methods while they taught within their diverse learning milieu.

* Through their experience of teaching mathematics within Higher Education the lecturers possessed the adequate content, pedagogic content and technological pedagogic content knowledge to transform their teaching methods successfully.

Reflecting in and on teaching

* Lecturers showed evidence of reflecting on previous experiences and reflecting while teaching within the diverse learning milieu.

* As a result of the participants reflecting in and on their teaching their teaching approach transformed to cater for the needs of their students.

* This change of teaching style and strategies were observed during the lecture observations.

The End
naidooj2@ukzn.ac.za