EXPLORING LECTURERS’ TECHNOLOGICAL KNOWLEDGE TOWARD THE TEACHING OF STUDENT TEACHERS IN THE SCHOOL OF EDUCATION

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Abstract

The purpose of this study was to investigate lecturers’ technological knowledge toward the teaching of student teachers at a study university of technology in the school of education in South Africa. The participants were 37 lecturers from four departments. They were 25 (67.6%) females and 12 (32.4%) males. The question posed in this study was: To what extent does the lectures’ technological knowledge impacts on the teaching of student teachers in the school of education? In order to answer this question, the mixed method was used. Qualitative data was collected by means of semi-structured individual interviews. Quantitative data were collected online with the aid of Technological knowledge, Technological pedagogical knowledge, Technological content knowledge as well as Technological pedagogical content knowledge of the TPACK framework. Qualitative data were analyzed using Atlas. ti and quantitative data were analyzed using SPSS. The reliability of a TPACK instrument was computed by a Cronbach’s alpha, α values range between .81 and .92. For the content validity the Kaiser- Meyer-Oklin and Bartlett’s test of sphericity were computed. The results show that less than half 48.6% of the teachers can create opportunities for students to collaborate online to produce project work. Furthermore, the findings revealed that some of the participants did not attend workshops on technology integration for teaching and learning. It is crucial the university makes it compulsory for lecturers to attend the in-service training on the incorporation of technology in their teaching practices.

Keywords: Technological knowledge, lecturers, teaching, student teachers, higher education.

1 INTRODUCTION

Digital technology has transformed the different spheres of our lives [1], [2] In the education sector, the rolling out of the ICTs for teaching and learning has altered how the knowledge is transmitted. For instance, in the South African schools, the chalkboards have been replaced by smartboards and the learners are provided with the tablets. [3] These technologies require the lecturers to be capacitated to integrate them as teaching and learning tools. It is purported that for lecturers to be able to integrate technology successfully, they need to acquire technological skills [4] Technology skills can only be offered through the pre-service and the in-service training programmes for the student teachers and lecturers respectively. ([5]). The importance of the lecturers to be capacitated on the technological skills that are needed for the 21st century in the higher institution of learning and can never be over emphasized [6] When lecturers are capacitated in the use of technology , they demonstrate these skills during the lectures and student teachers mimic their lecturers and apply them when given the opportunity to explore the technological tools before they are deployed to different schools for teaching practice [7] The student teachers from the study university are taught in the traditional manner and when deployed to different schools for teaching practice they are confronted with the current digital tools. It in this regard that this study investigated the lecturers’ technical knowledge towards the teaching of student teachers.

At the Study University of Technology, the License to teach is the training and development programme offered by the Directorate of Curriculum Development Support (CDS). for the lecturers [8] The aim of this programme is to coordinate and facilitate orientation programs for the newly appointed academics at different levels to ensure that they are equipped with necessary skills for teaching. It is a six months program and delivered through a series of contact sessions and facilitated via Blackboard, a learning management system. The license to Teach programme includes educational topics such as writing a teaching philosophy aligned to provide guidelines; facilitate learning within an authentic environment, applying interactive teaching strategies; develop outcomes and assessment criteria following provided criteria; develop a study guide following provided guidelines and criteria; assess students, adhering to the study university guidelines and policies; design an electronic classroom; and
develop a teaching portfolio that reflects evidence of reflective practice in teaching and learning and research in Higher Education.

Even though technology-enhanced teaching is included in the License to Teach programme, it is worth indicating that it does not include topics about technology-enhanced teaching and learning methods and strategies, teaching in the 21st century and electronic assessments [8]. These technology-enhanced teaching and learning methods are important as they could equip lecturers to be able to integrate the 21st century methods to enhance the traditional method of teaching [9]. In fact, it is crucial for education lecturers particularly in the school of education to understand how to integrate technology in their teaching practices in order to generate high quality learning that gives students an opportunity to participate in the demand of the 21st century. The aim here will be to better prepare students for success in today’s global economy and improve the skills required in the 21st century [9].

The challenge is that the current study university curriculum does not discuss any issues on the incorporation of educational technologies for teaching and learning [8]. As alluded earlier, currently, at a study University of Technology, student teachers in the school of education are taught using the traditional teaching methods and they are not given an opportunity to either witness the use of technology or to explore and experiment with the technologies for teaching and learning [10]. When the student teachers are deployed to schools for teaching practice, the university expects them to deliver the learning content following the traditional teaching methods [11]. On the other hand, at schools where the current technologies are installed, they expect the student teachers to be competent in the use of these technologies. This leads to students being perplexed by the replacement of chalkboards by smartboards, tablets and eBooks in their schools of placement. It was for this purpose that this study investigated the lecturers’ technological knowledge toward the teaching of student teachers. To evaluate the lecturers’ technological knowledge, the Technological Pedagogical Content Knowledge (TPACK) as a framework was adopted.

TPACK as a framework has been validated in many studies as a tool for assessment and development ([12]; [13]. It has therefore been used in a variety of studies. For instance, from 2005 to 2011 about 200 studies were conducted already [14]. Similarly, to this study, TPACK has been used to establish whether the teachers have the technology knowledge to integrate technology into teaching and learning and the results revealed that only a minority possessed technology knowledge [15]. The results showed that more teachers still need to be taken through different phases of professional development programme and must be capacitated on the technological knowledge for them to integrate technology successfully [15]. It was used to analyze how teachers construct knowledge when interacting with other communities of practice and that was successful in that after they were given an opportunity to create communities of the common practice, they could apply the technology knowledge in their own context [16]. It has also been used to establish the teachers’ perceptions towards the use of technology for teaching and learning. Teachers were tested before and after the engagement with the technology enhanced strategies. The results changed the teachers’ perceptions for better. It is also reported that the teachers also created assessment tools.

2 LITERATURE REVIEW

2.1 Professional development Programmes

Professional development programmes are utilized as the strategy to capacitate the lecturers to be effective and efficient in their duties. These programmes vary from in-service (INSET), pre-service and technology enhanced empowerment programmes [17]. Technology enhanced teaching cannot take place without technological strategies [18]. It is for this reason that the higher institutions of learning invested on the development programmes to capacitate lecturers to integrate successfully.

2.1.1 INSET programmes

INSET programmes in education are strategies developed and utilized to capacitate lecturers to be efficient and proficient to enhance teaching and learning [18]. The utilization of In-service training for the lectures in higher institution of learning, as an induction program has become a common practice internationally. The programmes vary from short to long programmes and are often compulsory and linked to the condition of employment [19]. It is pointed out that technology enhanced programmes are believed to can enhance teaching and learning [20].
Literature points out that, capacitating lecturers in the use of ICT needs continuous support through training programmes [21]. This author further indicates that the ICT policy for teaching and learning is fundamental. It is important therefore, that this is not only for the short term but covers lecturers’ entire careers. In fact, it is posited that professional development should have a long-term objective aimed at the development throughout the career [22]. With respect to continuously capacitating programmes different countries have developed policies to ensure that lecturers are empowered throughout their careers. For instance, in countries such as USA, UK, Korea and Australia, have seen the need to integrate ICT and developed policies as well as standards for the teachers [23] In Hong Kong in fact, these programmes are mandatory for lecturers [24]. In spite of the need for mandatory programmes for lecturers, problems do come up. For example, in the USA, it was found that INSET programmes were chosen by administrators and these had no barring to what lecturers needed [25] Furthermore, programmes are offered by outsiders identified by administrators and in most instances, these are found to be boring and irrelevant by lecturers [26],

2.1.2 Technology-enhanced teaching strategies

Teaching with technology utilizing technology to harness teaching and learning [27]; [28]. It is using technology in context [4] Examples of the technology enhanced models are: Technology Acceptance Model (TAM) [29] the Technology-Organization-Environment (TOE) framework [30], Rogers’ Innovation Diffusion Theory (IDT) [31], the Unified Theory of Acceptance and Use of Technology (UTAUT) ([32] Technological, Pedagogical and Content Knowledge (TPACK) [4] as well as network-based pedagogies [33]). These technology-enhanced teaching strategies have been explored in higher education [27]. These authors indicate that the latter strategies have been explored in the higher education

2.1.3 Technology-enhanced learning approaches for student teachers

Technology enhanced learning approaches are different ways in which students interact using different technologies to acquire knowledge [3] Conducive environment is created for student teachers to acquire 21st century skills for technology integration. They must be given an opportunity to explore and engage effectively to create new knowledge [34]; [9]; [35]. Also, the student teachers should be assisted to cope with technologies that are evolving at a rapid speed [36]

Figure1. TPACK Framework (adapted from [4])

2.1.4 Theoretical Framework - Technological, Pedagogical and Content Knowledge (TPACK)

Technological, Pedagogical and Content Framework (TPACK) is a conceptual framework that stipulates the three knowledge domains a teacher should possess to successfully integrate technology into teaching. [4]. This framework is used to describe the interaction and the integration of the main three domains of knowledge [37] It is argued that the interaction and the integration of pedagogical knowledge (PK), content knowledge(CK) and technology knowledge (TK)are necessary for successful teaching and learning and the teachers should therefore acquire the 21st technology skills for successful integration. [38]. Hence the Pedagogic content knowledge (PCK) framework invented by [39] was further developed into TPACK by incorporating the technology knowledge. TPACK does not only focus on what knowledge a teacher must possess but also on how to acquire that specific
knowledge. The three domains of knowledge in their model, namely, content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK) were amalgamated and that resulted into four more knowledge domains namely, pedagogical content knowledge (knowledge (TPK), technological content knowledge (TCK), and technological pedagogical content knowledge (TPACK) [4]. TPACK is therefore the framework which (The seven knowledge bases are represented in figure 1.

2.1.5 Technological Knowledge

Technology knowledge is more than what technology is but also how it is used for teaching and learning [13], it is stated that some lecturers use the technologies primarily as teaching aids not as tools that will enhance the learning experience. Lecturers must possess this critical knowledge for them to render a good service to student teachers, they need more than basic technological knowledge [40]; and [41] The lecturer in this case is perceived as the agency that can bring about transformation in the classroom using the technological tools [42]. It is further stated that lecturers will only be able to accomplish this mandate when they are capacitated through the on-going development programmes.

3 RESEARCH QUESTION

To what extent does the lectures’ technological knowledge impacts on the teaching of student teachers in the school of education?

4 RESEARCH METHODOLOGY

The mixed method approach was used For the quantitative data, an adopted standardized TPACK questionnaire was used to collect data and was analyzed using SPSS. The reliability of a TPACK instrument was computed by a Cronbach’s alpha, α values range between .81 and .92. For the content validity the Kaiser- Meyer-Oklin and Bartlett’s test of sphericity were computed. To collect the qualitative data, the semi-structured individual interviews were conducted. The qualitative data were analyzed using Atlas.ti.

4.1 Participants

For quantitative data collection, there were 37 lecturers from the school of Education in South Africa who participated in the online survey, were selected using stratified random sampling. The females were more (67%) than males. The majority (75.7%) of participants were Africans. More than half (56.8%) of the participants were from the Department of Technology Vocational Education followed by (21.6%), from the Science and Business and the same (10.8%). from the Primary Education and Education Foundation departments. The participants ages ranged from 20-30 (13.5%); 31-40 (5.4%, 41-50 (35.1%); 51-60 (35.1 and 60+ were (10.8%). Lecturers from Technology and Vocational Department (TVE) were more than half (56.8%), followed by the (21.6%) Mathematics, Science, and Business Education (MSBE) and Education Foundation and Primary Education which consisted of (10.8%0 each. The full- time lecturers were (64.9%) more than half and (54%) of them have a doctoral degree.

4.1.1 Instrument and procedure

The TPACK survey questionnaire that was used in this study consisted of seven subscales that measured technological knowledge, content knowledge, pedagogical knowledge, pedagogical content knowledge, technological pedagogical knowledge, technological pedagogical content knowledge [44] The focus of this study was on TPK and it consists of five items:

- TPK1: I know how to select effective teaching approaches to guide student thinking and learning in my subject areas
- TPK2: I can create opportunities for students to use digital technology for individualized learning.
- TPK3: I can create opportunities for my students to participate in online discussions.
- TPK4: I can create opportunities for students to collaborate online to produce project work.
- TPK5: I can create online activities that provide immediate feedback to student
A 5- Likert-type scale rating from 1: Strongly Agree and 5: Strongly disagree was provided. The reliability of a TPACK instrument was computed by a Cronbach’s alpha (Cronbach, 1951), $\alpha$ values range between .81 and .92. For the content validity the Kaiser-Meyer-Otlin and Bartlett’s test of sphericity were computed.

For qualitative data collection, 18 lectures were interviewed in the School of Education in the Study University of Technology in South Africa. These participants were selected using the Convenient, Purposeful Sampling and a standardized questionnaire was used.

5 RESULTS

5.1 Quantitative Results

In Question1, lecturer were requested to respond to the question: Can lecturers create opportunities for the students to participate in online discussions? The results show that less than half 48.6% strongly agree and agree that they can create opportunities for students to collaborate online to produce project. On the other hand, some of the lecturers 27% were not sure if they can create such opportunities for student teachers to collaborate online and develop projects and 13.5% disagree and 10.8%) strongly disagree that they can create opportunities for the student to collaborate on-line and create projects. In terms of (TCK), the results as demonstrated in table1, reveal that more than half (62%) of the participants are familiar with animations or videos I can use to help students understand concepts in the content to be learned. On the other hand, the TPCK findings revealed that more than half (58.5%) can choose technologies that improve the quality of the content of a lesson and more than half (64.8%) as well can create lessons that allow students of different abilities to be able to learn with content that is at the right level of difficulty.

<table>
<thead>
<tr>
<th>Table 1. Frequency distribution (%) of Technology Pedagogical and Content Knowledge and Technology Content knowledge</th>
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<tbody>
<tr>
<td><strong>Strongly Agree</strong></td>
</tr>
<tr>
<td><strong>Technology Content Knowledge</strong></td>
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<tr>
<td>(31) I am familiar with computer simulations and n that may help students to understand subject cont</td>
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<tr>
<td>(34) I am familiar with animations or videos I can use to help students understand concepts in the content to be learned</td>
</tr>
<tr>
<td>(32) I am familiar with mind mapping or concept mapping software that help students to learn about relationships between concepts and ideas.</td>
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<tr>
<td>I find mobile device useful in teaching &amp; learning</td>
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<tr>
<td><strong>Technology Pedagogical and Content Knowledge</strong></td>
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<tr>
<td>(7) I can choose a combination of pedagogy and technology to match the content I want to teach.</td>
</tr>
<tr>
<td>(10) I can choose technologies that improve the quality of the content of a lesson.</td>
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<td>(33) I can create technology-enhanced lessons that are student centered</td>
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<tr>
<td>(24) I can create lessons that allow students of different abilities to be able to learn with content that is at the right level of difficulty.</td>
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<tr>
<td>(35) I can create technology-enhanced lessons that allow students to learn at their own pace</td>
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<td>(36) can use technology to create rehearsal and practice classroom activities that provide computer feedback to students</td>
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<td>(3)I can use digital technology to create lessons</td>
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that use less time than traditional lessons to achieve learning outcomes.

(5) I use digital technology in my lessons to ensure that students have opportunities to be active rather than passive learners.

5.2 Qualitative Findings

In Question 2, lecturers were requested to provide information about the workshop they attended on the integration of technology. The findings demonstrated in Figure 1 revealed that some of the participants did not attend workshops on technology integration for teaching and learning. In this case Teacher Nkosi said “No as we have limited access, we have not attended any orientation on the integration of technology”. Some of the lecturers did not explain but indicated “no”. The findings also show some of the participants were not sure as they said “I am not sure if I attended the workshop. However, some of the participants indicated that “Yes, attended the workshop on the integration of technology.” They indicated that they were taught how to use “PowerPoint Presentation and the projector to teach”; “In-house Haaga–Helia and License to Teach workshops”; “WebCT2005/Imfundo workshop” and “License to Teach”

![Diagram showing training attended on technology integration]

Figure 2. Training attended on the technology integration

In Question 3, lecturers were asked: Which other technologies that you were empowered on? The results in Figure 3 shows that although some of the lecturers indicated that they were “not empowered” to use technology tools, others reported that they were also empowered on “the Padlet, Google forms, laptop and library system, projector and Nettop, Compasses; interactive whiteboard, computer integrated system, podium “and one of them indicated he was “empowered on” projector and smartboard”. 
6 DISCUSSION

The quantitative results show that less than half (48.6%) of the teachers can create opportunities for students to collaborate online to produce project work. These results are consistent with the qualitative results as they indicated that some of the lecturers did not attend workshops on the integration of technology. Literature points out that, capacitating lecturers in the use of ICT needs continuous support through training programmes [21]. Although some indicated that they attended Imfundo workshops on the integration of technology, it is important to note that this workshop focuses on the use of the Blackboard Learning Management system used in the Study University as a tool to communicate with students and upload the learning material. Some of the lecturers use it to administer e-assessment. However, this knowledge of the use of Imfundo cannot assist the student teachers when deployed to schools. Others indicated that they had limited access to technology in the lecture halls, they did not have technologies available to can use in their teaching. The lack of relevant technologies in the lecture halls is one of the deterrents of the integration of technology, resources must be available to the lecturers and student teachers for the integration to take place [3]. Others only indicated that they were shown how to use the Power-point presentation and the data projector to teach. Some lecturers indicated that they attended Haaga-Helia post graduate certification program, an in-service program offered by the study university to capacitate lecturers. In this program, some of the digital technologies are demonstrated to the lecturers. However, this program is not mandatory. It was also revealed that other lecturers attended License to teach, a development program that is offered to the newly appointed academics only, by the Study university. This program does not offer the 21century technology skills.

A follow up question on the other technologies that the lecturers were empowered on, revealed that they were empowered on “the Padlet, Google forms and library system.” Accessing information that is in the library anytime from anywhere promotes effective learning and laptop and library system are useful tools for research purposes. The e library system allows the students to access -library from anywhere at any time, [3] Nettop is a software that allows lecturers to interact with students provided they also have computer workstations in class. One of the participants indicated that he was capacitated on the use of smartboard in his previous workplace. A smartboard is one of the current technologies used at schools [45]. Lecturers need to be able to use smartboards and tablets as the 21century technologies to capacitate the student teachers before they are deployed to schools [3].

7 CONCLUSION

The purpose of this study was to investigate lecturers’ technological knowledge towards the teaching of student teachers at a study university of technology in the school of education in South Africa. The results show that in terms of Technological Pedagogical knowledge, less than half (48.6%) do possess technological knowledge as the results indicated that they can create opportunities for students to collaborate online to produce project work. However, results also reveals the different technological
tools that lecturers were empowered on in the School of Education. These tools are not in alignment with those currently used at schools. More than half cannot integrate as they indicated that they did not attend training, and some were not sure whether the attendance was for the integration of technology. There is no evidence that there are mandatory development programmes on the integration of technology at a study university of technology. Hence, the student teachers are not prepared for the reality in their future workplaces. Digital revolution is rapidly changing our lives even in education. Therefore, lecturers must adapt to the new development brought about by technology revolution for the student teachers to imitate them when they are deployed to schools for teaching practice. It may be concluded that the university must invest on the compulsory ongoing technology enhanced development programmes for lecturers and student teachers.

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