INVESTIGATING THE INTEGRATION OF IPAD AMONG MATHEMATICS TEACHERS IN A SECONDARY SCHOOL IN SAUDI ARABIA BASED ON TPACK MODEL

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Abstract

This paper presents some of the preliminary results of a pilot study investigating in-service teachers' levels of technological pedagogical and content knowledge (TPACK) among mathematics teachers in a secondary school in Saudi Arabia. The qualitative data was collected from three mathematics teachers who used iPad in teaching mathematics by using a semi-instructed interview and analysed by thematic analysis.

TPACK framework aims to support the integration of technology into a classroom (Koehler & Mishra, 2009). Teachers who know about TPACK can combine their knowledge of Information and Communications Technology (ICT) with their content and pedagogical knowledge to more easily promote students' learning (Graham et al., 2012).

Seven elements were identified to analyse the factors influencing in-service teachers' iPad integration in classrooms. The first is related to technological knowledge. This included issues such as how teachers know about digital technology. The second element is related to content knowledge. This includes issues such as teachers' knowledge about the actual subject matter, various strategies for developing teachers understanding and how teachers plan the structure of concepts. The third element is about pedagogical knowledge which explores students' performance and management of the classroom environment. The fourth element is related to pedagogical content knowledge. This includes details about an understanding of the topic, anticipating student misconceptions within a topic and identifying connections between various concepts in teachers' subject matter. The fifth element is about technological content knowledge. It explains more about using technologies such as iPad for teaching and enhancing the understanding of specific concepts. The sixth element is related to technological pedagogical knowledge and how teachers can choose technologies to enhance the teaching and learning approaches for a lesson. The final element is technological pedagogical content knowledge, and it covers how teachers teach lessons that appropriately combine teachers' subject matter, technologies, and teaching approaches.

The research is essential in upgrading the teachers’ competencies in technology skills, primarily to promote students learning. It is crucial to understand TPACK before the iPad can be integrated successfully in schools. One of the preliminary results is that teachers know the useful technologies for teaching specific concepts in their subject matter and how to use them from co-workers. The study will show how teachers' training and teaching experience were effective factors for mathematics teachers in a secondary school, how the TPACK framework helped with this.

The Ministry of Education (MOE) of Saudi Arabia is currently coping with a wave of educational reforms, which aim to improve the teaching and learning of all in-service teachers. ICT is key to Saudi Arabia's National Transformation Program under Vision 2030. Saudi Arabia’s Vision 2030 initiative is a long-term economic blueprint designed to curtail the country’s dependence on oil. MOE is attempting to maintain its academic excellence at par with other developed nations. Furthermore, ICT literacy enhances classroom teaching and learning via dynamic, interactive and engaging content that can promote experimentation, innovation and best practices. This research illuminates how teachers' understanding of TPACK can support ICT literacy development in classrooms.

Keywords: TPACK, iPad, Tablet, ICT, Technology, Teaching Mathematics, Mathematics Teacher, Mobile Learning.

1 INTRODUCTION

Over the past few years, the education sector has been much concerned about the integration of Information and Communications Technology (ICT) in educational practice, as education is becoming highly dependent on ICT. Numerous educational policies are used in different parts of the world to
ensure the efficient utilization of ICT in the classroom, but still, there are many risks involved limiting the successful integration of technology [1]. According to Petrina [2], there are numerous reasons behind the ineffective utilisation of advanced technology in the classroom, such as lack of access to information and communication technology, higher cost, and the time-consuming process. These proved to be some major reasons in this regard. Garba et al. [1], argued that most educational institutions have addressed the issue of lack of access, and technology usage in the classroom is considered as a basic educational practice now. However, most of the educators are still facing difficulties to integrate ICT despite having necessary tools like iPad, personal computers and internet facilities [3].

Mishrah and Koehler [4] suggest a lack of conceptual and theoretical models seems to be a major obstacle in the way of technology integration by teachers in the classroom. So, they have developed a framework Technology, Pedagogy and Content Knowledge (TPACK), emphasizing three different aspects: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). The differentiation among these three aspects is vital to realise how content (what is being taught) and pedagogy (how the content is communicated) underpins the integration of education technology effectively. The main aim of this framework is to offer a productive approach to deal with dilemmas faced by teachers in the classroom during the integration of technology [5]. Basically, TPACK combines pedagogy and knowledge with ICT, which ultimately allows the teachers to develop a level of pedagogical knowledge as well as enhance the learning capacity of students (Graham et al., 2009). Teachers who know about TPACK can combine their knowledge of ICT with their content and pedagogical knowledge more easily and increase their capacity to promote students’ learning [6].

Recently, new developments in the education sector allow students to use their personal devices i.e. iPhones and iPads in the classroom for education purpose. With this accomplishment, many new possibilities arise for the integration of technology in an education setting [7]. Northrop and Killeen [8] found iPad usage with the combination of a teaching strategy is beneficial to enhance learning of the students. They emphasized the importance of feedback, guidance and interaction in education, and all these aspects could be attained with effective integration of technology. Similarly, Maher [7] illustrated how elements of TPACK are used by teachers to integrate the iPad technology in the classroom and how the students responded to this technology by providing immediate feedback, demonstrating knowledge, and exploring concepts, suggesting the usefulness of this technology in the classroom. Furthermore, they argue that iPad learning enhances classroom study experience via dynamic, interactive and engaging content that can promote experimentation, innovation and best practices.

As ICT was shown to be a beneficial tool in the education sector, so both developed and developing countries are working towards the integration of information and communication technology in their educational institution. Similarly, the Ministry of Education (MOE) Saudi Arabia is also coping with a wave of educational reforms, which aim to improve the teaching and learning of all in-service teachers with technology. So, ICT is key to Saudi Arabia’s National Transformation Program under Vision 2030, as this initiative is a long-term economic blueprint designed to curtail the country’s dependence on oil. MOE is attempting to maintain its academic excellence at par with other developed nations by organising a planned change from teaching methods to administrative procedures of their educational system. This research illuminates how teachers’ understanding of TPACK can support ICT literacy development in order to reform education and how TPACK could be a useful tool for the integration of iPad among mathematics teachers in a secondary school of Saudi Arabia. Following are two major questions of this research report,

- What are the in-service teachers’ levels of TPACK among Mathematics teachers? and;
- How is the in-service teachers’ satisfaction when using TPACK model to guide their teaching of Mathematics?

2 METHODOLOGY

The primary research approach used in the study involved semi-structured interviews. The target population was teachers working in secondary school and using iPad for teaching. The purposeful sampling method is used for the selection of respondents from this targeted population. Purposeful sampling, also known as judgmental sampling, is a useful technique for qualitative research as it enables the researcher to select a sample based on certain characteristics. These characteristics/criteria are identified based on the researcher’s own judgement according to the nature of the study [9]. Therefore, the participants of this research are selected based on their teaching experience in secondary school and the subject of teaching, i.e. to be a participant one must be a math teacher and must possess an
experience of three years. The sample of the study is three mathematics teachers, having a teaching experience of three years in a secondary school.

Further, the next step is the selection of an appropriate method for the collection of the primary data from the respondents. Primary data can be collected in different ways, but this study has adopted the qualitative method to get in-depth and detailed information from the respondents. The main reason behind the selection of the primary approach was the collection of most relevant information directly from the respondents, whereas qualitative data was helpful to comprehend the underlying research issue effectively [9]. For this purpose, a semi-structured interview method is embraced where 20 questions were used to measure the seven different elements of the TPACK model. The questionnaire is developed by emphasizing on two major research questions, i.e. What are the in-service teachers’ levels of TPACK among Mathematics teachers? and; How is the in-service teachers’ satisfaction when using TPACK model to guide their teaching of Mathematics?. The data collected through the interview is documented in the written format and evaluated with the help of thematic analysis. Thematic analysis is useful to identify certain patterns in data while examining and pinpointing the important information. Mainly, seven elements of the TPACK Model are emphasized while analyzing the data through thematic analysis.

3 RESULTS
In order to meet the research aim, qualitative data is collected from three respondents via semi-structured interview analysis. Each interview took around 10 to 15 minutes and their views are recorded in format, which data will be analysed in this section to understand whether TPACK is a useful tool for the integration of iPad and whether the mathematics teachers have enough knowledge about the different elements of TPACK model.

3.1 Thematic Analysis

3.1.1 Technological knowledge

ICT is the key element of the vision of Saudi Arabia’s National Transformation Program. The first category of the interview analysis is Technological Knowledge of teachers in Saudi Arabia. According to the findings of the study, teachers prefer using technology in classes of mathematics because it makes the teaching methodologies more efficient and helpful. ICT literacy enhances classroom teaching and learning via dynamic, interactive and engaging content that can promote experimentation, innovation and best practices. Majority of teachers have an ability to use the technology especially the use of smart board and iPad. However, these technologies are not available at every school.

In addition, the technological knowledge of teachers is limited to the use of smart board and iPads. There are a few who have not been provided with this technology. Majority of the mathematics teachers in secondary schools of Saudi Arabia are not familiar with technical problems and do not have enough capacity to solve them. They have previously studied the techniques of education during their graduate or undergraduate studies but the previous technology is not the same as the new technology. In order to teach students with advanced technology, they have to learn it through self-education from the internet or from their colleagues who know how to solve a problem. Thus, teachers need the training to learn about the programs or applications in order to keep up with advanced technology.

3.1.2 Content knowledge

The second element of the interview analysis is related to content knowledge. This included issues such as teachers’ knowledge about the actual subject matter, various strategies for developing teachers understanding and how teachers plan the structure of concepts. The analysis suggests that teachers have knowledge about the subject matter and they know their subject content. They have learned in their undergraduates studies and they can also get the required help from internet easily. It is because technology has made information sharing easier.

Mathematics teachers are using a variety of teaching methodologies. There is a concept of active education and the teaching session is more than ever interactive. Student's actively participate and provide useful information. However, there are teachers who have to read a lot of new books and ideas to develop their abilities in a specific field. They keep on learning through self-learning, using applications or from a colleague who has experience. Teachers plan the structure of the concepts but it depends on their experience as well. In the beginning, they have to prepare more on the subject content.
but with experience, it becomes easier. Overall, teachers have knowledge about the content of their subject. However, schools should organize training and development programs in order to enable them to excel in their fields and to keep them up-to-date with the newer technology and teaching methodologies.

3.1.3 Pedagogical knowledge

The third category of the interview analysis is about pedagogical knowledge which explores students' performance and management of the classroom environment. The analysis suggests that teachers use assessments during or after the lessons in order to assess the performance of their students. The assessment during the lessons consists of a question about the last lesson and another question about today's lesson. There are monthly and annual tests in order to evaluate the performance level of students.

Teachers are using a number of teaching approaches in the classroom that includes individual learning or group learning strategies. The diversity in the teaching methodologies keeps the students interactive. They participate and focus more when teaching methods differ. The type of teaching methods, however, depends a lot on the type of lesson and the availability of technology in the classroom which is not the same everywhere. However, teachers in secondary school understand that they must build a suitable and friendly classroom environment for students. They also understand the importance of being prepared for the lessons, teaching methods, classroom management and bilingual learning. However, the level of student motivation plays an important role in maintaining the classroom environment. Thus, along with pedagogical knowledge, the availability of resources and teaching training programs are very important.

3.1.4 Pedagogical content knowledge

The fourth category of the interview analysis is related to pedagogical content knowledge. The study analysis suggests that teachers have an understanding of the topic they teach in class. They can produce lessons in order to keep students motivated and engaged. They use iPads and smartboards to make lectures interesting for them. All students are not at the same level of understanding so the same results cannot be expected from them. However, teachers can predict misconceptions of students on a specific topic. They help them to get over their mistakes and give useful feedback. They already know the common mistakes that students can make in a particular lesson, so they are always ready to deal with their mistakes.

Moreover, teachers take into account the individual differences among students and keep on simplifying the problem for students and connecting ideas to each other. They encourage students to do a brainstorm and learn from their own mistakes. They give relevant examples and link the previous and current lessons of mathematical equations to shorten the time and effort in delivering the information to the students. Overall, teachers have an understanding of the topic, they anticipate student misconceptions within a topic and identify connections between various concepts of the lessons.

3.1.5 Technological content knowledge

The fifth category of interview analysis is technological content knowledge. The study analysis suggests that modern technologies were not available at University for teachers, therefore, they need continuous courses for new technology. Teachers understand that they are not capable of using all the technologies so they focus on which they can from internet or colleagues. The lack of useful courses on how to use modern technology in mathematics is a serious problem. Teachers are surprised when someone tells them about a particular application they can use to teach a lesson. It is because they don’t know about technology much and how it makes the lesson simpler and easier.

Moreover, teachers are motivated to learn from their peers and technical support staff about new programs. They use the iPad to explain certain topics in mathematics and connecting the iPad to a projector makes it easier for them to present the lesson properly. Teachers observe time efficiency by comparison of teaching the concept before and after the technique. Teachers can now deliver a lesson in a few minutes which used to take the whole class to be explained. They understand that it is necessary to search the Internet to see how technology will be used in mathematics. They keep on consulting their colleagues who have previously taught the same course in order to learn better ways of teaching. Thus, teachers have knowledge about the use of technologies such as iPad for teaching and they know how to enhance the understanding of specific concepts.
3.1.6 Technological pedagogical knowledge

The sixth category of the analysis is related to technological pedagogical knowledge. The study analysis suggests that teachers understand that they need more education, knowledge and training. Every day they see new programs and applications but they do not know the useful ones, which can help them more in a classroom. However, they try to learn as much from their peers as possible. Their colleagues who know better use of technology teach them how to use the technology correctly and appropriately for a particular lesson. However, teachers practice well at home in order to determine the validity of new technology before applying the technique to the students. They analyse the technology if it is suitable for a particular lesson or not. They understand that they first need to create a class environment and manage it properly. They try to know the technique correctly and acquire sufficient information to implement successfully. Thus, teachers know how to choose technologies to enhance the teaching and learning approaches for a lesson. However, they need training and availability of resources.

3.1.7 Technological pedagogical content knowledge

The last category of the analysis is technological pedagogical content knowledge. The study analysis suggests that technology is used by teachers in order to minimize the efforts of a teacher and a student to communicate and understand the information. However, it depends upon teachers' understanding of the information, their experience, teaching methods and availability of resources. Good planning and management, technical knowledge, knowledge of teaching methods, full knowledge of the subject and iPads are the tools teachers use in order to teach a lesson in high schools. The technical information teachers studied at university studies is not compatible with the current technology. There is a limited practical application of the programs they studied. The training courses were just a list of information and there is no practical work.

Thus, today a lot of brainstorming on a teaching strategy, its implementation, teaching experience and insistence on applying a method, is required to use new technology effectively. Therefore, the teacher currently needs continuous courses to keep pace with the daily development of programs, applications and technology in order to benefit from what is new. Teachers need the availability of technology in Saudi schools in order to choose the appropriate technology. Overall, teachers teach lessons that appropriately combine teachers' subject matter, technologies, and teaching approaches.

4 CONCLUSIONS

From the above discussion, it has been concluded that teachers have knowledge about the content of their subject. They have knowledge about the use of technologies such as iPad for teaching and they know how to enhance the understanding of specific concepts. They also have an understanding of the topic, they anticipate the student misconceptions within a topic and identify connections between various concepts of the lessons. They teach lessons that appropriately combine teachers' subject matter, technologies, and teaching approaches. However, there is a call to increase courses for teachers on how to use technology in the field of specialization, not in general, in order to make use of efficient applications in iPad. Teachers need training to learn about the programs or applications in order to keep up with the advanced technology because they lack the experience on how to take advantage of technology properly and sometimes it is difficult to obtain information through self-education. The school management should organize special courses for teachers for each speciality. It's the age of technology and accelerating information so teachers need to be updated and they should be given the training to keep up with the newer technology and teaching methodologies. So, it is evident from the results that it is crucial for teachers to understand TPACK model to help with the integration of iPad in schools as it is also a useful framework for the effective training and teaching experience of mathematics teachers.

REFERENCES


