Technological Pedagogical Content Knowledge (TPACK) and Online Curriculum Integration Readiness in a Higher Education Context

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Abstract

According to the Saudi Ministry of Education [1], online education is expected to become the primary means of teaching and learning in the post-pandemic world. However, "the faculty in various universities in Saudi lack the basic knowledge needed for e-learning", [2, p.8]. Furthermore, few studies have examined whether Saudi teachers have the necessary pedagogical knowledge to implement digital curricula. The present study examines whether Saudi teachers possess the three dimensions of technological pedagogical content knowledge (TPACK), technological pedagogical knowledge (TPK), technological content knowledge (TCK) and pedagogical content knowledge (PCK), as well as assesses their competency in delivering online curricula. The qualitative and quantitative data were from 350 in-service teachers from humanities departments at four Saudi universities. A quantitative online survey assessed teachers' online curriculum integration readiness. In addition, 20 semi-structured qualitative interviews explored factors affecting the teachers' efficacy. The findings showed low competencies in online curriculum integration. The main challenges to attaining acceptable curriculum integration included a lack of online learning and teaching policies, regulations, curriculum guidelines, pedagogical approaches and strategies and teacher training. The study implications include valuable information about designing and delivering digital content.

Keywords: *TPACK, curriculum developers, policymakers, online curriculum integration, teachers' competencies.*

1. Introduction

Implementing a technology-integrated curriculum requires active teacher involvement where successfully implementing curricula into technology relies on teacher readiness and efficacy [3]. To test teachers' competences in technology integration, using the most widespread assessment model, the technological pedagogical and content knowledge (TPACK) framework [4], which was proposed by Mishra and Koehler [5]. According to Harris and Hofer [6, p. 212], "TPACK is a specialized, highly applied type of knowledge that supports content-based technology integration." It aids in the examination of teaching competencies, such as the instructors' perceived skills, knowledge, and attitudes. It also highlights the complex relationship between three main components of a learning environment: technological knowledge (TK), pedagogical knowledge (PK) and content knowledge (CK) [5]. As such, it is useful as a guide to design online courses and materials while offering a new perspective about how teachers can use technology in the classroom [7], [5].

Because of the Saudi Ministry of Education's [1] decision to integrate technology into learning environments, this study examined the quantitative and qualitative factors that affect teacher readiness and efficacy related to a technology-integrated curriculum. Furthermore, the research focused on teachers' technical and pedagogical readiness related to curriculum integration and assessed their competencies in terms of the implementation, facilitation and assessment of online curricula by examining three components of the TPACK framework knowledge areas: technological content knowledge (TCK), pedagogical content knowledge (PCK), and technological pedagogical knowledge (TPK) (see Fig 1). TCK refers to "knowledge of how technology can create new representations for specific content. It suggests that teachers understand … they can change the way learners' practice and understand concepts" [8, p. 125]. PCK is knowledge about curriculum development and student assessment, that is, teachers can identify best practices for teaching a given subject. TPK is knowledge about how teaching and learning can change when using specific technologies as well as knowledge about how to use digital tools for the desired learning outcomes.

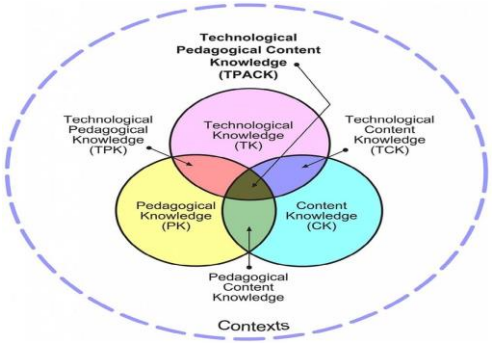

Figure 1 TPACK framework [Koehler & Mishra, 5]

2. Methodology

2.1 Participants

For the present study, the author randomly selected 350 in-service male participants from humanities departments which consist of two sections which are Arts and Humanities departments of four Saudi universities. The study sample included participants from Arts (n = 210) and Humanities faculties (n =149). The participants had an average of 2 years of online teaching experience and used the learning management system to upload lectures and mark student assignments.

2.2 Data collection and analysis

The researcher used a combination of qualitative and quantitative approaches. Two instruments were utilized to examine teachers' pedagogical and technical readiness to implement online curricula: a TPACK survey and semi-structured interviews. The survey concentrated on TCK, PCK, and TPK to examine teachers' ability in implement e-curriculum into technology. The researcher adopted Archambault and Crippen's [7] TPACK self-efficiency scale and a five-point conformity scale, which ranged from 0 (strongly disagree) to 5 (strongly agree). To measure their readiness, the means and standard deviations (SD) were used which the results divided into three scales; high readiness ranged from 3.50 – 5.00, moderate level ranged from 2.50 to 3.49, and low level 1.00 to 2.49. MANOVA were utilized to test the statistical relationship of TCK, PCK, and TPK between Arts and Humanities teachers.

Semi-structured interviews and thematical analysis gained greater insights into teacher readiness and identified factors that influence their efficiency [9]. This interview format provided the participants with flexibility when sharing their experiences and ascertained participants' viewpoints and insights about institutional factors affecting their ability to adopt a new e-learning curriculum.

3. Results

Table 1 shows the mean values with SD for the teachers' TCK responses; results for all three questions were similar, and no statistical difference was found between them. The mean score for each question was approximately 2, indicating a low level of readiness to adopt a digital curriculum.

Q	Survey items	Mean	SD
1	My ability to use technological representations (i.e., multimedia, visual demonstrations) to demonstrate specific concepts in my content area	2.03	0.447
2	My ability to implement the district curriculum in an online environment	2.04	0.436
3	My ability to use various courseware programs (e.g., Blackboard, Centra) to deliver instruction	2.04	0.440

Table 1. Mean and SD of teachers' TCK

Table 2 shows the mean values with SD for the teachers' PCK responses. The mean scores for all four questions were similar and ranged between 3.28 and 3.42, indicating moderate level of readiness.

Q	Survey items	Mean	SD
4	My ability to distinguish between correct and incorrect problem-solving attempts by students	3.28	1.30
5	My ability to anticipate likely misconceptions by students on a particular topic	3.42	1.30
6	My ability to comfortably produce lesson plans with an appreciation for the topic	3.38	1.33
7	My ability to assist students in noticing connections between various concepts in a curriculum	3.35	1.29

Table 2. Mean and SD of teachers' PCK

Table 3 shows the mean values with SD for the teachers' TPK responses. The mean scores for these questions ranged from 2.00 to 2.06, indicating a low level of readiness.

Q	Survey Item	Mean	SD
8	My ability to create an online environment which allows students to build new knowledge and skills	2.02	0.441
9	My ability to implement different methods of teaching online	2.05	0.482
10	My ability to moderate online interactivity among students	2.05	0.476
11	My ability to encourage online interactivity among students' technological pedagogical content knowledge	2.04	0.520
12	My ability to use online student assessments to modify instruction	2.05	0.499
13	My ability to use technology to predict students' skills/understanding of a particular topic	2.06	0.492
14	My ability to use technology to create effective representations of content that depart from textbook knowledge	2.00	0.519
15	My ability to meet the overall demands of online teaching	2.01	0.589

Table 3. Mean and SD values of teachers' TPK

Table 4 shows the means and SD of three components of the TPACK framework for each area of specialty where teachers show moderate readiness in PCK and low readiness in TCK and TPK.

Area of Specialty		Mean	SD
Humanities	TCK	2.07	0.21
	PCK	3.40	1.22
	TPK	2.06	0.26
Arts	TCK	2.02	0.32
	PCK	3.42	1.25
	TPK	2.03	0.27

Table 4. Descriptive statistics regarding of teachers' readiness of area of speciality

Table 5 shows the factorial MANOVA results for the teachers' readiness to implement a digital curriculum with respect to their specialty area. The independent variable was area of speciality. The table's last column shows the statistical significance related to the specialty areas. For TCK, the result was not statistically significant (p = 0.079). For PCK, the results were also not significant (p = 0.737). The results for TPK were also not significant (p = 0.246). Thus, at a 5% level of significance, we can conclude that there is no difference in the readiness of teachers to adopt a digital curriculum with respect to their area of speciality.

Source	Dependent variable	Type III Sum of Squares	d.f.	Mean Square	F	Sig.
Area of specialty	TCK	0.238	1	0.238	3.109	0.079
	PCK	0.007	1	0.007	0.113	0.737
	TPK	0.096	1	0.096	1.349	0.246

Table 5. The result of MANOVA test

3.1 Factors affecting teacher readiness to implement e-learning curriculum

3.1.1 Technology-integrated curriculum policies and regulations

According to the participants, Saudi higher education institutions do not have a clear e-learning vision or regulations related to technology-integrated curricula. The participants highlighted the importance of a vision for guiding the integration of e-learning curricula into technology and justifying decisions about how to activate technology and how to integrate online curricula. Teachers noted that these measures would illustrate the value of e-learning and clearly articulate each institution's strategy, which would, in turn, positively affect their readiness.

Regarding policies and regulations, the participants expressed three main recommendations. First, e-learning policies must have a strategic approach that allows for e-curriculum development and clarifies teaching practices and teacher responsibilities related to technology integration and online curriculum creation and integration. Second, e-learning regulations should help create a learning environment centred on students, indicating that "Saudi students are passive, waiting for the teachers to navigate their learning." Third, policies should activate best practices for e-learning, as illustrated in the following section.

3.1.2 Policies related to best practices for e-learning curriculums

According to the participants, policies should reflect best practices by emphasising three factors. First, officials must create a broad array of e-learning standards to model and incorporate online syllabi into e-learning. These standards should help to formulate strategies for creating technology-integrated curriculum ecosystems that enable interaction with e-learning resources. Second, these regulations should emphasise teachers' and students' social existence. Officials need to ensure that teachers and learners communicate during the e-course to improve the online learning process, so there's a lively e-curriculum ecosystem that enhances constant communication.

Third, policymakers should formulate evaluation parameters to ensure the e-curriculum model is well-matched with learning objectives. Student and e-curriculum evaluations must be before the course beginning and continue throughout the course. E-learning guidelines should emphasise assessments of novel methods for using e-learning resources, assist in continuous regulation and evaluation and verify that students fulfill course requirements.

3.1.3 Training on pedagogical approaches and strategies for e-learning

The massive unplanned process of transitioning traditional learning into e-learning "is not a similar matter of exchanging paper tasks" (from one teacher). Therefore, according to the participants, teachers need training on instructional design and effective knowledge for delivering e-learning curricula and creating assessment instruments.

3.1.3.1 Instructional design

According to the participants, there is a shortage of training sessions that help teachers develop skills for designing, implementing and testing important instructional tools and materials, including instructional methods to evaluate the merits and weaknesses of e-curricula. Teachers should also have the criteria for piloting online materials as well as learning objectives. They stated the adaptable quality of training helped the teacher to modify e-curriculums in a short period of time and led to enhance course contents during semesters.

3.1.3.2 Effective pedagogical uses of e-technology

Given the absence of e-learning regulations, the participants found it difficult to choose suitable scaffolds to accommodate students' various learning styles. Therefore, emphasis should be upon the student-centred methods in the learning process. Regarding instructional scaffolding, the participants recommended shifting from the teacher as the dominant subject matter expert to a dynamic with the students as a facilitator. However, as courses move away from teacher-directed instruction, it is essential to integrate instructional scaffolding into online courses to increase cognitive and social skills.

3.1.3.3 Assessment instruments

Unlike in the traditional learning setting, the participants expressed a need to design and be train for three types of assessments suitable for online environments. The first type should assess the e-learning contents, including activity plans, the e-learning guidelines and e-curriculum enhancement and the application of the e-syllabus. The second type should determine whether students achieved the desired learning outcomes and assess the pedagogical process. The third type should be a self-assessment that helps learners judge their performance and identify their strengths and weaknesses.

4. Discussion, implications and conclusion

The result indicated that e-learning policies, teacher training, and proper pedagogical uses, assessment tools and procedure of e-learning play a vital role in guiding the teachers' readiness to integrate e-learning curriculums into technology. Therefore, Saudi must develop a national vision that outlines e-learning curriculum objectives and standards. The study showed there is a need for e-learning policies that contribute to consistent and clear best practices and facilitate communication between stakeholders. Policies should address 1) a vision and a strategic plan; 2) the principles of e-curriculum design, proper development schemes, implementation and evaluation; 3) professional teachers' development; and 4) accreditation and e-curriculum quality. Furthermore, all stakeholders should participate in this policy to foster dynamic involvement and engagement between stakeholders from the educational public and private segments.

An essential aspect of curriculum implementation is teachers' competence in designing, implementing and evaluating e-curricular effectiveness. Therefore, teachers must be well-trained in technological skills related to instructional design and e-learning content. Teachers should also know how to use learning theories to develop innovative learning methods. In addition, they should have skills related to analysing learning objectives and instructional strategies and transfer these skills to learners. Therefore, a dynamic balance between technology and pedagogy is necessary to identify the best practices for an e-learning environment.

In addition, learning materials must be designed to help learners communicate and use their knowledge to solve problems and develop metacognitive abilities. Furthermore, students should participate in peer and self-evaluation, taking responsibility for their learning. Teachers should direct students in their activities while allowing them to negotiate their points of view; this approach might help students develop logical and communicative abilities and a feeling of ownership. Overall, Saudi policymakers should focus on teacher readiness related to the integration of e-learning resources, especially if the e-learning ecosystem is rigorous.

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