ALIGNMENT OF TEACHER EDUCATION PROGRAMS AT A LEBANESE UNIVERSITY WITH THE TPACK FRAMEWORK

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Abstract. This study examines the perceived TPACK levels of pre-service teachers at a private university in Lebanon and the extent to which this university's teacher education programs (TEP) align with the TPACK framework (Technological Pedagogical and Content Knowledge). It also examines the ability of the university to prepare pre-service teachers to integrate technology into their future teaching. A mixed-method (triangulation) approach was used for this study. Quantitative data were collected by means of a TPACK survey completed by 187 pre-service teachers. Qualitative data were collected from interviews with six administrators, 21 teacher educators and 57 pre-service teachers, as well as document analysis of 45 undergraduate and postgraduate TEP course syllabi. Our survey results indicate that pre-service teachers have a positive perception of their own TPACK level. Our interview findings suggest that most pre-service teachers consider themselves competent in using technology, that their TEP has prepared them to integrate technology into their future teaching, and that they are ready to implement it. However, our syllabi analysis shows that TEP curricula emphasize pedagogy and content over technology. Also, unlike CK, which was addressed in all syllabi (followed by PK and PCK), the TPACK framework was not addressed in any course outcome.

Keywords: TPACK framework. Technological Pedagogical Content Knowledge, Teacher education programs, Higher education, Pre-service teachers.

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Resumen. Este estudio tiene como objetivo estudiar el nivel percibido de TPACK (Conocimiento Tecnológico Pedagógico y del Contenido) de los futuros maestros y la alineación de los programas de formación docente (TEP) en una universidad privada, en Líbano, con el marco TPACK, así como su capacidad para preparar a los futuros maestros para integrar la tecnología en su enseñanza futura. Se adoptó un enfoque de triangulación de métodos mixtos. Se recopilaron datos cuantitativos basados en la encuesta TPACK respondida por 187 futuros maestros. Se recopilaron datos cualitativos a partir de entrevistas con 6 administradores, 21 educadores y 57 futuros maestros, además del análisis de documentos de 45 programas de cursos de TEP de pregrado y posgrado. Los resultados de la encuesta muestran que los futuros maestros tienen una percepción positiva de su propio nivel de TPACK. Por otro lado, las entrevistas muestran que la mayoría de los futuros maestros creen que son competentes en el uso de la tecnología. También creen que el TEP los ha preparado para integrar la tecnología y que están listos para hacerlo en su futura enseñanza. Además, el análisis de los programas muestra que el plan de estudios del TEP enfatiza la pedagogía y el contenido sobre la tecnología. El constructo TPACK nunca se abordó en ningún resultado de curso, a diferencia del CK que se abordó en todos los programas, seguido por el PK y el PCK.

Palabras clave: marco TPACK, Conocimiento Tecnológico Pedagógico y del Contenido, programas de formación docente, educación superior, futuros maestros.

Introduction

Technology has become an integral part of contemporary society, transforming many facets of our lives, including education. Technology integration in the field of education has the potential to improve teaching and learning, thus preparing students to be successful in an increasingly digital world. To realize the maximum potential of technology in education, teachers must be equipped with the knowledge and skills needed to integrate technology into their teaching practices. This requires a thorough analysis of teacher education programs (TEPs) and the alignment of these programs with frameworks that promote the integration of technology. More than simple comprehension of technology, however, integration

requires the careful alignment of pedagogical strategies, content knowledge and technological understanding. This concept is known as Technological Pedagogical Content Knowledge (TPACK). TPACK is an essential paradigm for teachers navigating the complex interaction between these elements in their practice. As in several other countries, in Lebanon the process of incorporating technology into TEPs is ongoing and requires much research and exploration.

1. Description of the problem

Education professionals in Lebanon, have been urging public and private institutions to review the school system, which dates back to 1993. Since it lacks the survival techniques it needs to keep up with a constantly changing environment, Lebanon's education sector has become vulnerable to the effects of globalization. According to Soueid *et al.* (2014), the competencies of pre-service teachers in Lebanon have not reached the standards of other nations with comparable educational systems. Limited research on 21st-century skills in the Lebanese education system reveals that neither the national curriculum nor teachers nor higher education institutions adequately address these skills (BouJaoude, 2002; Ghaith, 2010; Ghamrawi *et al.*, 2017). Integrating TEPs into the TPACK framework while assuring the ability of pre-service teachers to integrate technology into their future teaching methods is therefore critical. This alignment would not only address the issue of underprepared graduates but also add to the general development of a skilled workforce that is able to flourish in the knowledge-based economy of the 21st century.

1.1 Rationale for this study

The rationale for this study is rooted in the emergent importance of technology in education and the need to ensure that TEPs effectively prepare educators to integrate technology into their teaching practices. This research will address three major research gaps in the literature on technology integration in TEPs in Lebanon: the first concerns the alignment of TEPs with the TPACK framework; the second concerns pre-service teachers' self-perception of their TPACK; and the third concerns the readiness of pre-service teachers on TEPs to integrate technology into

their prospective teaching. By concentrating on the Lebanese context, we provide insightful information that contributes to the body of knowledge on technology integration in teacher education.

1.2 Aims of the study

The aims of this paper are to study the extent to which TEPs at a Lebanese university align with the TPACK framework and evaluate the ability of these TEPs to prepare pre-service teachers to integrate technology into their future teaching. This paper also examines perceived TPACK levels among pre-service teachers enrolled on TEPs at the university. We postulate that their perceptions of their TPACK abilities will provide invaluable insights into the effectiveness of their TEPs.

1.3 Research questions

The research questions evaluated in this study are:

1. What perception do pre-service teachers have regarding their own TPACK level?
2. Do TEPs at this Lebanese university prepare pre-service teachers to integrate technology into their future teaching?

2. Background to the study

To prepare learners for the modern industrial era, TEPs should train pre-service teachers to effectively integrate technology into their teaching. This training should begin on teacher-education programs. Highly qualified teacher educators who adopt best practices in technology integration should train pre-service teachers in this skill. These pre-service teachers will then train their own students in using technology.

2.1 Background to the TPACK Framework

TPACK is rooted in the pedagogical content knowledge (PCK) model developed by Shulman (1986). In 2006, Punya Mishra and Matthew Koehler suggested that educational technology cannot stand alone and proposed that it could be added to Shulman's pedagogical content knowledge model.

Koehler and Mishra (2009) then proposed seven sub-domains that fall under their framework: content knowledge (CK), pedagogical knowledge (PK), technological knowledge (TK), pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK). Figure 1 shows these TPACK components (reproduced by permission of the publisher; © 2012 by tpack.org).

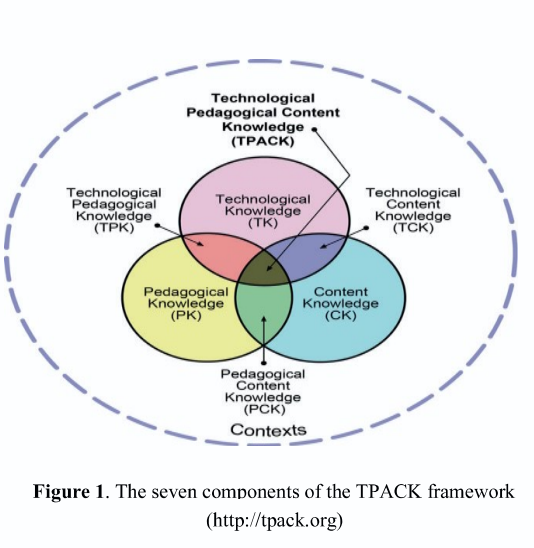

Figure 1. The seven components of the TPACK framework (http://tpack.org)

- Content Knowledge (CK) refers to knowledge of the content of the subject matter and its concepts, theories and facts.
- Pedagogical knowledge (PK) refers to knowledge of teaching pedagogies, which include classroom management, student motivation, lesson planning, assessment, and knowledge of teaching methods.
- Technological knowledge (TK) refers to knowledge of various technologies used in educational contexts.
- Pedagogical content knowledge (PCK) refers to knowledge of the best practices for teaching a particular subject matter; this means not just knowing the content and the pedagogy but also understanding the interplay between them.
- Technological content knowledge (TCK) refers to knowledge of how available technologies and tools can enhance the content as well as knowledge of how students will interact with it.
- Technological pedagogical knowledge (TPK) refers to knowledge of what technology can do for specific pedagogical goals, how it can meet those goals, and how to select the most suitable technologies for achieving a certain outcome.
- Technological pedagogical content knowledge (TPACK) combines comprehensive content knowledge with knowledge of how to choose the most suitable teaching method for a specific content in order to best accomplish the learning outcome while applying the most suitable technology (Graham, 2011; Mishra & Koehler, 2006).

To better develop technology integration knowledge and skills, TEPs need to help pre-service teachers connect technological, pedagogical and content knowledge (Mouza *et al.*, 2017; Sun *et al.*, 2017). Koehler and Mishra (2009) also asserted that effective technology integration requires teachers to be competent not only in applying these three knowledge components separately but also, and more importantly, in integrating them together (Schmidt *et al.*, 2009).

3. Research design

To answer our research questions, we used the mixed-method triangulation approach by merging quantitative and qualitative data to provide a comprehensive analysis of the research problem. The quantitative data were collected from pre-service teacher surveys, while the qualitative data were collected from interviews with administrators, teacher educators and pre-service teachers, as well as from document (syllabi) analysis.

3.1 Participants

This study was conducted at nine campuses of a private university in Lebanon. This university was purposefully selected by the researcher thanks to its range of Education programs and the diversified sample of registered future teachers. The participants recruited from this university were pre-service teachers (187 for the questionnaire and 57 for the interview), teacher educators (21 for the interview), and administrators (six for the interview).

3.2 Instruments

Three instruments were used in this study: a questionnaire, semi-structured interviews, and document analysis of the syllabi.

3.2.1 TPACK Questionnaire

The questionnaire used in this study was an adapted version of the TPACK survey developed by Schmidt et al. (2009) created on Google forms. The questionnaire consists of two sections. The main section comprises 28 items and examines teachers' perceptions on each TPACK construct: items 1 to 6 examine TK, items 7 to 9 examine CK, items 10 to 16 examine PK, item 17 examines PCK, item 18 examines TCK, items 19 to 27 examine TPK, and item 28 examines TPACK (see Appendix A). The second section examines pre-service teachers' perceptions on the TPACK models as well as on faculty and schoolteachers, who should usually act as models for future teachers. A reliability test for the questionnaire using Cronbach's Alpha obtained a value of 0.942, which indicates strong reliability. Datasets from this questionnaire were statistically analyzed using SPSS software version 25.

3.2.2 Semi-structured interviews

Semi-structured interviews were conducted with the participants. Pre-service teachers were asked about their competency level when using technology and about the tools and applications with which they are competent. They were also asked whether they believe the TEP has prepared them to integrate technology into their future teaching and

whether they were ready to implement it. Teacher educators were also asked about their level of competence when using technology and which tools and applications they feel competent with. Administrators were asked about rules and guidelines on technology integration imposed by the TEP.

3.2.3 Document Analysis (Syllabi)

Course syllabi from 45 courses (28 undergraduate and 17 graduate) on the TEP were analyzed. These courses were those of the major and the core courses of the program. Course outcomes for all courses were identified as TK, PK, CK, TPK, TCK, PCK or TPACK. A predetermined rubric was used to indicate the TPACK constructs present in each course syllabus. The total frequency for each individual TPACK construct was then calculated for the undergraduate and graduate courses. These constructs were then compared and an analysis was made.

4. Results

To answer the first research question, we examined the results of the first section of the TPACK questionnaire. To answer the second research question, we examined the second part of the TPACK questionnaire, the interview responses, and the results of our document analysis.

4.1 Results of TPACK Questionnaire

Table 1 shows results from the first section of the TPACK questionnaire. Most means are very close to 4, which indicates that most pre-service teachers have a positive perception of their TPACK level. The highest means are for CK, PK and PCK while the lowest are for TK and TPACK.

Table 1. Pre-service teachers' perception of TPACK constructs

	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree		Mean	Std. Deviation
Code	1		2		3		4		5			
	N	%	N	%	N	%	N	%	N	%		
1	9	4.8	10	5.3	32	17.1	92	49.2	44	23.5	**3.81**	1.012
2	7	3.7	10	5.3	13	7.0	72	38.5	85	45.5	**4.17**	1.026
3	5	2.7	13	7.0	31	16.6	81	43.3	57	30.5	**3.92**	0.994
4	9	4.8	15	8.0	42	22.5	91	48.7	30	16.0	**3.63**	1.004
5	9	4.8	10	5.3	47	25.1	83	44.4	38	20.3	**3.70**	1.009
6	5	2.7	11	5.9	32	17.1	96	51.3	43	23.0	**3.86**	0.929
								TK average mean			3.85	
7	12	6.4	7	3.7	21	11.2	84	44.9	63	33.7	**3.96**	1.087
8	9	4.8	9	4.8	31	16.6	82	43.9	56	29.9	**3.89**	1.042
9	12	6.4	5	2.7	19	10.2	85	45.5	66	35.3	**4.01**	1.070
								CK average mean			3.95	
10	11	5.9	5	2.7	23	12.3	83	44.4	65	34.8	**3.99**	1.055
11	9	4.8	3	1.6	27	14.4	90	48.1	58	31.0	**3.99**	0.978
12	10	5.3	6	3.2	24	12.8	86	46.0	61	32.6	**3.97**	1.034
13	10	5.3	7	3.7	21	11.2	83	44.4	66	35.3	**4.01**	1.050
14	11	5.9	8	4.3	28	15.0	83	44.4	57	30.5	**3.89**	1.072
15	11	5.9	7	3.7	28	15.0	93	49.7	48	25.7	**3.86**	1.035
16	12	6.4	6	3.2	30	16.0	88	47.1	51	27.3	**3.86**	1.060
								PK average mean			3.94	
17	11	5.9	6	3.2	23	12.3	90	48.1	57	30.5	**3.94**	1.043
								PCK average mean			3.94	
18	9	4.8	9	4.8	26	13.9	92	49.2	51	27.3	**3.89**	1.016
								TCK average mean			3.89	
19	13	7.0	4	2.1	21	11.2	86	46.0	63	33.7	**3.97**	1.080
20	10	5.3	3	1.6	25	13.4	92	49.2	57	30.5	**3.98**	0.994
21	6	3.2	11	5.9	34	18.2	81	43.3	55	29.4	**3.90**	0.997
22	8	4.3	9	4.8	31	16.6	88	47.1	51	27.3	**3.88**	1.004
23	9	4.8	6	3.2	26	13.9	92	49.2	54	28.9	**3.94**	0.996
24	7	3.7	11	5.9	28	15.0	85	45.5	56	29.9	**3.92**	1.010
25	7	3.7	9	4.8	32	17.1	87	46.5	52	27.8	**3.90**	0.987
26	9	4.8	6	3.2	44	23.5	88	47.1	40	21.4	**3.77**	0.981
27	9	4.8	9	4.8	23	12.3	98	52.4	48	25.7	**3.89**	1.000
										TPK average mean	3.9	
28	8	4.3	9	4.8	29	15.5	96	51.3	45	24.1	**3.86**	0.979
										TPACK average mean	3.86	

Table 2 shows results from the second section of the TPACK questionnaire. Item 1 gives the percentage of teacher education professors who provided an effective model of combining content, technologies and teaching methods in their teaching. Item 2 refers to educators outside the teacher education programs. Item 3 refers to the cooperating teachers.

Pre-service teachers believe that over half the teacher educators, educators outside teacher education, and cooperating teachers, respectively, were good models for technology integration.

Table 2. Pre-service teachers' perceptions of TPACK Models

	25% or less		26% - 50%		51% - 75%		76%-100%		Mean	Std. Deviation
Code	1		2		3		4			
	N	%	N	%	N	%	N	%		
1	14	7.5	34	18.2	89	47.6	50	26.7	**2.94**	0.865
2	22	11.8	64	34.2	81	43.3	20	10.7	**2.53**	0.838
3	32	17.1	56	29.9	77	41.2	22	11.8	**2.48**	0.912

4.2 Results of the interviews

We asked the pre-service teachers and teacher educators about their level of technological competence and about the tools and applications they are competent with.

Tables 3 and 4, respectively, show the responses of these pre-service teachers and teacher educators to the first of these questions.

Table 3. Pre-service teachers' level of technological competence		
Pre-Service Teachers (Undergraduate)		**Pre-Service Teachers (Post graduate)**
Not competent	4.8 %	5.6 %
Competent	61.9 %	50 %
Very competent	33.3 %	44.4 %

Table 4. Teacher educators' level of technological competence		
	N	%
Not competent	2	9.5 %
Competent	18	85.7 %
Very competent	1	4.8 %

Around 95 % of pre-service teachers believe that they are competent or very competent in using technology compared to roughly 90% for teacher educators. The tools and applications pre-service teachers and teacher educators believe they are competent at using are Microsoft PowerPoint, Google Slides, Prezi, Zoom, Kahoot, Google Classroom, Microsoft Teams, Microsoft Word, Google Sites, Storyboard, Screencast-O-Matic, and PhET Simulations.

We also asked pre-service teachers whether their TEP has prepared them for technology integration (Table 5) and whether they feel ready to integrate technology into their future teaching (Table 6). Most undergraduate and postgraduate pre-service teachers believe that their TEP has prepared them to integrate technology into their teaching and that they are ready to implement it.

Table 5. Pre-service teachers' perceptions of the extent to which their TEP has prepared them to integrate technology		
	Pre-Service Teachers Undergraduate (%)	**Pre-Service Teachers Postgraduate (%)**
Yes, the TEP has prepared me	76.2 %	75.8 %
The TEP has somewhat prepared me	9.5 %	12.1 %
No, the TEP has not prepared me	14.3 %	12.1 %

Table 6. Pre-service teachers' perceptions of their readiness to integrate technology into their teaching		
	Pre-Service Teachers Undergraduate (%)	Pre-Service Teachers Postgraduate (%)
Yes, I am ready	81 %	85.7 %
I am somewhat ready	4.7 %	2.9 %
No, I am not ready	14.3 %	11.4 %

Below is a sample of pre-service teachers' responses:

1. "Yes, the program is preparing me to integrate technology and I feel ready to integrate technology into my future teaching. TEP is working on effective teaching processes by engaging teachers with new technological skills."

2. "The TEP doesn't prepare us as teachers for our future teaching. I can effectively implement technology in my teaching but this is due to self-development and the workshops I attend on my own, not to the TEP."

3. "The educational technology course offered at university was very useful to me but we need to practice more in order to master the applications being taught on this course. I don't feel ready to integrate technology into my future teaching."

We also asked administrators about any rules and guidelines the Education Department imposes on teacher educators to integrate technology into their teaching. All administrators agreed that there are no rules and that educators are left to decide on these issues for themselves.

Below is an example of an administrator's response:

"The Education program didn't impose the use of technology. Some teachers who were up-to-date with the use of technology have integrated technology into their classes. But most instructors didn't integrate technology unless they were teaching a course on education technology."

4.3 Document analysis (Syllabi)

Table 7 shows the results of our document analysis. CK was represented in the course outcomes of all courses. PK, PCK, TPK and TK were represented to a much lower extent. TCK and TPACK were not represented at all in any course outcome.

Table 7. Total representation of TPACK constructs in the course outcomes of all Education courses

Type of Course	TPACK Constructs in Education Course Outcomes						
	PK	CK	TK	PCK	TCK	TPK	TPACK
Undergraduate Courses	39.3 %	100 %	3.5 %	42.9 %	0 %	3.5 %	0 %
Post graduate Courses	52.9 %	100 %	0 %	23.5 %	0 %	17.6 %	0 %
All Courses	**44.4 %**	**100 %**	**2.2 %**	**35.5 %**	**0 %**	**8.9 %**	**0 %**

5. Analysis

In general, the pre-service teachers perceived themselves as skilled and knowledgeable across the TPACK constructs. Their most positive perception was in relation to CK, PK and PCK. This positive perception decreased slightly when it came to technology (TPK, TCK, TPACK and TK, in that order). This could be due to the TEP curriculum, which emphasizes pedagogy and content over technology, as is evident from the results of our syllabi analysis. CK, PK and PCK are represented the most in the syllabi of both undergraduate and postgraduate Education courses. However, when technology was introduced, representation dropped dramatically for TPK and was completely absent for TCK and TPACK. This is also supported by administrators' responses to the question on whether rules or guidelines are imposed on teacher educators by the Education Department to integrate technology into their teaching. All the assistant deans and chairs interviewed said that there are no rules in this regard and that the instructors are left to choose whether to use technology. Moreover, roughly 25% of pre-service teachers responded that fewer than half of their teacher educators were good models for TPACK integration, which indicates that technology was not fully integrated across all Education courses by all instructors. Also, roughly half of the pre-service teachers reported that less than half of their educators outside Education and less than half of coordinating teachers at school were good models for technology integration. Pre-service teachers are therefore not fully exposed to technology integration during their TEP. Another finding is that TPK scores were greater than TK scores for pre-service teachers. This may be because their recent training focused more on the pedagogical applications of technology than on the technology itself.

Another reason for the poor representation of technology constructs could be the rapid advancements in technology. With the shift to online learning introduced during the pandemic, the numerous new tools and applications developed made it difficult for pre-service teachers to catch up. Another explanation could be their comfort levels with using technology since pre-service teachers reported in their interviews that they are not given enough opportunities to practice technology integration themselves.

Although pre-service teachers perceived themselves to be competent or highly competent in using technology, our syllabi analysis shows that their academic development is not the only or main source of this confidence. TEP content (or what they are being taught) are not the most important factors behind their confidence. What is important is how they are being taught, which is reflected in the results from the second section of the questionnaire on TPACK models. Most pre-service teachers believe that their teacher educators were good models for technology integration. This is supported by the responses from teacher educators to the question on their own technology competency, most of whom felt that they were competent. Moreover, when asked about the tools and applications they are competent in using, pre-service teachers mentioned the same tools as those used by teacher educators during the teaching process. This reflects the importance of technology integration modeling.

Most pre-service teachers believe that their TEP has prepared them to integrate technology into their future teaching. However, if we compare these responses to their responses in relation to their readiness to integrate technology into their future teaching, we find some discrepancies. Pre-service teachers who reported that their TEP has not prepared them to integrate technology but who are ready to integrate it attributed their response to self-development and justified it by referring to their attendance at workshops and webinars on technology integration. These pre-service teachers also asserted that, although their TEP has provided them with strategies and theories, they were able to apply them only when they began teaching in schools. This explains why pre-service teachers at the postgraduate level reported a higher competency (very competent) in technology use than those at the undergraduate level. Pre-service teachers who reported that their TEP has prepared them to integrate technology but are not ready to do so justify this opinion by asserting that they need practice in using and integrating technology as well as more time to familiarize themselves with it.

When we compared the readiness of undergraduate and postgraduate pre-service teachers to integrate technology, we found that postgraduate pre-service teachers are more ready. This may be due to the opportunities they have had to integrate technology, since, unlike undergraduate pre-service teachers, who lack exposure and training, most of them are currently teaching in schools.

6. Discussion and conclusion

As reported by numerous other studies (Farjon *et al.*, 2019; Isler & Yildirim, 2018; Redmond & Lock, 2019), the pre-service teachers participating in this study have positive perceptions towards TPACK. However, educators should take into account that TK, PK and CK are not predictors of TPACK. This means that trying to develop the TK, PK and CK of pre-service teachers independently does not guarantee TPACK development (Kaplon-Schilis & Lyublinskay, 2020). Efforts should therefore be made to integrate these constructs (Mouza et al., 2017; Sun et al., 2017). Moreover, high PK and PCK are positive factors since it is difficult to expect pre-service teachers to develop TPACK without their acquiring solid PK and PCK (Jones et al., 2017). Another factor educators should take into account is that integrating TK into TPK and TPACK requires more time, more opportunities, and different types of tasks (Bueno-Alastuey *et al.*, 2018).

Teacher educators and cooperating or mentor teachers at schools have an important role in pre-service teachers' experience of technology integration because they act as role models (Gill & Dalgarno, 2017; Tiba & Condy, 2021; Zipke *et al.*, 2019). However, this alone is not sufficient. Pre-service teachers need to practice technology integration themselves so as to better develop their technology-integration skills (Durdu & Dag, 2017; Gill & Dalgarno, 2017). Pre-service teachers could also benefit from technology-related projects and workshops (Gill & Dalgarno, 2017; Tiba & Condy, 2021).

Finally, a problem faced by TEPs is the traditional approach they adopt in their curricula. Efforts should be made to reform these curricula in order to integrate technology better. Educational institutions should also have clear policies that mandate the adoption of recent theories and frameworks on technology integration since not doing so only complicates matters further (Tunjera & Chigona, 2020).

Appendix A

TPACK Survey (Adapted Version)

		Item
TK	1	I know how to solve my own technical problems.
	2	I can learn technology easily.
	3	I keep up with important new technologies.
	4	I frequently play around the technology.
	5	I know about a lot of different technologies.
	6	I have the technical skills I need to use technology.
CK	7	I have sufficient knowledge about my first teaching subject.
	8	I can use my first teaching subject (mathematical, historical, scientific, literary,..) as a way of thinking.
	9	I have various ways and strategies of developing my understanding of my first teaching subject.
PK	10	I know how to assess student performance in a classroom.
	11	I can adapt my teaching based-upon what students currently understand or do not understand
	12	I can adapt my teaching style to different learners.
	13	I can assess student learning in multiple ways.
	14	I can use a wide range of teaching approaches in a classroom setting.
	15	I am familiar with common student understandings and misconceptions.
	16	I know how to organize and maintain classroom management.
PCK	17	I can select effective teaching approaches to guide student thinking and learning in my first teaching subject.
TCK	18	I know about technologies that I can use for understanding and doing my first teaching subject.
TPK	19	I can choose technologies that enhance the teaching approaches for a lesson.
	20	I can choose technologies that enhance students' learning for a lesson
	21	My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.
	22	I am thinking critically about how to use technology in my classroom.
	23	I can adapt the use of the technologies that I am learning about to different teaching activities.
	24	I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn
	25	I can use strategies that combine content, technologies and teaching approaches that I learned about in my coursework in my classroom.
	26	I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district.
	27	I can choose technologies that enhance the content for a lesson.
TPACK	28	I can teach lessons that appropriately combine my first teaching subject, technologies and teaching approaches.

References

Boujaoude, S. (2002). «Balance of scientific literacy themes in science curricula: The case of Lebanon». *International Journal of Science Education, 24*, 139-156.

Bueno-Alastuey, M. C.; Villarreal, I., & Esteban, S. G. (2018). «Can telecollaboration contribute to the TPACK development of pre-service teachers?» *Technology Pedagogy and Education*, *27*(3), 367-380.

Durdu, L., & Dag, F. (2017). «Pre-Service teachers' TPACK development and conceptions through a TPACK-based course». *Australian Journal of Teacher Education*, *42*(11), 150-171.

Farjon, D.; Smits, A., & Voogt, J. (2019). «Technology integration of pre-service teachers explained by attitudes and beliefs, competency, access, and experience». *Computers & Education*, *130*, 81-93.

Ghaith, G. (2010). «An exploratory study of the achievement of the twenty-first century skills in higher education». *Education & Training, 52*(6/7), 489-498.

Ghamrawi, N.; Ghamrawi, N. A. R., & Shal, T. (2017). «Lebanese public schools: 20th or 21st century».

Gill, L., & Dalgarno, B. (2017). «A qualitative analysis of pre-service primary school teachers' TPACK development over the four years of their teacher preparation programme». *Technology Pedagogy and Education*, *26*(4), 439-456.

Graham, C. R. (2011). «Theoretical considerations for understanding technological pedagogical content knowledge (TPACK)». *Computers & Education, 57*(3), 1953–1960.

Isler, C., & Yildirim, O. (2018). «Perceptions of Turkish pre-service EFL teachers on their technological pedagogical content knowledge». *Journal of Education and Future-Egitim Ve Gelecek Dergisi*(13), 145-160.

Jones, E. M.; Baek, J. H., & Wyant, J. D. (2017). «Exploring pre-service physical education teacher technology use during student teaching». *Journal of Teaching in Physical Education*, *36*(2), 173-184.

Kaplon-Schilis, A., & Lyublinskaya, I. (2020). «Analysis of relationship between five domains of TPACK framework: TK, PK, CK math, CK science, and TPACK of pre-service special education teachers». *Technology Knowledge and Learning*, *25*(1), 25-43.

Koehler, M. J., & Mishra, P. (2009). «What is technological pedagogical content knowledge (TPACK)?» *Contemporary Issues in Technology and Teacher Education, 9*, 60–70.

Mishra, P., & Koehler, M. J. (2006). «Technological pedagogical content knowledge: A framework for teacher knowledge». *Teachers College Record*, *108*(6), 1017-1054.

Mouza, C.; Nandakumar, R.; Yilmaz Ozden, S., & Karchmer-Klein, R. (2017). «A longitudinal examination of preservice teachers' technological pedagogical content knowledge in the context of undergraduate teacher education». *Action in Teacher Education, 39,* 153–171.

Redmond, P., & Lock, J. (2019). «Secondary pre-service teachers' perceptions of technological pedagogical content knowledge (TPACK): What do they really think?» *Australasian Journal of Educational Technology*, *35*(3), 45-54.

Schmidt, D. A.; Baran, E.; Thompson, A. D.; Mishra, P.; Koehler, M. J., & Shin, T. S. (2009). «Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers». *Journal of Research on Technology in Education, 42*(2), 123–149.

Shulman, L. S. (1986). «Those who understand: Knowledge growth in teaching». *Educational researcher*, *15*(2), 4-14.

Soueid, M.; Ghanem, S.; Hariri, Z.; Yamout, N., & Nehme, R. (2014). *Analysis of Lebanon's Education Sector.* BankMed Market & Economic Research Division.

Sun, Y.; Strobel, J., & Newby, T. J. (2017). «The impact of student teaching experience on pre-service teachers' readiness for technology integration: A mixed methods study with growth curve modeling». *Educational Technology Research and Development, 65*(3), 597–629.

Tiba, C., & Condy, J. L. (2021). «Identifying factors influencing pre-service teacher readiness to use technology during professional practice». *International Journal of Information and Communication Technology Education*, *17*(2), 149-161.

Tunjera, N., & Chigona, A. (2020). «Teacher educators' appropriation of TPACK-SAMR models for 21st century pre-service teacher preparation». *International Journal of Information and Communication Technology Education*, *16*(3), 126-140.

Zipke, M.; Ingle, J. C., & Moorehead, T. (2019). «The effects of modeling the use of technology with pre-service teachers». *Computers in the Schools*, *36*(3), 205-221.