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ORIGINAL PAPER

Academic Staff's Attitudes Towards a Curriculum Mapping Tool

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Abstract

Curriculum mapping is a method in which teachers record the operational curriculum to be used for ongoing curriculum review and development. Therefore, schools aim to establish a fluid system for maintaining and updating the curriculum. As teachers are the main practitioners of curriculum mapping, this study aimed to investigate the factors that impact teachers' attitudes towards an online curriculum mapping tool. In this study we employedthe Technology Acceptance Model (TAM) to examine the attitudes of the academic staff in a private school in Dubai towards the use of a curriculum mapping tool and whether the staff role impacted their perceptions. Also, we examined the factors that impact perceived ease of use and perceived usefulness of the curriculum mapping tool. The external factor considered as a determinant of perceived usefulness is relevance, which is studied in terms of long-term planning, short-term planning, curriculum alignment, teachers' collaboration, and students' achievement. The factors considered as determinants of perceived usefulness are training and time. The results indicated that the staff did not have significant positive attitudes towards the tool. Also, while perceived ease of use and actual usage were significantly high, perceived usefulness was significantly low. The results also showed that there were no differences in perceptions according to the staff role except for perceived usefulness, which was significantly higher for leaders compared to teachers. Results also indicated that perceived short-term planning and teacher collaboration were good predictors of perceived usefulness, while perceived training and time were good predictors of perceived ease of use. The results reflect a shallow understanding of the theory that underlies the use of the curriculum mapping tool. School leaders should dedicate time and resources to extend communication about the purpose of curriculum mapping and how the mapping tool can help the process.

Keywords Curriculum mapping · technology acceptance · Teachers attitudes · Leaders attitudes

Introduction

Curriculum is a broad term that encompasses all what a student experiences in the educational process. It includes all the materials and means that the student interacts with to achieve the desired learning outcomes. Skills, content, assessments, standards, strategies, and resources are all major elements of the curriculum (Harden, 2001). The design and the goal of the curriculum reflect the philosophy of the educational institution and are at the core of the teaching and learning processes that occur in a school setting. Curriculum development, however, has always been an area of concern that challenges educators while trying to bridge the gap between the actual and the intended curriculum. The intended curriculum is a plan and an aspiration of what should happen in schools, while the actual curriculum is the real practice of what in fact happens in schools. The fact that the responsibility of developing the curriculum has always been seen to be that of experts was the reason for the existence of the gap between the intended and the actual curriculum (Carl, 2009). Teachers usually adapt the curriculum based on their knowledge, experience, and the needs of their students which consequently results in differences from what is actually intended to be taught (Cuban, 1995).

The discrepancy between the intended curriculum and the one that is actually taught necessitated the need for a curriculum audit system such as curriculum mapping that describes "what is actually being taught, how long it is being taught, and the match between what is being taught and the district's testing program" (English, 1980, p. 559). Curriculum mapping also ensures alignment of the curriculum with the required state standards (Udelhofen, 2005).

Curriculum mapping facilitates the curriculum documentation as well as the review process. The multiple components of

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the curriculum would require a design that is easily communicated to stakeholders as well as a database that would help during the periodic review of the operating curriculum or when curricular reform is required (Jacobs & Johnson, 2009). Both curricular review and reform are conducted to ensure an optimized learning experience for students (Al-Eyd et al., 2018). By bringing together all the curriculum elements in an orderly manner and ensuring that connections are made between in a scope and sequence that exists across the life span of a course, educators would then be able to avoid pitfalls such as addressing the same standards or outcomes many times throughout a course or even a worse scenario sometimes like not addressing them at all.

Educational institutions benefit from the use of new technologies to cover all pedagogical, methodological, and instructional aspects to consider improving these processes in reasonable and efficient ways (Serdyukov, 2017). The need arose for using technology for curriculum documentation purposes in order to avail easy access, avoid loss, secure connections across the various components, and make it possible and practical to examine those connections to ensure that broad institutional goals are being achieved (Mathiesen, 2008).

In the United Arab Emirates, and in Dubai specifically, the requirements for the schools to be regularly inspected by local authorities or to be accredited by international boards, mandated introducing innovation through technology in both the documentation as well as the delivery systems of the curriculum being at the heart of the educational institution with the whole teaching and learning pivoting around it. It is worth mentioning that private schools in Dubai follow different jurisdictions compared to private schools in other emirates and all public schools in the UAE (Ridge et al., 2017; Siyam & Hussain, 2021). Dubai's private education sector accommodates 90% of the student population in the UAE. The Knowledge and Human Development Authority (KHDA) is the regulatory authority that oversees the operation of the private schools offering various curricula. The KHDA holds every school accountable for the quality of education and student outcomes through annual school inspections (Al Ali et al., 2019). However, as private schools in Dubai follow different curricula (i.e., UAE Ministry of Education, US curriculum, International Baccalaureate, National Curriculum in England, and Indian curriculum), each school is responsible of mapping their lessons according to the curriculum they follow. This study is limited to staff perceptions in a private school in Dubai that follows the US curriculum, and therefore, leaders and teachers are required to map their lessons to match the state standards the school follows.

Many technological tools are available in the market that provide solutions for curriculum mapping. When making the choice for a suitable platform for storing and communicating the curriculum, being user-friendly would be at the top of the required features list. Moreover, and very importantly, technology should only support and facilitate the school's curriculum framework and processes and not define the curriculum structure, avoiding what usually happens when seeking technological aids for educational problems when technology becomes the focus rather than the quality of the outcome itself (Herrington & Reeves, 2011). In spite of the vast availability of curriculum mapping technological tools, not any one can be adopted by educators unless they perceive its usefulness and how much it will help them do their work better. Technology, in general, as indicated by history, is integrated into current educational practices but rarely impacts those processes (Papert, 1998).

To ensure success of any new initiative in an educational setting, teachers' perceptions of it should be sought and their willingness to implement it should be investigated, including curriculum-related initiatives as teachers are the key people in the field and have a major role in documenting the curriculum, aligning it with standards, and setting long and short-term instructional goals. Introducing a new platform for curriculum mapping, and depending on the platform itself, training of teachers and leaders is a non-negotiable requirement to ensure effective implementation and sound and efficient outcomes (Mathiesen, 2008).

This study aims to investigate how academic staff (i.e., teachers and leaders) in a private school in Dubai perceive the use of a technology-based curriculum mapping tool as well as the factors that impact their perceptions. This study aims to answer the following questions:

RQ1: What are the academic staff's attitudes towards the use of the curriculum mapping tool?

RQ2: Does the role of the school staff (teacher vs school leader) impact their attitudes towards the use of the curriculum mapping tool?

RQ3: How do external factors, namely relevance represented in long-term planning, short-term planning, curriculum alignment, teacher collaboration, and students' achievement, impact perceived usefulness of the curriculum mapping tool?

RQ4: How do external factors, namely training and time, impact perceived ease of use of the curriculum mapping tool?

RQ5: Does the Technology Acceptance Model (TAM) apply to the use of a curriculum mapping tool?

Curriculum Mapping

The concept of "Curriculum Mapping" first originated in the 1970s and then was developed in the 1980s by English who described curriculum mapping as a means to keep records of the content, skills, activities, and attitudes associated with each major concept in a certain course, along with the allotted time required to teach each concept. According to English (1980), the implemented curriculum was very distinct from the intended curriculum and the main goal of curriculum mapping to him was to identify the implemented curriculum. To English (1980, p. 558), curriculum mapping was a “reconstruction of the real curriculum teachers have taught”, as compared to the old “top-down” approach where teachers were aligning their class time with the intended curriculum they received from experts.

In the late ‘80s, Jacobs, who is considered to be a major contributor in K to 12 curriculum development, focused on the teacher’s role in the development process as being primary rather than depending on a third party. Jacobs model built on the earlier model of English (1980) but was significantly different in being a way to develop a school-wide interdisciplinary curriculum that is based on what teachers are doing to help their students achieve the learning goals, rather than being a tool based on standards and confined to a single teacher’s use in a classroom (Jacobs, 1997). To Jacobs, the teacher’s role is fundamental and his/her input should be well-integrated in the whole school curriculum (Jacobs, 2004).

Jacobs’ model considered the limited or even absent communication between teachers across levels to be the main reason in developing curricular gaps. Therefore, he considered the use of curriculum mapping as a method to enhance communication and dialogue among teachers through the variety of available commercial mapping systems to ensure curricular coherence (Jacobs, 2004). Moreover, curriculum mapping allows for vertical and horizontal alignments of the curriculum within and across schools (Kallick & Colosimo, 2008). Curriculum mapping enhances teachers’ planning skills, collaboration across subjects and grade levels and also allows for regular review of the curriculum in response to the schools’ arising needs and for implementing necessary changes in response to those needs (Udelhofen, 2005).

Jacobs (1997) proposes that curriculum mapping, serving as a reporting tool, should be based on the academic calendar. It is usually used to generate reports on the teaching and learning activities designed by the teachers, what they teach, when they teach it, how they assess it and how well it is aligned with content standards. Once all maps of the actually taught curriculum are fed into the software that is used for this purpose, the process continues spontaneously with each step initiating the next one, leading teachers to hold professional dialogues that would inform the curricular review processes and help making sound curricular decisions based on data.

Another theory that supports any institutional change like for instance, introducing a curriculum mapping model in a school, is Fullan’s (2007) theory of educational change that consists of three phases: initiation, implementation, and institutionalization or continuation and the changes associated with each phase. According to change theorists, change is not a linear process; however, phases of change “will merge imperceptibly into each other” (Marsh, 2009, p. 117), and “all phases must be thought about from the beginning and continually thereafter” (Fullan, 2007, p. 103). The change would not be successful if the processes and activities associated with it are not analyzed from the perspective of the teachers (Hall & Hord, 2006).

Related Work

Despite the technological advancements and their uses for curriculum development purposes, and in specific the use of special platforms for curriculum mapping, the research around curriculum mapping tools is still limited and the number of research papers that studied it, if found, are mainly published dissertations (Lucas, 2005). Papers that exist about teachers’ perceptions of curriculum mapping as an effective tool for instructional planning and curriculum alignment, generally revealed positive feedback and a great impact on enhancing and promoting school improvement (Shilling, 2013). Researches have also found that student attainment and progress have improved after the implementation of curriculum mapping (Fairris Jr., 2008). Most of the studies in the literature focused on the main practices and activities that emerged upon implementation of curriculum mapping. For instance, Lucas (2005) investigated teachers’ perceptions to determine whether they perceive curriculum mapping as a useful tool for increasing the efficacy of instructional planning and curriculum alignment. Similarly, Wilansky (2006) examined teachers’ attitudes towards curriculum mapping concerning assessment, standards alignment, and professional collaboration. More recently, Shilling (2013) investigated the perceptions educators about the factors that impact the curriculum mapping implementation, including setting short-term and long-term instructional goals, reducing gaps and redundancies in the curriculum, ensuring alignment of curriculum with standards, and enhancing collaboration and more professional dialogue among academic teams. The challenges, perceived by the participants included: lack of ownership of taught material, professional development, resistance to change, and inconsistent support and leadership.

There is less focus in the literature regarding the digital tools and how they can be used to facilitate curriculum mapping. However, the move towards virtual teams and the need to provide all stakeholders with an innovative way to access and edit the curriculum has encouraged researchers and educators to optimize the use of technology in developing curriculum mapping. Using digital tools has the capability of transforming curriculum mapping into a more efficient and transparent procedure (Khoerunnisa et al., 2018).

Few studies investigated teachers’ perceptions regarding curriculum mapping initiatives through technology tools. For instance, Shoja (2016) analyzed the teachers' perceptions in regard to professional development requirements for a curriculum mapping initiative as well as the usefulness of implementing the initiative through available tools and resources. The school used Rubicon Atlas Software as a curriculum mapping tool. Surveys measured the teachers' perceptions regarding the usefulness of Atlas for long-term and short-term instructional planning, curriculum alignment with standards, related teachers' communication and dialogue, and students' academic achievement. The study revealed positive perceptions of the participants regarding all the survey items, but to a lesser extent in regard to students' achievement which is very congruent with the literature in this regard.

Another quantitative descriptive study was conducted in a Northwestern State where public cross-sectional data was collected by the State's Department of Education (Mathiesen, 2008). The study focused on the tools, methods, and theory behind teachers' use of a technology-based tool and process to align the K-12 curriculum with state standards. Participants used TechPaths software as a tool for curriculum mapping. The study results revealed that the tool is very useful for the purpose of organizing the curriculum and aligning the instruction with standards. More than half of the respondents agreed that curriculum mapping positively influences instruction. As for the benefits and values factor, teachers believed that education is improved due to the effective decisions pertaining to the curriculum as a result of the mapping. However, teachers believed they need more training and support for a more advanced and sophisticated use of the tool features beyond only entering data.

Technology Acceptance

Developed in the late 80s, the Technology Acceptance Model (TAM) (Davis, 1989) is an adaptation of the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1975) that is concerned specifically with the field of information technology. TAM is useful to explain the factors that impact the acceptance of a certain technology. This process is defined by two factors; perceived usefulness (PU) and perceived ease of use (PEU), which are considered the main determinants of users' attitudes towards a certain technology (ATU).

The TAM model has gone through many evolutions (Stockless, 2018). One significant contribution to the model is the revised TAM model, named TAM2 (see Fig. 1), which takes into account external variables, rather than just considering individual characteristics (Venkatesh & Davis, 2000). Adding external variables to TAM allows to pinpoint the particular reasons for which the technology may not be adopted, aiding researchers and practitioners to adopt appropriate corrective measures (Davis et al., 1989).

The TAM model has been widely used in the education literature to study the acceptance of technology in general, e-learning, social media, and information systems, among others (Siyam, 2019). However, few studies have focused on teachers' perceptions of curriculum mapping systems (CMS) (Lucas, 2005). On the other hand, TAM has been widely used to examine students and teachers' perceptions on learning management systems (LMS) (Alharbi & Drew, 2014; Alshammari et al., 2016; Juhary, 2014; Stockless, 2018). While the LMS and CMS each serve a different purpose, they usually overlap, creating a confusion about the ultimate purpose of either one and the expected outcomes of each. A LMS is a digital tool that allows educators and students to access the curriculum, including course content, assessment, and grading schemes. It also allows educators to document, track, and report the curriculum (Watson & Watson, 2007). On the other hand, CMS is a tool for structuring a curriculum framework that would facilitate both access and review of the curriculum (Harden, 2001). The external factors that have been used to examine the perceived ease of use and usefulness of LMS include job relevance, prior experience, technical support, and self-efficacy (Alharbi & Drew, 2014; Alshammari et al., 2016).

Methodology

This study follows a quantitative methodology based on data collected through questionnaires to examine academic staff attitudes towards the use of a curriculum mapping tool.

Participants

Teachers and academic leaders in a private school in the UAE were invited to participate in the study by answering the questionnaire. The school had a total of 110 teachers and academic leaders, including heads of academics, heads of departments, coordinators, subject leaders, and learning assessment coordinators. Out of the 110 teachers and leaders invited, seventy-one ($n = 71$) returned the questionnaires. The majority (82%) of the sample are females. The larger proportion, 37%, of the sample come from Jordan, 28% come from Egypt, 18% come from Syria, and 17% come from other countries. The sample is considered well experienced as 80% have been teaching for 4 to 20 years. Demographic data of participants are summarized in Table 1.

Atlas Rubicon is a curriculum mapping online tool that is being used in many schools around the world (Faria Educational Group, 2021b). The participating school has been using Atlas as a curriculum mapping tool for one year and a half when the study was conducted. All participating staff received training on how to use Atlas for curriculum mapping. Atlas is a web-based platform that allows educators to manage

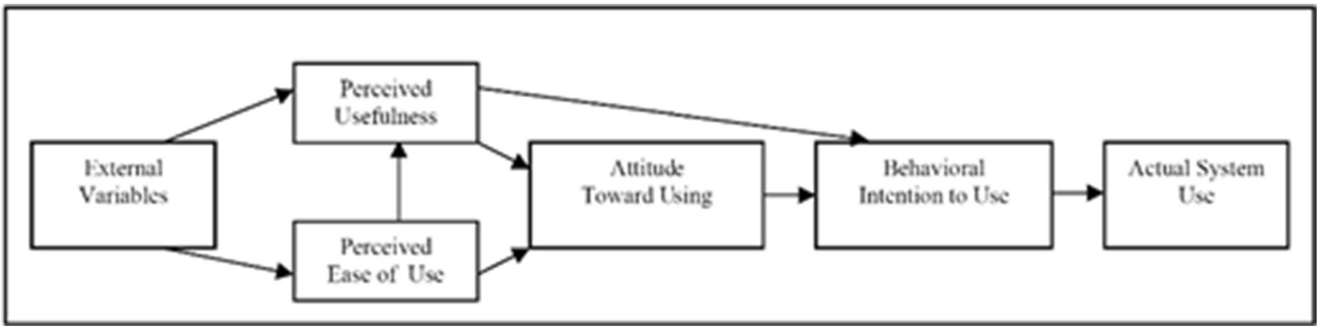

Fig. 1 Technology Acceptance Model

their curriculum and lesson planning. The curriculum in Atlas is first represented as a Unit Calendar which allows educators to view and edit how units are mapped across the school calendar. Each Unit Calendar is composed of Unit Plans. Unit plans include relevant curriculum categories (e.g., standards, content, skills, etc.) that guide the curriculum work and alignment. In Atlas, several users can work collaboratively on a Unit Plan. Teachers can then add Lesson Plans to the Unit Plans. All users of Atlas have rights to browse and view Unit Calendars for different subjects and grade levels. However, the edit rights are only granted to those developing or teaching the course. Atlas allows users to run different kinds of reports to find answers to specific questions. Reports include standards and assessment reports, scope and sequence reports, and keyword search reports (Faria Educational Group, 2021a).

Questionnaire Design

The questionnaire in this research is based on the TAM (Davis, 1989). Relevance has been used in many previous studies such as Siyam (2019), Alharbi and Drew (2014), and Park et al. (2009) as an external factor impacting perceived usefulness. However, in this study, we choose to extend this construct to five constructs related to the relevance of the tool for specific curriculum mapping tasks. These tasks were developed based on the previous studies by Shoja (2016) and Doğan and Alrun (2013). External factors related to perceived ease of use were adopted from previous studies by Siyam (2019) and Mathiesen (2008).

Questionnaires were sent to participants via email. Moreover, the questions were written in both English and Arabic to accommodate participants' preferences. The questionnaire included demographic questions including gender, nationality, job position, and years of experience. The questionnaire also consisted of 26 questions measuring TAM model and 28 questions measuring the seven constructs (which are the external variables in the hypothesized research model): long-term planning (LTP), short-term planning (STP), curriculum alignment (CA), teacher collaboration (TC), students' achievement (SA), training (TR), and time (T). Participants were asked to indicate their level of agreement for attitudes or the frequency (for actual usage) on a 5-point Likert scale.

Table 1 Sample Descriptive Summary ($N = 71$)

	N	%		N	C%
Gender			**Teaching Experience**		
Female	58	81.7	1–3 years	6	8.5
Male	13	18.3	4–10 years	28	39.4
Nationality			11–20 years	28	39.4
Egypt	20	28.2	21–30 years	7	9.9
Jordan	26	36.6	More than 30 years	2	2.8
Syrian Arab Republic	13	18.3	**Job Position***		
Other	12	16.9	Teachers	57	80.3
			Leaders	14	19.7

Rubicon Atlas Curriculum Management System (Atlas).

Hypotheses

According to the TAM model, attitudes towards using a certain technology (ATU) are positively impacted by the perceived ease of use (PEU) and perceived usefulness (PU). Then, attitudes towards technology (ATU) impacts the behavioral intention to use the technology (BI), which in return impacts the actual use of a certain technology (AU) (Davis, 1989). In this paper, the first aim is to study academic staff attitudes towards the curriculum mapping tool, Atlas. To this aim, and to answer the first research question, the following hypothesis is formulated:

> **H1:** Academic staff have positive attitudes towards Atlas as a curriculum mapping tool.

As curriculum mapping tools may serve different purposes to different academic staff members, and therefore may be perceived differently by teachers and leaders, this study also aims to examine whether the role of the academic staff impacts their attitudes towards the use of Atlas. Therefore, to

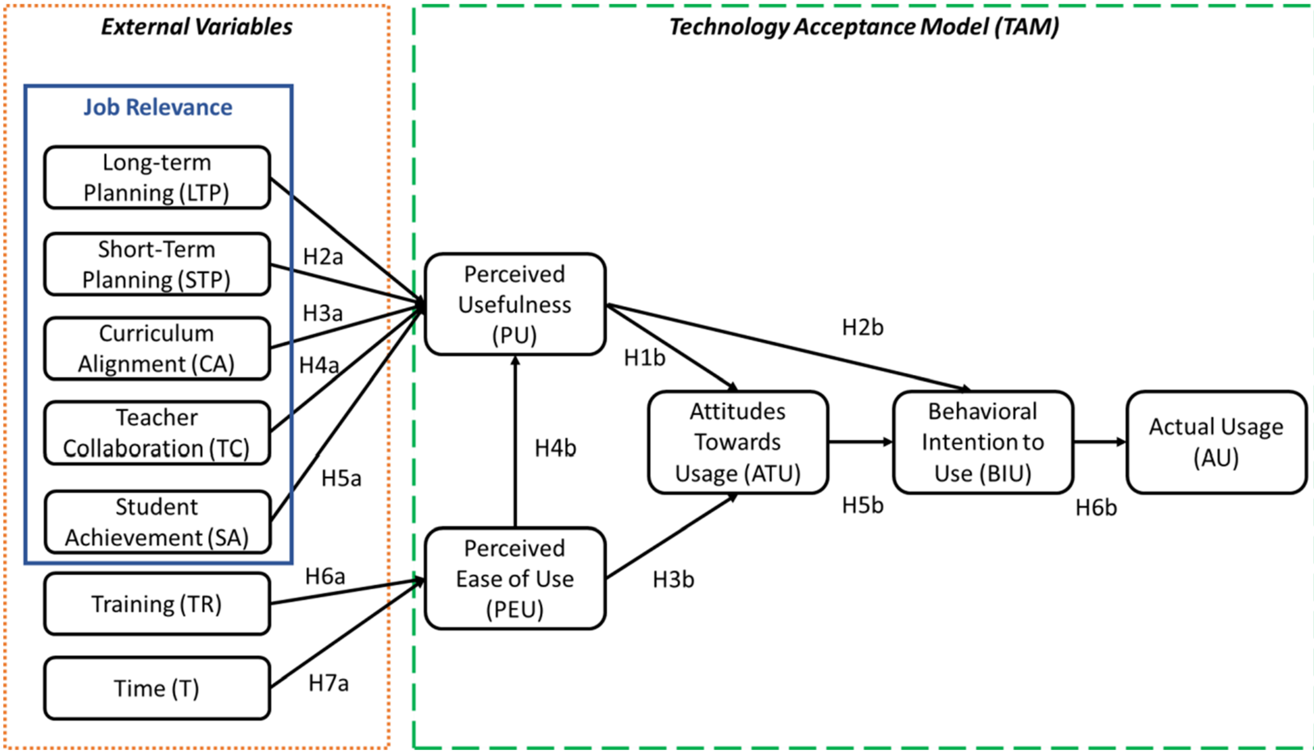

Fig. 2 Research Model and Hypotheses

answer the second research question, the following hypothesis is formulated:

> **H2:** Staff role significantly impacts attitudes towards Atlas as a curriculum mapping tool.

Perceived usefulness (PU) refers to the teacher's degree of belief of how the curriculum mapping tool is useful. In this research, we consider items related to the relevance of the curriculum mapping tool as variables impacting the PU. Relevance is the match between the features available in the curriculum mapping tool and users' needs regarding the curriculum (Park et al., 2009). Moreover, job relevance reflects' users' beliefs about the applicability of the tool to their daily routines at work (Venkatesh & Davis, 2000). Job relevance is considered one of the factors that impact PU in the revised model of TAM, known as TAM2 (Venkatesh & Davis, 2000). The more users find the tool relevant to their tasks, the more likely they perceive the system as useful (Park et al., 2009). Users' relevance judgment was also found to impact the behavioral intention to use the tool (Venkatesh & Davis, 2000).

Literature on curriculum mapping indicated that it can be a useful tool for instructional long-term (LTP) and short-term planning (SLP), curriculum alignment (CA), collaboration between teachers (TC), and increased student achievement (SA) (Doğan & Altun, 2013; English, 1980; Jacobs, 2004; Lucas, 2005; Shoja, 2016). This research aims to investigate how these factors influence the PU of the curriculum mapping tool. Therefore, the following hypotheses were formulated:

> **H1a:** LTP significantly impacts PU.
> **H2a:** STP significantly impacts PU.
> **H3a:** CA significantly impacts PU.
> **H4a:** TC significantly impacts PU.
> **H5a:** SA significantly impacts PU.

Perceived ease of use (PEU) refers to the degree of teachers' belief in how easy it is to learn to use the technology-based curriculum tool and the little effort it requires (Aggarwal, 2018; Siyam, 2019). In this study, we consider the support and training (TR) teachers receive on the use of the curriculum tool as well as the time (T) available and needed to use it as determinants of the PEU. Therefore, to answer the fourth research question, the following hypotheses are formulated:

> **H6a:** TR significantly impacts PEU.
> **H7a:** T significantly impacts PEU.

Moreover, this study aims to study whether the original TAM applies to the use of online curriculum mapping tools. To this aim, the following hypotheses are tested:

> **H1b:** PU significantly impacts ATU.
> **H2b:** PU significantly impacts BIU.

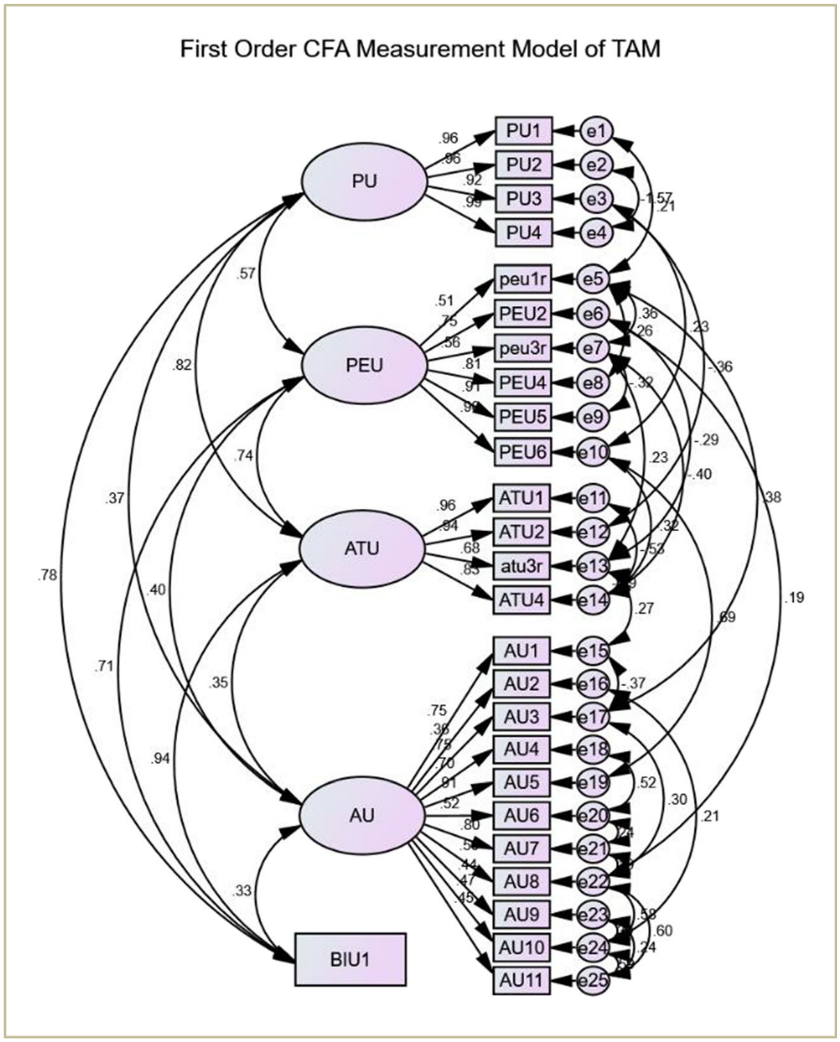

Fig. 3 TAM 1st Order CFA Measurement Model

H3b: PEU significantly impacts ATU.
H4b: PEU significantly impacts PU.
H5b: ATU significantly impacts BIU.
H6b: BIU significantly impacts AU.

Figure 2 describes the proposed research model and hypotheses. This research aims to investigate the relationships between the external variables and PU and PEU as well as the agreement with the original TAM constructs.

Research Measurement Validation

The validity and reliability of the measurements were tested by performing confirmatory factor analysis (CFA). A CFA was conducted to validate the TAM model, and a separate CFA was conducted to validate each construct of the external variables. The CFA was conducted using AMOS 24 to assess the reliability and validity of the proposed model structure of the main TAM constructs: Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitudes Towards Usage (ATU), Behavioral Intention to use (BIU), and Actual Use (AU). Other measurement models of the seven constructs (external variables) are assessed individually. Before evaluating each model fit, psychometric (validity and reliability) checks of the instrument using the measurement model are presented.

TAM Model

Using the first and second order measurement models of TAM in Figs. 3 and 4, the TAM questionnaire psychometric characteristics were analyzed through checking the following validity and reliability checks: convergent validity, discriminant validity, composite reliability, and construct reliability (Akgül, 2019).

Convergent Validity

Convergent validity was verified using three criteria; factor loading γ of an item, which should be more than 0.5 (Hair, 2009), average variance extracted AVE greater than 0.5 and

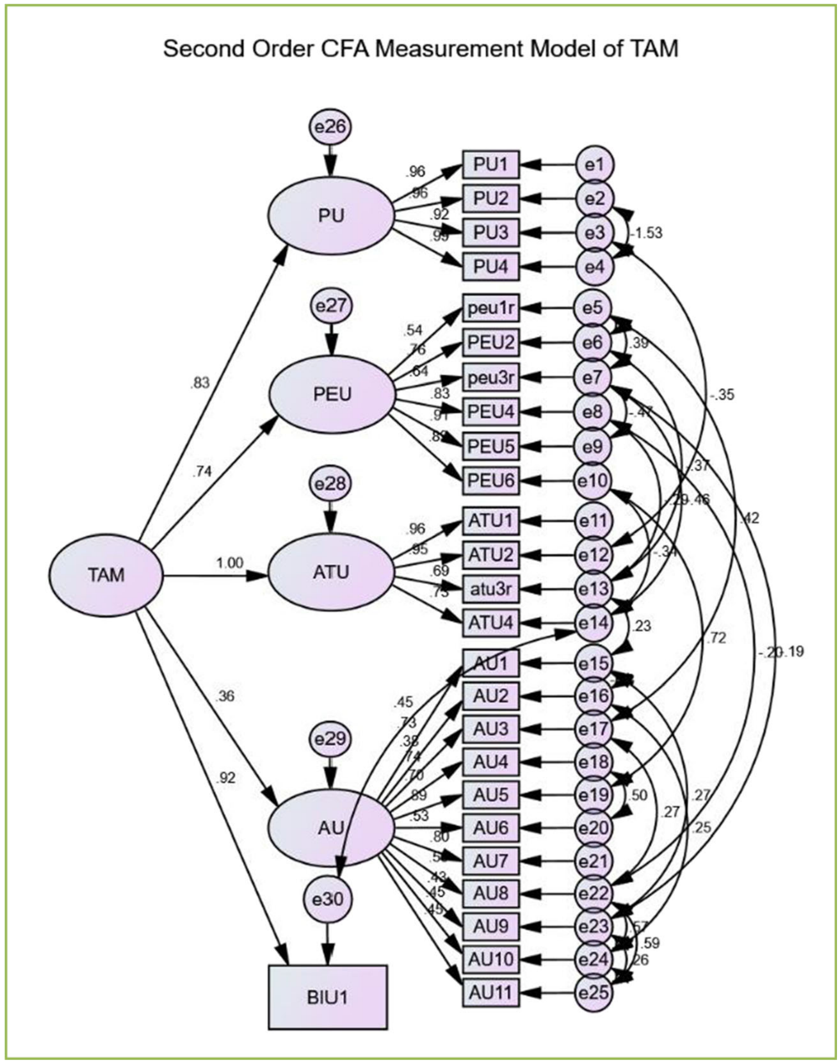

Fig. 4 TAM 2nd Order CFA Measurement Model

composite reliability CR of all constructs above 0.7 (Fornell & Larcker, 1981). Table 2 shows factor loadings for TAM constructs and their items. The results demonstrate convergent validity as factor loading values of all observed variables are significant and above 0.5 (Fornell & Larcker, 1981), except item AU2, AU8, AU9, AU10, and AU11 with factor loading just below the cutoff of 0.5. However, it was retained in the model as it is significantly contributing to the model. Similarly, convergent validity was indicated for latent variables, with factor loadings significant and above 0.5. Cronbach's alpha was used as a measure of construct reliability. As shown in Table 2, the results indicate that alpha values range between 0.889 and 0.975, which satisfies the minimum threshold of 0.6 for exploratory research (J. Hair, 2009). Composite reliability (CR) is used to test the internal reliability of measurement models. All CR values reported in Table 2 are above 0.7, which shows adequate internal consistency of data. AVE values ranged between 0.388 to 0.919, demonstrating convergent validity (Fornell & Larcker, 1981).

Discriminant Validity

Discriminant validity of latent factors (the five constructs) is assessed by comparing the square correlation between constructs to the square root of AVE; that is, the square correlation between constructs must be smaller than the square root of AVE (J. F. Hair et al., 1998). The factor correlation matrix in Table 3 shows the square root of AVE's on the diagonal items, which is a measure of variance between construct and its indicators, and the off-diagonal items represent squared correlation between constructs. The results show that the squared correlation values between constructs were lower than the values of the square root of AVEs, which supports discriminant validity.

TAM Measurement Model Fit

After validating the TAM measurement model, the output of the CFA produced by AMOS were used to evaluate the model

Table 2 CFA Psychometric Measures of TAM

Construct/Item		FL	M	SD
TAM				
Perceived Usefulness (α=.975, CR=.979, AVE=.919)		**.828**	**2.65**	**1.204**
PU1	Using ATLAS enables me to do my tasks more quickly	.964	2.65	1.288
PU2	Using ATLAS improves my job performance	.958	2.68	1.240
PU3	Using ATLAS increases my productivity.	.920	2.56	1.216
PU4	I find ATLAS useful	.992	2.72	1.244
Perceived Ease of Use (α=.892, CR=.896, AVE=.598)		**.742**	**3.54**	**.986**
PEU1	I feel that it would be hard to become skillful at using ATLAS	.535	3.70	1.074
PEU2	Learning to use ATLAS would be easy for me	.765	3.49	1.308
PEU3	I make errors frequently when using ATLAS	.641	3.61	1.189
PEU4	I find it easy to correct errors while using ATLAS	.826	3.63	1.124
PEU5	It is easy for me to remember how to perform tasks using ATLAS	.911	3.45	1.296
PEU6	Overall, I find ATLAS easy to use	.890	3.34	1.330
Attitudes Towards Usage (α=.893, CR=.905, AVE=.708)		**1.003**	**2.85**	**1.180**
ATU1	I believe that it is a good idea to use ATLAS	.960	2.79	1.319
ATU2	I like the idea of using ATLAS	.948	2.73	1.341
ATU3	I dislike the idea of using ATLAS	.694	2.86	1.397
ATU4	I prefer using ATLAS rather than using other conventional methods for curriculum and lesson planning	.728	3.01	1.368
Behavioral Intention to Use		**.921**	**2.77**	**1.396**
BIU	Assuming I have the option, I intend to use ATLAS in the future	.921	2.77	1.396
Actual Use (α=.889, CR=.866, AVE=.388)		**.365**	**3.62**	**.786**
AU1	How often do you use ATLAS?	.733	4.58	1.078
	How often do you use ATLAS to perform the following tasks?			
AU2	Add or update Annual Plans	.377	3.44	.996
AU3	View Annual Plans	.736	3.80	1.142
AU4	Add or update Unit Plans	.698	3.90	.973
AU5	View Unit Plans	.892	3.97	1.028
AU6	Add or Update Lesson Plans	.534	4.14	.867
AU7	View Lesson Plans	.803	3.96	1.224
AU8	Run reports	.499	2.94	1.297
AU9	Share Unit or Lesson Plans with other teachers	.426	3.61	1.213
AU10	View Unit Calendars or Plans for other grade levels	.451	2.96	1.259
AU11	View Unit Calendars or Plans for other subjects	.446	2.52	1.382

FA: Factor Loadings, M: Mean, SD: Standard Deviation.

fit of the TAM measurement model to confirm the proposed model structure, using Maximum Likelihood (ML) Estimation method. Inspection of model fit for both models revealed indices that were well meet the acceptable thresholds (J. F. Hair et al., 1998), see Table 4.

External Variables

External variables are represented by seven constructs. Only constructs with more than two items could be assessed for validity by CFA (Fig. 5). Thus, the SA and T constructs were not assessed for validity by CFA. The reliability coefficient of Cronbach's alpha was calculated and reported. Psychometric evaluation measures for the seven constructs are reported in Table 5. The table shows factor loadings for the five constructs (LTP, STP, CA, TC, and TR) and their items. The results demonstrate convergent validity as factor loading values of all observed variables are significant and above 0.5 (Fornell & Larcker, 1981). The results also indicate that alpha values range between 0.764 and 0.970, which satisfies the minimum threshold of 0.6 for exploratory research (J. Hair, 2009). All CR values reported are above 0.7, which shows adequate internal consistency of data (Fornell & Larcker, 1981). AVE values ranged between 0.65 to 0.87, demonstrating convergent validity (Fornell & Larcker, 1981).

Table 3 Factor Matrix showing Discriminant Validity of TAM Constructs

	PU	PEU	ATU	BIU	AU
PU	.959				
PEU	.338	.773			
ATU	.687	.566	.841		
BIU	.610	.503	.882	1.000	
AU	.143	.172	.133	.106	.623

Model Fit

After validating the measurement models in Fig. 5, the output of the CFA produced by AMOS were used to evaluate the models fit, using Maximum Likelihood (ML) Estimation method. Inspection of model fit for the five models revealed indices that were well meet the acceptable thresholds (J. F. Hair et al., 1998), see Table 6.

Analysis and Results

This section includes the analysis conducted to test the hypotheses proposed to answer the research questions.

Attitudes towards the Curriculum Mapping Tool

A one-sample t test was used to test whether teachers have positive attitudes towards Atlas as a mapping tool. That is, to test whether mean scores given by teachers for TAM exceed the undecided score of '3'. The test revealed that TAM mean score was not significantly different from '3' [t = 0.779, Mean Difference = 0.09, $p = 0.439$]. Therefore, a detailed view was conducted to test whether mean scores given by teachers for PU, PEU, ATU, BIU and AU exceed the undecided score of '3'. The results indicate that PU mean score is significantly lower than the hypothesized mean of '3', t = −2.44, $p = 0.017$, indicating that respondents' perceived usefulness was low. On the other hand, respondents have significantly higher mean scores of PEU and AU than '3', $p < 0.001$. The tests of ATU and BIU were not statistically significant, $p > 0.05$, as reported in Table 7.

Impact of Staff Role on Attitudes Towards the Curriculum Mapping Tool

Two-independent samples t test was conducted to find whether or not staff role significantly impacts attitudes towards Atlas as a mapping tool. The results are reported in Table 8, showing that, overall, there is no significant difference between teachers and leaders in terms of TAM mean score, t = −1.415, $p = 0.161$. However, on the detailed level, leaders have significantly higher mean score of perceived usefulness, $p < 0.05$.

Impact of External Variables on Perceived Usefulness and Ease of Use

Structural equation modeling in the form of path analysis was used to test the impact of the external variables LTP, STP, CA, TC, SA, TR, and T on PU and PEU. Path analysis is used to determine causal relationships between exogenous and endogenous variables (Randolph & Myers, 2013). In path analysis, two types of fit indices are used to assess model fit: absolute fit indices and incremental fit indices. Of absolute fit indices, the Chi-square test and the Root Mean Square Error of Approximation (RMSEA) are used. Of the incremental fit indices, Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) are used. The results from the goodness of fit model are shown in Table 9. The hypothesized path model was tested and it was a good-fit.

Estimated, regression weights are reported in Table 10. The results of the path analysis revealed that both T and TR had a significant positive impact on PEU, with ($\gamma = 0.365$, $p < 0.001$) and ($\gamma = 0.507$, p < 0.001) respectively. Additionally, STP and

Table 4 Model Fit Indices for CFA Measurement Model of TAM

Model Fit Indices	Acceptable levels	Obtained Fit Statistics	
		1st Order	2nd Order
χ^2	Low χ^2 relative to df	330.380	378.452
df	–	247	270
χ^2/df	< 5 (Bentler, 1989)	1.338	1.402
CFI	≥ .90 (Hu and Bentler, 1999)	.949	.940
RMSEA	< .07 (Steiger, 2007)	.069	.076
TLI	.90 to .95 (Tucker and Lewis, 1973)	. 938	.927

χ^2 : (CMIN), χ^2 /df: Minimum Discrepancy, CFI: Comparative Fit Index, RMSEA: Root-mean-square error of approximation, TLI: Tucker Lewis Index.

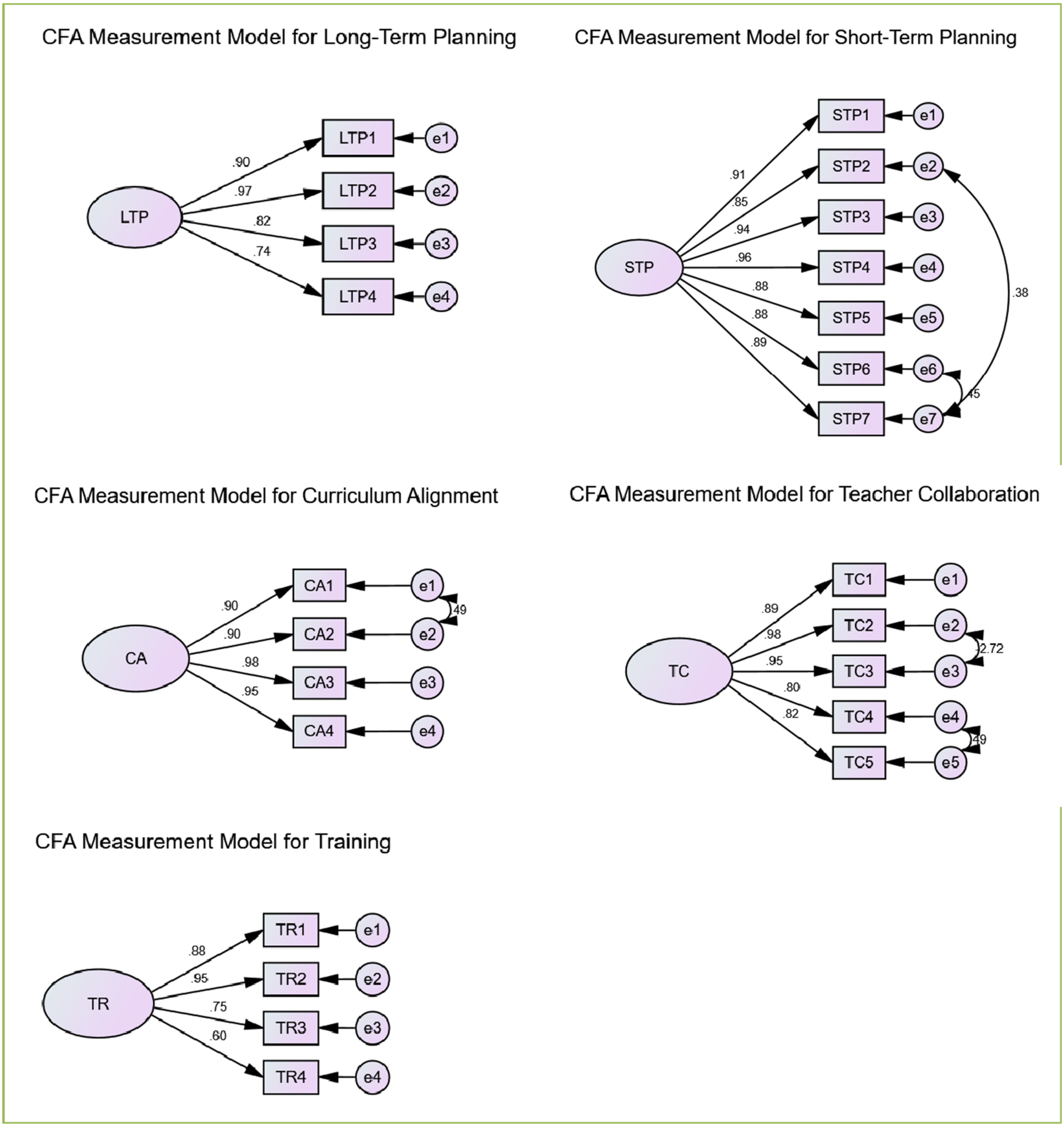

Fig. 5 CFA Measurement Models of External Variables Constructs

TC had a significant positive impact on PU, with ($\gamma = 0.238$, $p = 0.03$) and ($\gamma = 0.456$, $p < 0.001$) respectively.

TAM Agreement

The path analysis was also used to test the agreement of the results with the original TAM constructs. PU had a significant positive impact on ATU ($\gamma = 0.279$, $p = 0.002$), and ATU had a significant positive impact on BIU ($\gamma = 0.784$, $p < 0.001$). On the other hand, unlike the original TAM, PEU did not impact ATU, PU did not impact BIU, BIU did not impact AU, and PEU did not impact PU. These unsupported links warrant further investigation (Table 11).

Figure 6 summarizes the findings of the regression analysis conducted for hypotheses testing for the external variables and the TAM constructs.

Table 5 CFA Psychometric Measures of Constructs of External Variables

Construct/Item		FM	M	SD
Long-term Planning (α=.918, CR=.918, AVE=.738)			**3.58**	**1.081**
LTP1	Using ATLAS is useful for maintaining long-term curriculum records	.897	3.75	1.155
LTP2	Using ATLAS is useful for evaluating/adjusting long-term plans	.967	3.51	1.263
LTP3	Using ATLAS is useful for developing annual plans	.820	3.41	1.271
LTP4	Using ATLAS is useful for sequencing units	.736	3.68	1.131
Short-term Planning (α=.970, CR=.968, AVE=.815)			**3.15**	**1.103**
STP1	Using ATLAS is useful for planning unit standards	.913	3.34	1.206
STP2	Using ATLAS is useful for planning unit enduring understandings and essential questions	.847	3.04	1.164
STP3	Using ATLAS is useful for planning unit content/concepts	.945	3.10	1.148
STP4	Using ATLAS is useful for planning unit skills	.957	3.11	1.190
STP5	Using ATLAS is useful for planning unit assessments	.875	2.90	1.161
STP6	Using ATLAS is useful for planning/preparing lesson plans	.884	2.97	1.219
STP7	Using ATLAS is useful for evaluating/adjusting short-term plans	.892	3.13	1.170
Curriculum Alignment (α=.968, CR=.964, AVE=.870)			**3.17**	**1.175**
CA1	Using ATLAS is useful for articulating the curriculum (scope and sequence)	.905	3.20	1.203
CA2	Using ATLAS is useful for aligning units and lessons to standards	.899	3.27	1.264
CA3	Using ATLAS is useful for aligning assessments to standards	.978	3.13	1.194
CA4	Using ATLAS is useful for identifying gaps and redundancies	.947	3.07	1.257
Teacher Collaboration (α=.950, CR=.951, AVE=.797)			**2.86**	**1.015**
TC1	Using ATLAS is useful for sharing and discussing curriculum	.892	2.96	1.034
TC2	Using ATLAS is useful for facilitating dialogue about curriculum	.981	2.77	1.124
TC3	Using ATLAS is useful for collaboration with teachers	.953	2.97	1.171
TC4	Using ATLAS is useful for facilitating dialogue about students' achievement	.800	2.73	1.068
TC5	Using ATLAS is useful for planning cross-curricular links	.824	2.87	1.158
Students' Achievement (α=.956)			**2.86**	**1.063**
SA1	Using ATLAS is useful for preparing students for graduation requirements	–	2.85	1.023
SA2	Using ATLAS is useful for preparing students for standardized testing	–	2.87	1.146
Training (α=.865, CR=.878, AVE=.650)			**3.59**	**.857**
TR1	I have the knowledge needed to use ATLAS	.877	3.82	.850
TR2	I received enough training on how to use ATLAS that allows me to easily complete my tasks	.948	3.65	1.016
TR3	I receive enough support on how to use ATLAS to complete my tasks	.752	3.63	1.031
TR4	ATLAS platform provides helpful guidance in performing tasks	.605	3.25	1.143
Time (α=.764)			**2.67**	**1.149**
T1	I don't have the time needed for using ATLAS[R]	–	2.59	1.271
T2	I have enough time to learn and practice using ATLAS	–	2.75	1.284

[R]. *Reversed item*

Table 6 Model Fit Indices for CFA Measurement Models of External Variables

Model Fit Indices	Acceptable levels	Obtained Fit Statistics				
		LTP	STP	CA	TC	TR
χ^2	Low χ^2 relative to df	4.845	20.855	1.062	3.684	1.793
df	–	2	12	1	3	2
χ^2/df	< 5 (Bentler, 1989)	2.422	1.738	1.062	1.228	.896
CFI	≥ .90 (Hu and Bentler, 1999)	.987	.986	1.000	.998	1.000
RMSEA	< .07 (Steiger, 2007)	.143	.103	.030	.057	.000
TLI	.90 to .95 (Tucker and Lewis, 1973)	.961	.976	.999	.994	1.004

Discussion

To answer the first research questions, "H1: Academic staff have positive attitudes towards Atlas as a curriculum mapping tool" was tested. This hypothesis was not supported, indicating that, in general, the curriculum mapping tool was not perceived positively. First, academic staff attitudes towards Atlas as a curriculum mapping tool was not significantly positive. When examining the constructs further, it was found that perceived ease of use was found to be significantly positive but perceived usefulness was found to be significantly negative. Surprisingly, the self-reported actual use of the tool was significantly high. That is, the staff did not find it hard to use the tool and used it frequently as required by the school. However, they did not believe in the added benefits of the tool.

When examining the constructs related to the relevance of the tool to teachers' job, it was found that long-term planning has the highest mean score, followed by curriculum alignment and short-term planning, with a mean score of 3.58, 3.17 and 3.15 respectively. While these scores are significantly high, except for long-term planning, the results are somehow consistent with Lucas's (2005) study where teachers perceived curriculum mapping as a useful tool for curriculum alignment and long-term planning, and to a lesser degree, supportive of short-range planning. Moreover, the studies by Shilling (2013) and Shoja (2016) found that teachers had higher positive attitudes towards curriculum mapping tools when it comes to long-term planning. This is also consistent with English's (1980) definition of curriculum mapping and how it is considered a solution to creating curriculum guides that reflect the actual curriculum and provide stakeholders with an outline of the content taught across the instructional calendar.

Conversely, the results showed that staff attitudes towards Atlas as a tool for teacher collaboration and students' achievement were low. While Atlas was designed in a way that allows teachers to work collaboratively on unit and lesson plans, teachers may still prefer face to face discussions or may even be not receptive to the curriculum mapping tool and had negative interactions with the colleagues, as suggested by Shoja (2016). Also, while an aligned curriculum is considered one of the factors linked with increased student achievement (Bay, 2016), how teachers perceive curriculum mapping as a useful tool to increase students' achievement is understudied. The results of this study may imply that academic staff did not attribute student's achievement to the use of the tool, which is consistent with previous studies (Shoja, 2016).

To answer the second research question, "H2: Staff role significantly impacts attitudes towards Atlas as a curriculum mapping tool" was tested. This hypothesis was not supported, indicating that the role of the staff did not impact their attitude towards the curriculum mapping tool in general. However, leaders had significantly more positive attitudes toward the mapping tool in regards of perceived usefulness compared to teachers. Moreover, leaders had generally higher mean scores in all constructs compared to teachers. This could be attributed to the fact leaders have the responsibilities to articulate the curriculum, aligning units to standards, and identifying gaps and redundancies in the curriculum. Using technological tools facilitate such tasks as they provide visual reports.

Another reason that may have impacted the perceived usefulness of the tool is that unlike educational tools like LMS and learning delivery tools, the curriculum mapping tool is not directly used by teachers to deliver instruction. This may also explain the significant difference in perceived usefulness between teachers and leaders, as perceived usefulness was significantly higher for leaders compared to teachers.

To answer the third research question, hypotheses H1a to H5a were tested to examine the factors that impact the perceived usefulness of the curriculum mapping tool. The results indicated that perceived short-term planning and teacher collaboration were good predictors of perceived usefulness while perceived long-term planning, curriculum alignment and students' achievement were not. To answer the fourth research

Table 7 One-sample t Test Results – Test Value = 3

Construct	Descriptive		Test Value=3			95% C.I. for MD	
	M	SD	MD	t	Sig.	Lower	Upper
TAM	**3.09**	**.934**	**.09**	**.779**	**.439**	**−.135**	**.308**
PU	2.65	1.204	−.35	−2.440	.017*	−.634	−.064
PEU	3.54	.986	.54	4.593	< .001**	.304	.771
ATU	2.85	1.180	−.15	−1.081	.283	−.431	.128
BIU	2.77	1.396	−.23	−1.360	.178	−.560	.110
AU	3.62	.786	.62	6.642	< .001**	.434	.806

**. Significant at 0.05*

***. Significant at 0.01*

Table 8 Results of Independent-samples t Tests (Staff Role)

	Teacher (*n*=57)		Leader (*n*=14)		Independent-samples t Test	
	M	SD	M	SD	t	Sig.
TAM	**3.01**	**.928**	**3.40**	**.927**	**−1.415**	**.161**
PU	2.50	1.125	3.27	1.357	−2.196	.031*
PEU	3.51	.950	3.65	1.152	−.494	.623
ATU	2.75	1.205	3.25	1.014	−1.431	.157
BIU	2.70	1.439	3.07	1.207	−.886	.378
AU	3.59	.825	3.76	.606	−.741	.461

*. Significant at $\alpha = .05$

Table 9 Test Results of Goodness of Fit of Path Model

Goodness of Fit Index	Cut off Value	Value	Fit
Chi-square	Smaller is better	59.341	–
CMIN (DF)	< 5 (Bentler, 1989)	2.826	Reasonable
RMSEA	< .07 (Steiger, 2007)	.162	Poor
CFI	≥ .90 (Hu and Bentler, 1999)	.956	Good
TLI	≥ 0.95 Good fit, > 0.8 mediocre fit*	.860	Mediocre

**. Bentler & Bonett 1980; Sharma* et al. *(2005)*

questions, hypothesis H6a and H7a were tested to examine the factors that impact perceived ease of use. The results indicated that both training and time were good predictors of perceived ease of use as both hypotheses were confirmed.

Finally, to answer the fifth research question and to investigate whether the TAM apply to the use of a curriculum mapping tool, hypotheses H1b to H6b were tested. The analysis indicated that the results of this study do not agree with all the assumptions of the original TAM proposed by Davis (1989). For instance, perceived ease of use was not a predictor of perceived usefulness nor attitudes towards usage. Moreover, perceived usefulness was not a predictor of the behavioral intention to use. Behavioral intention to use did not predict the actual use as well. Moreover, the results of this study do not agree with the original TAM in that when a person finds a technology easy to use, the perception towards that technology becomes useful (Alshammari et al., 2016).

Conclusion

This study aimed to examine educators' attitudes towards the use of a web-based curriculum mapping tool (Atlas). The study also aimed to examine whether the staff role impacted their perceptions of the curriculum mapping tool. The results indicated that the staff did not have significant positive attitudes towards the tool. Also, while perceived ease of use and actual usage were significantly high, perceived usefulness was significantly low. The results also showed that there were no differences in perceptions according to the staff role except for perceived usefulness, which was significantly higher for leaders compared to teachers. Results also indicated that perceived short-term planning and teacher collaboration were good predictors of perceived usefulness, while perceived training and time were good predictors of perceived ease of use.

These results reflect a shallow understanding of the theory that underlies the use of the curriculum mapping tool. Although participants have acquired the basic skills to perform curriculum mapping, they still need more time to gain a full understanding of the whole cycle and develop new awareness that would allow users to experience the benefits of the tool and develop new attitudes and beliefs. According to the change literature, teachers, and especially experienced ones, may resist new initiatives as they find it challenging and time consuming to learn to use new technological tools. Change would be possible and effective only if there is a shared understanding, a common vision, and guiding statements in place before launching a new initiative (Kotter, 1996). A school adopts a change like a new platform for curriculum mapping, and the teachers implement the change. The change would not be successful if teachers do not perceive that change to be important (Fullan, 2007). Therefore, schools should continue to dedicate time and resources to extend communication about

Table 10 Regression Weights for Hypothesized Path Model, Estimated

Hypothesis		Path Coefficient[a]	Estimate	S.E.	C.R.	P	Hypothesis
H1a	**LTP ➔ PU**	.188	.207	.125	1.660	.097	Not Supported
H2a	**STP ➔ PU**	.238	.258	.119	2.168	.030*	Supported
H3a	**CA ➔ PU**	−.068	−.069	.120	−.577	.564	Not Supported
H4a	**TC ➔ PU**	.456	.537	.159	3.371	< .001**	Supported
H5a	**SA ➔ PU**	.096	.108	.123	.876	.381	Not Supported
H6a	**T ➔ PEU**	.365	.313	.078	4.027	< .001**	Supported
H7a	**TR ➔ PEU**	.507	.583	.104	5.593	< .001**	Supported

**. Significant at 0.05*

***. Significant at 0.01*

a. Standardized Regression Weights.

Table 11 Regression Weights for TAM, Estimated

Path		Path Coefficient[a]	Estimate	S.E.	C.R.	P	Hypothesis
H1b	**PU ➔ ATU**	.279	.273	.089	3.084	.002**	Supported
H2b	**PU ➔ BIU**	.146	.170	.098	1.734	.083	Not Supported
H3b	**PEU ➔ ATU**	.132	.157	.083	1.889	.059	Not Supported
H4b	**PEU ➔ PU**	.059	.072	.080	.899	.369	Not Supported
H5b	**ATU ➔ BIU**	.784	.929	.100	9.288	< .001**	Supported
H6b	**BIU ➔ AU**	.099	.056	.112	.496	.620	Not Supported

**. Significant at 0.05*

***. Significant at 0.01*

a. Standardized Regression Weights.

the purpose of curriculum mapping and how the mapping tool can make the process more effective and efficient (Shilling, 2013). Schools that are planning for a curriculum reform should also consider assessment and identification of needs prior to initiative launching. One of way of achieving this is through Backward Design (Wiggins & McTighe, 2012). This approach that has been widely used in curriculum review ensures end goals are kept in mind when designing instruction (Wright et al., 2018).

Curriculum mapping should also be integrated into the school's culture by building a team of administrators and teachers to lead the initiative, and ensuring commitment and enough time and training for a successful outcome (Goode et al., 2018; Shoja, 2016). Moreover, teachers may require more training and guidance in the use of the advanced features to generate reports of the curriculum mapping tool to move them beyond the initial phase of just entering the data to the system (Mathiesen, 2008). Additionally, future work should investigate students and parents' perceptions regarding the curriculum mapping tool. The curriculum mapping tool studied in this research provides access to students and parents, allowing them to navigate the different courses and preview the course description and standards alignment. Therefore, it is worth investigating whether students' awareness and accessibility of the curriculum mapping impacts their understanding of the connection between different subjects and their selection of elective courses.

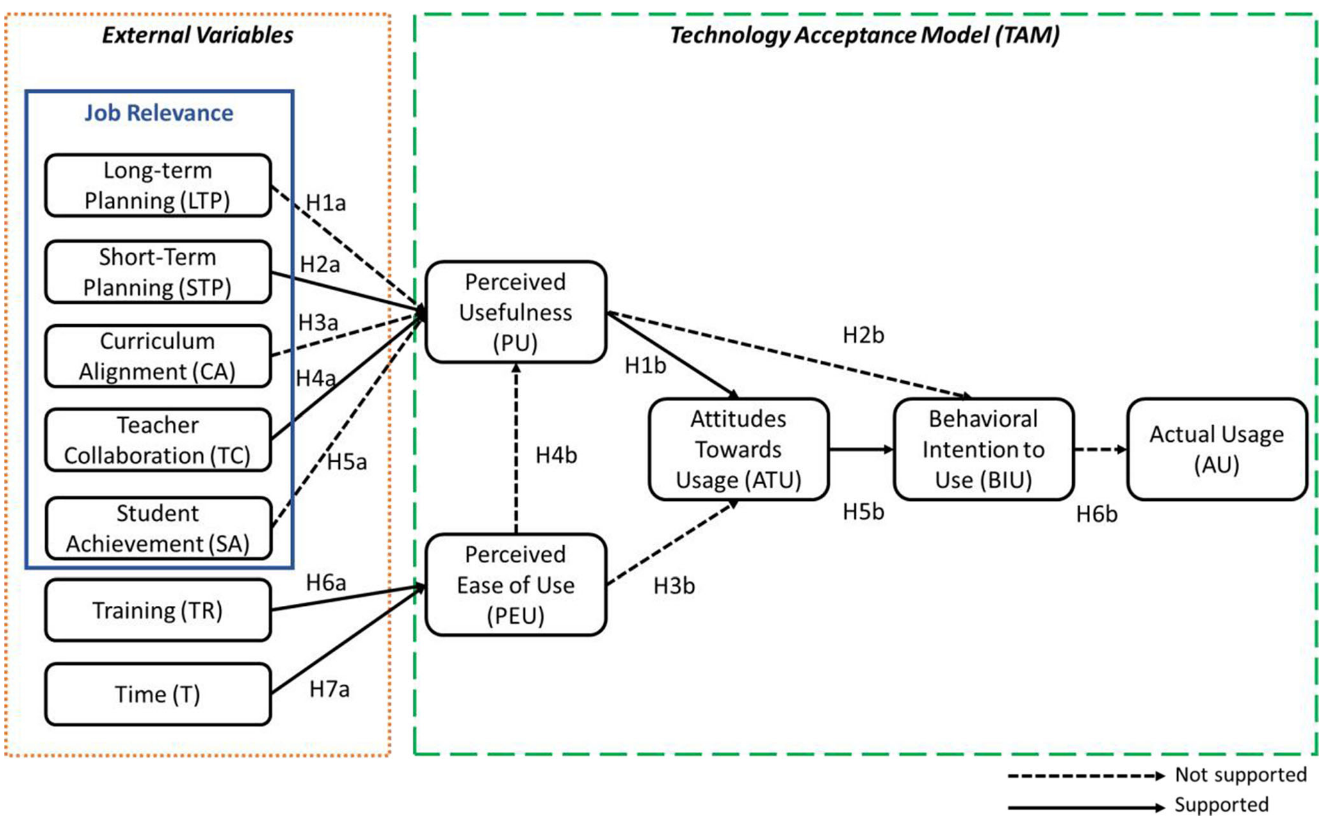

Fig. 6 Results of Hypothesis Testing

Another point to consider when adopting tools for educators is including the users of the system in the design process from its early stages to ensure that the developed tool provides them with tools that are tailored to their needs (Steketee, 2015). The literature shows how including users in the design process improves the usability of the system and users' satisfaction (Siyam & Abdallah, 2021). Moreover, the tool studied in this research did not include a mobile app or mobile based version where teachers and leaders can dynamically access and edit relevant curriculum information. The use of mobile technology was found to motivate usage and engagement and was considered in the literature as a mean to improve plans coordination and curriculum development (Siyam & Abdallah, 2021; Vallance et al., 2017).

This study was limited to teachers and leaders in a private school in Dubai using one type of curriculum mapping software. This may limit the generalization of results. Moreover, the number of participants is considering a limitation as only 57 teachers and 14 leaders participated in the questionnaire. Additionally, the analysis examining the relationship between different constructs included both teachers and leaders. This may have impacted the results and contributed to the variation of results compared to previous studies. Future studies can consider examining the relationship between the TAM constructs for teachers and leaders separately.

Also, the study is limited in that it relies on staff perceptions only without measuring the actual use of the system. Future research should consider the actual use of the tool as well as the factor that may impact the actual use of the tool. Additionally, as the results of this study indicate that TAM may not be completely adequate to explain the factors that impact users' perception of the curriculum mapping tool, future work should attempt to employ alternative models such as the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2016) and to examine additional possible factors. Lastly, a longitudinal future study can be conducted to examine whether behavioral intention to use in channeled into actual use of the tool.

Declarations

Conflict of Interest There are no conflicts of interest.

Informed Consent Informed consent was obtained from all individual participants prior to administering the questionnaire.

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