

TPACK Model Construction for Sustainable Educational Management: The Contribution of Organizational Learning Readiness and Authentic Learning

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Abstract

In this technological era, the Technological Pedagogical and Content Knowledge (TPACK) framework has become a widely adopted model for educators. This study quantitatively examines how organizational learning readiness and authentic learning contribute to TPACK model construction within sustainable educational management. Data were collected through a 4-point Likert-scale questionnaire based on five components of organizational learning readiness (Senge, 2006) and seven indicators of authentic learning (Mullin, 2019) from 150 primary school teachers in DKI Jakarta Province, Indonesia. The data were analyzed using Structural Equation Modeling (SEM) with SmartPLS. The results show that both organizational learning readiness and authentic learning significantly influence TPACK model construction. The t-value for organizational learning readiness was 4.721 (> 1.96), and for authentic learning 3.582 (> 1.96), leading to the rejection of both null hypotheses. These findings reinforce that sustainable educational management is strengthened through organizational learning cultures and authentic pedagogical practices that enhance teachers' professional competence.

Keywords: TPACK Development Model; Organizational Learning Readiness; Authentic Learning.

Introduction

It is worth mentioning that technology plays pivotal role almost in all aspects of life including in education. Technology and education develop hand in hand (Safiq Adzkie et al., 2024) Therefore, integrating technology into teaching and learning process needs a framework such as TPACK --- Technological, Pedagogical, and Content Knowledge – to direct teachers to serve effective and efficient learning (Agustina, Noni; Susanto, 2021). By employing the concept of TPACK, teachers are required to understand knowledge of technology and pedagogy and the methods to link those two, and technology and content (Beri, 2021) TPACK has become a comprehensive model to measure teachers' teaching competencies and professional development since its inception (Ebrahim, Reham, S., Afify, Waleed, Abdelkareem, Reda, 2021) Therefore, its model should be constructed in such a way, not only to enhance the capacity and capability of teachers, but also their interaction with organizations and students, in an integrated manner

As a model used in the instructional process, the readiness of organization to carry out the learning by applying TPACK is obviously important.(Griffin, 2015) claimed that schools, especially in developing countries, still face 'irritation' during online learning implementation. To respond to this, they did a research study to measure the influence of organizational supports on TPACK and teachers' performance and the analysis data revealed that support of organization positively affected both TPACK and teachers' performance. In the same vein, Mishra and Kohler (Haleem et al., 2022) opined that teachers often get lack of support from their organization in their efforts of teaching with technology. In another research work, Kaschulu (Kaschuluk, 2019) adopted Marsick and Watkins) reported that teachers assessed the seven factors of learning organization culture as the variables closely related to the components of TPACK.

Those seven dimensions are: 1) creating the opportunities of continuous learning; 2) promoting dialogue and inquiry; 3) encouraging team learning and collaboration; 4) empowering people to be in a collective goal; 5) connecting the organization with its surrounding; 6) establishing systems to build learning; 7) providing leadership and strategic learning. "The first four dimensions encompass characteristics at the individual level while the last three are representatives of the structural level"(Buele & Llerena-aguirre, 2025). These seven dimensions were proposed by

Marsick and Watkins (2003) on a questionnaire called 'The Dimension of the Learning Organization Questionnaire (DLOQ)' which was confirmed by Vowell(Lang, 2024) as a reliable and valid instrument to measure a study related to organizational culture.

The three prior studies above show that in developing TPACK to be utilized in learning, organizations are required to support teachers and this support should be preceded by its readiness. According to Susanto, et al. (Ratnawati Susanto et al., 2020) as learning organizations, the readiness of educational institutions becomes a pillar in the development of TPACK model. Senge (2006) (Lynn, 2023) proposed five components of organizational learning readiness, i.e., 1) systems thinking; 2) personal mastery; 3) mental models; 4) shared vision, and 5) team learning. Panagiotopoulos, et al. (Maipita, Indra; Dongoran, 2023) explained each of them as follows: 1) systems thinking is the fundamental principle which intertwines with the other four in which individuals do not only focus on personal parts or events but on the overall views. Through a certain way of communication, it explains in-depth understanding of the relationships among all principles. Thus, organization needs capable leadership and active engagement of each individual in that organization to build an innovative learning environment. 2) personal mastery refers to the ability and discipline of individuals to understand and shape their personal vision and creative imagination as individuals who continuously have the perseverance and capability to keep learning in order to improve and develop professionally. This also opens significant opportunity to possess superior abilities in the competitive landscape globalization.

3) mental models refer to the reflective ability, which is how individuals reflect to find principles and values aligned with the organization. This might cause diversity of perceptions among people in the organization which may lead to arguments. Therefore, awareness and understanding of differences should be the 'mental' of every personal by giving respect to mental models of others hence common learning patterns can be developed. 4) shared vision refers to the simultaneously ambitions, dreams, and vision of both personal and group that should be achieved according to organization's goals. All people in the organization are expected to be creative to embrace their future desire.

5) team learning reflects team collaboration in which they build communication, share views and knowledge, understand one another, learn together even from failures and mistakes and also expand collective intelligence.

As part of an organization member, teacher's readiness in mastering technology plays a crucial role in building a learning process that strengthen the understanding of the material, optimizing thinking skills, problem solving, and creativity (Munir, Syahrul; Adi, 2025; Rahayu, 2024; Santos, Joseline M; Castro, 2025) In today's technological time, teacher's creative and innovative teaching approaches (pedagogy) will give impactful learning experiences to students' outcomes and empower teacher's professional growthn(Rodriguez, 2024) Additionally, the ability of teachers to develop content and knowledge based on their expertise also significant contributors in TPACK development.(Dagdag et al., 2024)

By incorporating innovative approaches and platforms that assess and develop teachers' creative abilities, schools can empower teachers to enhance their creative potential and deliver more impactful learning experiences. This empowerment is crucial not only for teachers' professional growth but also for improving students' learning outcomes.

According to Polatbekova, Karlygash Yergubekova, Zhanat (Polatbekova & Yergubekova, 2025)with the development of educational technology, more meaningful engaging ways to utilize technology, are seek by many teachers to create an authentic learning atmosphere where the activities link theory to practice. Developing authentic learning requires an open mind-set to acquire new skills, which significantly impacts a conducive learning environment(Griffin, Patrick; Care, 2015) (Griffin, Patrick; Care, 2015). Therefore, teacher's ability to create and produce teaching resources to promote student engagement in the process of learning is fundamentally required (Vowell, 2023). If learning is authentic, students will 'learn by doing' and they will experience the ability on how to apply what they have learned in real lifenAuthentic learning builds learning atmosphere that duplicates the scenarios of real-world, thus it requires dynamic interplay among learning assignments, students and other relevant contexts where the learning takes place (Arabic & Arabic, 2021)

In the context of teaching by using technology, said that authentic learning can depend on technological education to expand particular case studies in which the learners would be able to confront the milieu of real life during their process of learning. At this stage, teachers should be technological savvy to deliver content in an authentic learning setting. described that authentic

learning is characterized by the embodiment of learning new skills covering: 1) the continuity of learning cycle; 2) the importance of learning stages; 3) the importance of information and feedback; and 4) the importance of supporting structures, whether physical, social, or mental. (Herrington & Kervin, 2025)

As part of learning activities, it is assumed that the use of authentic learning can be applied in TPACK concluded from their study that the combination of technology, pedagogy and content gives positive impact on the flow of learning. Besides, they also argued that teachers' competence can be strengthened by the influence of employing TPACK where they will be proficient in three aspects of professional support, i.e., the aspects of technology, pedagogy, and content knowledge. The opinion of Santos and who said that TPACK is an ideal application utilized in all important aspects of learning activities implicitly confirms that authentic learning can also be inserted in TPACK-based instructional process.

There were huge number of prior studies discussed TPACK with various objectives, however the ones which measured the contributions of organizational learning readiness and authentic learning of TPACK model development were found to be limited. (Kiryakova & Kozhuharova, 2024; R. Susanto, 2020; Ratnawati Susanto & Rachbini, 2024) in their study reported that the development of TPACK model could be constructed from the readiness of organization to conduct learning. They further explained that having superior readiness, learning organization was supported by the challenges faced by every individual in that organization who grows and puts efforts in the learning process. Additionally, Kaschuluk (2019) said that the development of TPACK in which teachers transfer their knowledge affected by the ability of school leaders to build opportunities for teachers to effectively and successfully instilled technology into their instruction. Thus, the urgency of this research work stems from the pivotal role of TPACK model development in relation with organization's readiness and teachers' use of authentic learning to achieve successful instructional practice.

In accordance with the research gap above, this study aims to quantitatively analyze the construct of TPACK development model, with the variables of Learning Organization Readiness (RLO) and Authentic Learning (TNL), mediated by TPACK model. A formula of SEM Smart PLS was used in this analysis. The data were collected by using a 4-Likert scale questionnaire distributed to 150 elementary school teachers, randomly selected from both public and private schools in DKI Jakarta Province, Indonesia. The questionnaire was modified by composing the indicators of the three variables; RLO, TNL, and TPACK. The following Figure 1 below is the design of TPACK model which was developed:

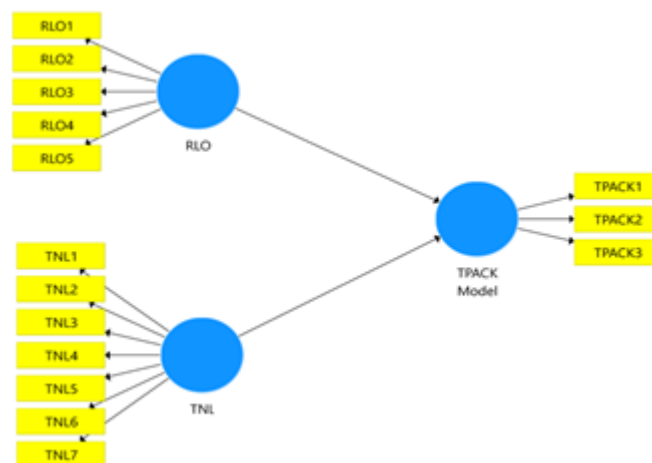


Figure 1. TPACK Model Development

The indicators used in the questionnaire were as follows:

Learning Organization Readiness -- RLO (adopted and modified from Senge, 2006 cited by Susanto, et al., 2021):

1. System thinking (RLO1)

2. Implementation of personal mastery (RLO2)
3. Mental model implementation (RLO3)
4. Implementation of shared vision (RLO4)
5. Team learning (RLO5)

Authentic Learning – TNL (adopted and modified from Mullin, 2019):

1. Continuous learning cycle (TNL1)
2. The importance of learning stage (TNL2)
3. The significance of information and feedback (TNL3)
4. The importance of supporting structures—physical, social, mental (TNL4)
5. Ability to motivate (TNL5)
6. Ability to design knowledge, skills, and attitudes (TNL6)
7. Ability to perform tasks and job responsibilities effectively and with high quality (TNL7)

TPACK Development Model (TPACK)

1. Ability to integrate technology into education (TPACK1)
2. Ability to use learning community (TPACK2)
3. Ability in scientific mastery (TPACK3)

This research was guided by three questions:

1. Does learning organization readiness construct the development of TPACK in teacher teaching practice?
2. Does authentic learning construct the development of TPACK in the teaching practice?
3. In these two variables, which indicators are most dominant in the construction of TPACK?

Findings and Discussion

The following Figure 2 is the results of TPACK development model using outer loadings

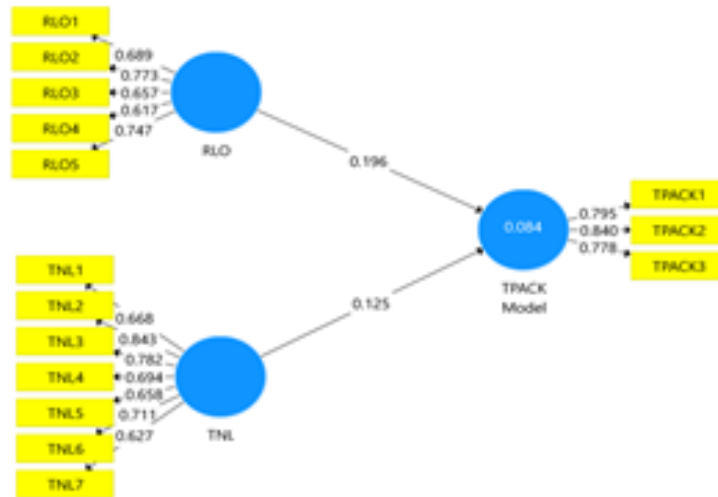


Figure 2. First Analysis of TPACK Model Development

Figure 2 above shows that all indicators have a loading factor greater than 0.60 indicating that all of them are constructs forming the model. This is further demonstrated by the presentation of the outer loadings on Table 1 below:

Table 1 Outer Loadings

	RLO	TNL	TPACK Model
RLO1	0.689		
RLO2	0.773		
RLO3	0.657		
RLO4	0.617		
RLO5	0.747		
TNL1		0.668	
TNL2		0.843	
TNL3		0.782	
TNL4		0.694	
TNL5		0.658	
TNL6		0.711	
TNL7		0.627	
TPACK1			0.795
TPACK2			0.840
TPACK3			0.778

Reliability Analysis

Reliability can be presented on Table 2 as follows:

Table 2 Reliability Analysis Results

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
RLO	0.742	0.758	0.826	0.489
TNL	0.844	0.893	0.879	0.512
TPACK Model	0.728	0.730	0.846	0.648

On Table 2 above, Cronbach's Alpha for each construct is greater than 0.70, the composite reliability for each construct is greater than 0.70 and the Average Variance Extracted (AVE) for each construct is greater than 0.70 with the Average Variance Extracted (AVE) of greater than 0.50 for each, indicating that all constructs are reliable.

Goodness of Fit Model

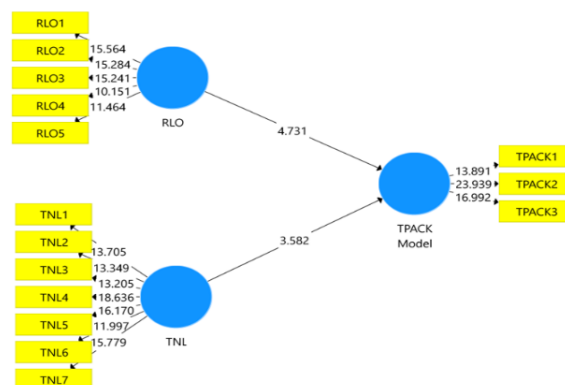


Figure 3. Second Analysis of TPACK Development Model

From the second analysis, TPACK development model is obtained and the relationships between constructs can be tested as follows:

The Relationships between Constructs

The Relationships between constructs can be shown using the Path Coefficients as follows:

Table 3 Path Coefficients

Mean, STDEV, T-Values, P-Values		Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
RLO TPACK	-> Model	0.366	0.366	0.077	4.731	0.000
TNL TPACK	-> Model	0.278	0.290	0.078	3.582	0.000

Hypothesis Testing

From the relationships above, the research hypotheses answered can be described as follows:

The relationships between constructs using the Path Coefficients are described below:

1. H1: It is hypothesized that the readiness of learning organization (RLO) variable influences the TPACK development model.

Decision Criteria:

- a. If the probability value (p-value) > 0.05 or t-table < t-stat < t-table, then Ho is not rejected.
- b. If the probability value (p-value) > 0.05 or t-stat < -t-table or t-stat > t-table, then Ho is rejected.
- c. The t-table value for alpha = 0.05 is 1.96 and the t-table value for alpha = 0.10 is 65.
- d. If the probability value (p-value) > 0.05 or t-table < t-stat < t-table, then Ho is not rejected.
- e. If the probability value (p-value) > 0.05 or t-stat < -t-table or t-stat > t-table, then Ho is rejected.
- f. The t-table value for alpha = 0.05 is 1.96 and the t-table value for alpha = 0.10 is 65.

The analysis results on Table 3 above explained that t t-stat value = 4.731 > 1.96, then Ho is rejected, and H1 is accepted, which means the RLO variable has a positive and significance influence on TPACK model variable. The higher the RLO, the higher TPACK development model is. In conclusion, TPACK development model can be constructed from the 'Readiness of Learning Organization'.

Learning organization readiness is a fundamental aspect that must be prioritized to facilitate and shape each individual as a member of a learning organization. Every organization has its strong pillars and foundations, allowing each individual to maintain consistency and sustainability in continuing to learn and grow. Thus, capacities and capabilities of those individuals thereby shaping an organizational paradigm (Vostroknutiv, et L., 2020). Learning organization readiness should be carried out through the adaption of innovations in the application of five discipline (Senge, 2006).

In terms of educational institutions, Ning, et al. (2021) argued that the promotion of TPACK development should also be intervened by teacher education as many schools in the world had been incorporating training to education plans of the teachers. Their quantitative study proved that the intervention of teacher education positively influenced TPACK (d = 0.839, p < 0.0001). These interventions were different on effects due to the differences of experimental participants, sample types, experiment types, cultural background, intervention durations and types, learning environment and measurement methods.

According to Voogt and McKenney (2016), to implement TPACK, early literacy should be given by the institutions to teachers since integrating technology effectively does not mean that teachers only need to know TPACK framework but further, they are required to be proficient on how to shape teaching practices where knowledge of technology, content, and pedagogy are

embedded. Their qualitative study on five educational institutes invented that due limited use of many new technologies in schools, technological knowledge of teachers received very small attention, hence teachers educators themselves struggled in utilizing technology utilization effectively. This research also found that those five education organizations had both early literacy and technological experts, however, there was a distinct lack of integrated the two specialists.

Having seen impactful relationship between the readiness of the organization and TPACK which also proven by previous research, the result of this study revealed the same line.

H2: It is hypothesized that the authentic learning (TNL) variable influences TPACK development model (t-table for alpha = 0.05 is 1.96 and t-table for alpha = 0.10 is 1.65). Based on Table 3 above, it can be explained that the t-stat value = 3.582 > 1.96, therefore, H0 is rejected, H1 is accepted, which means the TNL variable has a positive and significant influence on TPACK model variable. The higher the TNL, the higher TPACK development model is. In conclusion, TPACK development model can be constructed from 'authentic learning' with the structural equation of: $TPACK\ Model = 0.366RLO + 0.278TNL + e$.

When learning organization has achieved superior readiness, efforts to construct the educational environment at an individual level are no longer challenging. Further, the involvement of teachers in learning a new skill is not at the initial stage anymore but it has reached the stage where they recognize its importance. This surpasses two studies conducted by Orion and Fergusson (2020).

Tan (2022, p. 73) explained that students' activities in authentic learning do not only deal with practical opportunities that apply knowledge and explore real cases but also improve their ability to cope with those cases. This type of learning activities is necessary, particularly in the subjects that require high-order learning goals. In terms of TPACK, in which the learning practices are integrated with technology, Tan (2022) further said, "authentic learning can rely on education technology to develop specific case studies that learners could encounter in real-life settings along the learning process" (p. 70).

The finding of this study above shows that the authentic learning positively and significantly affects the development of TPACK model construction, hence this result in line with what prior studies found.

The factors contributing to the formation of TPACK development attributed to Learning Organization Readiness and Authentic Learning are as follows:

The contributing factors of Learning Organization Readiness (RLO) to the construction of TPACK development: (a) implementation of personal mastery (RLO2) at 0.773; (b) implementation of team learning (RLO5) at 0.747; (c) implementation of thinking system (RLO1) at 0.689; (d) implementation of mental models (RLO3) at 0.657; (e) implementation of shared vision (RLO4) at 0.617.

The results above indicate that "implementation of thinking system" is the most contributing factor which affected the construction of TPACK model.

The contributing factors of Authentic Learning to the formation of TPACK development are: (a) significance of learning stages (TNL2) at 0.843; (b) significance of information and feedback (TNL3) at 0.782; (c) the ability to design knowledge, skills, and attitudes (TNL6) at 0.711; (d) the importance of supporting structures --- physical, social, and mental (TNL4) at 0.694; (e) continuity of learning (TNL1) at 0.668; (f) the ability to motivate (TNL5) at 0.668; (g) the ability to motivate (TNL) at 0.658; and (h) the ability to carry out tasks and responsibilities effectively and with high quality (TNL7) at 0.627.

Referring to the results above, it can be seen that the most contributing factor impacted TPACK construction is "significance of learning stages".

Conclusion

The results of the analysis data revealed that both learning organization readiness (RLO) and authentic learning quantitatively contributing to the development TPACK model. The statistical analysis of learning organization readiness resulted t-stat value = 4.721 > 1.96, thus it confirmed that H0 was rejected. Meanwhile, the statistical analysis of authentic learning (TNL) reached t-stat value = 3.582 > 1.96 which also indicated that H0 was rejected. These results explained that the variables of both learning organization readiness and authentic learning significantly and positively influenced TPACK model development. In terms of the most dominant factors contributing to TPACK development in each of the variable are: 'implementation of thinking system' for the

variable of RLO and ‘significance of learning stages’ for TNL variable. These results underlined that each individual within organization will grow and face challenges to contribute to the learning organization which has superior readiness (Chang & Lee, 2007; Marks & Printy, 2003; Susanto, 2017; Hirst, et al., 2009).

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