International Society of the Learning Sciences

# Fostering TPACK via Idea Improvement in Teacher Education

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**Abstract**: This study examined 38 pre-service teachers' ideas regarding TPACK development in their lesson design during online discussion. Data include all discourse posts and the findings showed three main kinds of idea development processes existing in teacher's discussion. Such results indicate that to help advance teachers' TPACK, teachers' idea development must go through an integration process instead of stagnating at a diversification or elaboration stage.

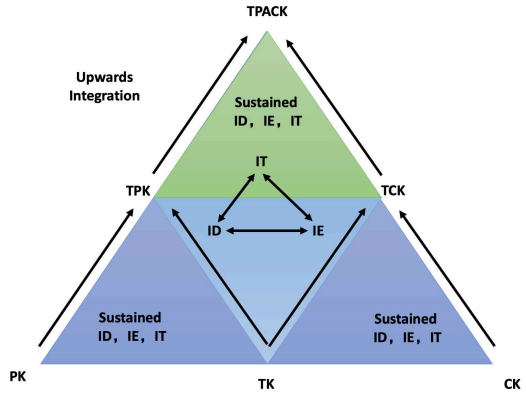
## 1. Introduction

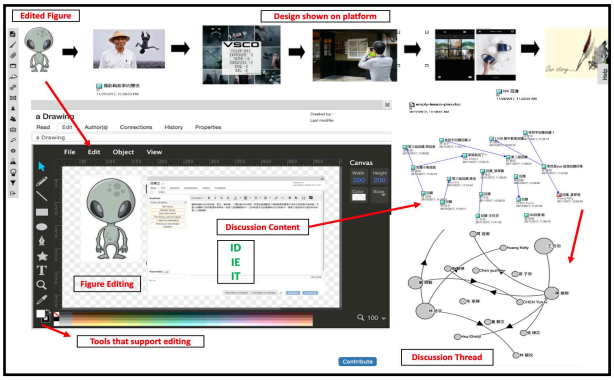
In many Asia countries with an examination-oriented culture and a rigid administration atmosphere, teachers tend to be teacher-centered and traditionally, covering more concise and pragmatic-use knowledge for school tests or nationwide exams. Lately, there has been an education reform in the curriculum guideline in Taiwan: putting the learner at the center of teaching and encouraging teachers to co-design lessons interdisciplinarily. Teachers now are asked to move away from being merely a lecturer to becoming a designer in organizing and integrating their teaching into a technology-enhanced learning environment in the post-pandemic era. Recent research also suggested supporting pre-service teachers' understanding of the connection between TPACK and their practical development is critical (Tondeur et al., 2020). Therefore, teachers must immerse themselves in sustained idea improvement processes (Hong & Sullivan, 2009) while co-designing lessons. These processes include idea diversification to enrich idea quantity, idea elaboration to enhance idea quality, and idea integration to innovate or rise-above ideas to advance knowledge. However, it is not easy for teachers to suddenly shift their teaching mode in response to the reform due to long-term habits. Under this background, our research aims to reveal how pre-service teachers develop ideas to build on TPACK knowledge. The research questions concern: In pre-service teachers' discourse, what is the idea development process, and what frequency of TPACK related ideas are found? How do they develop their ideas regarding TPACK to design their lesson?

## 2. Context and Method

Participants were 38 pre-service teachers in Taiwan. They enrolled in a course that required them to work in a group (with 3-4 people) and design a web-based, e-learning lesson to help them develop TPACK more explicitly. As a case study, an online platform called Knowledge Forum was employed for participants to explore, discuss, and design their web-based lessons. This learning environment was guided by three idea-related design principles (Scardamalia, 2002), including (1) idea diversity (**ID**), (2) idea elaboration (**IE**), and (3) idea integration (**IT**) while developing their TPACK (see Figure 1). The research team collected online discourse and conducted discourse analysis through two analytical phases. Firstly, ideas were identified as the units of analysis (see Figure 2 presenting 15 ideas contributed by a group of participants). Secondly, researchers analyzed and quantified each idea to examine its TPACK dimension (see Table 1) and idea improvement activities (see Table 2).

**Figure 1.**
*The design of this study (left)* ***and*** *the discussion space on Knowledge Forum (KF) (right).*




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**Table 1**.
*The coding example for TPACK knowledge*

| Dimension | Example |
|---|---|
| **TPK** | They also set up an extra website [T]. This may lead them *(children level's learners) to* have a clear learning procedure [P] and a more pleasing experience while learning. (S3) |
| **TCK** | I feel that more links to related websites, information or videos [T], and picture books about ocean knowledge [C] or courses-related can be put in the course. (S9) |
| **TPACK** | You *[the teacher designer)* can consider trying to wrap the learning activities and course contents in a more integrated way with the use of google map so that the learner would know why they need to learn this way [TPACK]. (S26) |

## 3. Result

Primary findings showed that all three idea improvement activities (including ID, IE, IT) were not focusing on TPACK ($F$=1.079, $p$ >.05; $F$=1.751, $p$ >.05) (Table 2.), indicating that there is still room for students to deal with more advanced TPACK knowledge and to engage in higher-level idea improvement activities. On the other hand, the discourse analysis showed that ID, IE, and IT were all essential for TPACK development. As shown in Figure 2., students initially proposed many diverse ideas talking websites and videos, followed by elaborating specific ideas and digital materials for presenting target content. Finally, they discussed how to integrate ideas to best create an instructional design in a technology-enhanced learning environment.

**Table 2.** *The comparison between T-related knowledge and ideas development*.

| | M (SD) | | | F | p-value |
|---|---|---|---|---|---|
| | TPK | TCK | TPACK | | |
| **ID** | 1.132 (1.234) | 2.711 (3.161) | 1.816 (2.649) | 3.856 | <.05 |
| **IE** | 2.184 (2.078) | 1.684 (1.454) | 1.289 (1.575) | 2.572 | >.05 |
| **IT** | 1.132 (1.319) | 1.658 (1.632) | 1.263 (1.245) | 1.437 | >.05 |

## 4. Conclusion and Discussion

Research on teacher learning is challenging to examine knowledge, practice, and work contexts (Fishman et al., 2014). Pre-service teachers need to develop TPACK knowledge and integrate it with their ideas to strengthen instructional designs toward student-centered learning environments. In this study, we argue the importance of idea development should be considered. We further examined how pre-service teachers interact with group ideas dynamically through ID and IE and build on TPK and TCK. Our results indicate that the IT process is essential to driving pre-service teachers to develop TPACK knowledge. We conclude that to deepen the idea development among pre-service teachers, teacher educators should identify the early stage of idea diversification and elaboration and, most importantly, encourage opportunities for idea integration.

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