TITI
DOI: http://dx.doi.org/10.3126/jtd.v4i0.26837

Journal of
Training and Development
2019, Volume 4
ISSN: 2392-456X(Print)
ISSN: 2392-4578(Online)

TPACK-integrated Worked Examples for Technology Integration

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Abstract

The purpose of the study was to develop and validate the Worked Examples to enhance the instructors' competencies in carrying out technology integration during teaching and learning. Worked Examples in the study was developed based on the Gagne's Nine Event of Instruction, which is one of the classroom-oriented micro level Instructional Design Models. Technology integration in the study is defined as an implementation of technological resources and pedagogical strategies to deliver the required content knowledge during classroom instruction. Thus, Technological Pedagogical and Content Knowledge (TPACK) was integrated in the developed Worked Examples. Development and Design research design was implemented to develop and validate the Worked Examples, employing qualitative and quantitative data, where three instructors from Teacher Education Program utilized Worked Examples during their classroom instruction. Extraneous cognitive load of instructors found to be addressed because of employing Worked Examples. Furthermore, pre-service teachers learning outcomes was also significantly improved because of instructors' instructions with Worked Examples.

Keywords: TPACK; Worked Examples; Technology Integration; Instructional Design Model

Technology Integration

As argued by numerous researchers and practitioners, technology integration has become an integral part of the educational system in the twenty-first century learning environment in the developed and developing countries (Clements & Sarama, 2003; Haugland, 2005; McKenney & Voogt, 2012; Parette & Blum, 2013; Yelland, 2005). Kozma (2002, p.2) highlighted that increased utilization of "technology into classroom and curricula" is to improve educational systems and prepare the learners for the twenty-first century. Further, United National Educational, Scientific and Cultural Organization (UNESCO) has been providing technical assistance for the enhancement of instructors' competencies in the developing countries (UNESCO, 2008). These efforts from various stakeholders including national bodies, international organizations, and donor agencies were focused on enhancing the instructors' technical competencies for the utilization of technology in classroom instruction.

As reported by numerous studies, the utilization of technology in classroom instruction is crucial because technology opens up numerous opportunities, such as promoting teaching and learning effectiveness, addressing the teaching and learning load, making teaching and learning more flexible, and enhancing classroom interactions (Hall & Higgins, 2005; Kennewell, 2001; Lopez, 2010, Smith, Higgins, Wall, & Miller, 2005). Furthermore, technology supports learners to understand the subject matter (Taylor, Harlow, & Forret, 2010) while enhancing their engagement in the classroom activities leading to purposeful learning (Jang, 2012). YouTube videos, educational blogs, social media, software, and applications, which encourage learners to think beyond the four walls of the classroom, play important roles in education to improve learning (Bajracharya, 2017; Gilory, 2010; Haddad & Draxler, 2002). In addition, technology helps learners to be critical thinkers, communicators, collaborators, creators, and problem-solvers to eventually become effective and efficient citizens, workers, and future leaders of the nation (Cynthia, 2015). Technology in education, therefore, is important to improve teaching and learning in the twenty-first century society.

However, as Bitner and Bitner (2002), Gulbahar (2007), and Pierson (2001) mentioned for technology to be truly effective in education, appropriate technology integration in teaching and learning is essential. The U.S. Department of Education (2002, p.174) has defined the term technology integration as "the incorporation of technology resources and technology-based practices" into teaching and learning. As mentioned by Hunter (2015), an incorporation of technology resources refers to the use of technological tools in teaching and learning in general content areas. Further, technology-based practices serve to enhance instruction that also supports the learners' learning (Amy & Katina, 2014; Richard, 2009).

Meanwhile, Mishra and Koehler (2006) argued that technology integration is not about putting technological resources together and replacing the technical skills in regular classrooms to enhance the learners' learning. As noted by Norris, Shullivan, and Poirot (2003), the availability of technological tools and instructors' technical competencies could create the possibility of technology integration but their competencies in creating a technology-integrated instruction by implementing pedagogical strategies for the content are also crucial for carrying out technology integration. Therefore, technological resources and instructors' technical competencies could not be enough for bringing technology integration during classroom instruction.

Technological Pedagogical and Content Knowledge (TPACK)

Recent developments in the field of educational technology have led to a renewed interest in considering the three specific elements in technology integration consisting of *Technology, Pedagogy,* and *Content* as specified by Koehler and Mishra (2005). Further, Mishra and Koehler (2006) organized those elements into three major areas of knowledge including *Technological Knowledge, Pedagogical Knowledge,* and Content Knowledge required by instructors for technology integration, which is termed as Technological Pedagogical and Content Knowledge (TPACK). TPACK is a conceptual framework that builds on Shulman's (1986, p.12) theoretical basis of Pedagogical Content Knowledge (PCK) referring to the "instructors' understanding of technologies and PCK" for bringing technology integration in the classroom instruction (Koehler & Mishra, 2008; Mecoli, 2013). A TPACK framework addresses the complexity of teaching by integrating technologies and pedagogical strategies simultaneously to deliver the required content during classroom instruction, which focuses on the enhancement of instructors' competencies for technology integration (Bajracharya, 2015; Mishra & Koehler, 2006; Mishra & Koehler, 2009; Mishra, Koehler, & Kereluik, 2009). Thus, in the study, technology integration is defined as an implementation of technological resources and pedagogical strategies to deliver the required content knowledge during classroom instruction.

Barriers to Technology Integration

As found by Hunter (2015, p.5), technology integration "is not easy" because many instructors prefer to simply add technological tools to the classroom, for example by utilizing word processing for literacy tasks and Excel spreadsheets for entering numerical data without considering its effects on learners' learning experiences. In addition, Dockstader (1999, p.73) argued that the substitution of 30 minutes of reading with 30 minutes of computer skill development is a poor example of technology integration. All these studies reveal that the act of technology integration into teaching and learning is a complex process hindered by several barriers. Brickner (1995), Ertmer (1999), and Tsai and Chai (2012) discussed three types of barriers to technology integration, such as first-order, second-order, and third-order barriers. The first-order barrier is an external factor that includes lack of adequate resources, time, training, and institutional support. The second-order barrier is related to personal beliefs which is more instructor-centered relating to instructors' attitudes toward technology integration. These attitudes consist of the instructors' self-efficacy toward technology integration and attitude toward technology. The second-order barriers are the main causes for the instructors' willingness to adopt technology in education in the first place. The third-order barrier refers to instructors' competency in creating a technology-integrated lesson plan for the classroom instruction. It is associated with the utilization of technological resources with appropriate pedagogical strategies to deliver the content during classroom instruction.

As argued by the number of authors, even if the first-order and second-order barriers are resolved, technology integration may not necessarily proceed naturally without addressing the third-order barriers which are associated with the instructors' competencies for creating technology-integrated lesson plans (Albirini, 2006; Almekhlafi & Almeqhadi, 2010; Goktas, Yildirim, & Yildirim, 2009; Lim & Chai, 2008; Lim & Pannen, 2012; Tsai & Chai, 2012). In particular, Jhurree (2005) argued that instructors from developing countries possess a high level of apprehension to integrate technology in the classroom because they lack the necessary competencies to create a technology-integrated lesson plan, even if they possess high levels of technical knowledge. This shows that the instructors' competencies for creating a technology-integrated lesson plan are crucial for implementing technology integration in the classroom.

In the context of Nepal, Karmacharya (2015) reported that Nepalese instructors require a lot of continuous guidance and support to integrate technology while delivering instruction, even if they were willing to practicing technology integration in the classroom. The finding was based on a mega project named *Open Learning Exchange Nepal* (OLE-Nepal) which was conducted in 26 academic institutions across six districts of Nepal. During the training period of the project, instructors were trained to enhance their technical competencies and were provided with the required technological resources for carrying out technology integration. This evidence highlighted that even if Nepalese instructors possess the technological resources, training, and willingness, which are necessary for technology integration in the classroom, their low level of competencies to create a technology-integrated lesson plan are need to be addressed. Further, Wagle (2013) emphasized that technology needs to be used as an effective instructional tool by instructors for enhancing the learners' learning, which should not be limited to simply enhancing the instructors' technical competencies.

Existing Issues

The above discussions suggest that a developing country like Nepal may need further detailed guidance for instructors in creating and implementing technology-integrated instructions regardless of their technical competencies. Studies done by Bauer and Kenton (2005) and Mishra and Koehler (2006) also highlighted that instructors' high level of technical competencies are not enough for technology integration. Thus, in a developing country like Nepal where efforts have been prioritized to provide technological resources and skill-based trainings to enhance instructors' technical competencies with the aid of international agencies, there is a need to urgently consider an applicable way to assist instructors in creating and implementing technology-integrated instructions for carrying out technology integration in the classroom.

Studies revealed that developing countries suffer considerably from the first-order barriers to technology integration (technological infrastructures and trainings) because of issues related to national policies and funding, which are beyond the control of most instructors (Jhurree, 2005; Khan, Hossain, Hasan, & Clement, 2012). However, as discussed above in the Nepalese context, third-order barrier: creating a technology-integrated instruction is hurdle to technology integration in the classroom instruction, which is termed as the instructors' competencies in the study (the term *instructors' competencies* is used throughout the study in the place of the instructors' knowledge and skills to create technology-integrated instructions).

Numerous studies revealed that instructors' competencies for technology integration could be improved with an appropriate technology integration model in a Teacher Education Program to train pre-service teachers (Dawson, 2008; Kirschner & Selinger, 2003; Stuart & Thurlow, 2000; Tearle & Golder, 2008; Tondeur, van Braak, Sang, Voogt, Fisser, & Ottenbreit-Leftwich, 2012). A study done by Stuart and Thurlow (2000) argued that pre-service teachers need to be adequately trained for assisting instructors to carry out technology integration. Further, Hare, Howard, and Pope (2002, p.193) conducted a study with 26 pre-service teachers to examine *a gap between what pre-service teachers are taught about the technology integration* and *how they could implement those competencies to teach in the classroom.* The authors found that the pre-service teachers trained with technology-integrated instructions had a high level of beliefs and confidence to integrate technology in the classroom instruction compared with those pre-service teachers who were trained under as usual instruction.

As discussed by Chai, Koh, and Tsai (2010), Niess (2005), Tondeur, Pareja Roblin, van Braak, Voogt, and Prestridge (2017), Teacher Education Program is a platform to educate future instructors to enhance the willingness as well as a competency that required for carrying out technology integration in the classroom instruction. Among which, Teacher Education program also appears to be crucial for enhancing positive attitudes toward technology integration (Shirvani, 2014; Wang, Ertmer, & Newby, 2004).

Studies done by Lee (2014), and Lee and Sparks (2014) in the Nepalese context, argued that even if Nepalese instructors had access to mobile phones, computers, and digital cameras, there are continued hurdles for technology integration. Based on the focus group interview with 27 Nepalese instructors and follow-up of individual interviews, the authors found that the instructors lacked enough competencies to create a technology-integrated lesson plan for classroom instruction. Therefore, the authors suggested that the availability of detailed guidance could assist instructors to create and implement technology-integrated instructions, which could bring a significant improvement in carrying out technology integration. Similarly, Khan, Hossain, Hasan, and Clement (2012) also revealed that the instructors of developing countries require detailed structure in accomplishing the procedures that assist them to create technology-integrated instructions.

Carlson and Gadio (2002) argued that instructors could experience an extraneous cognitive load because of lacking detailed guidance in creating and implementing technology-integrated instructions based on the available models and framework [existing Instructional Design (ID) models, Substitution, Augmentation, Modification, and Redefinition (SMAR) model, TPACK framework, and TPACK-based instructional design models) for technology integration. van Merrienboer and Sweller (2005) found that an extraneous cognitive load could be alleviated by effective instructional interventions. One idea from a study done by Saravanan and Nagadeeps (2017) in India recommended that the extraneous cognitive load could be minimized by offering scaffolding process with *Worked Examples* for instructors.

Worked Examples

Worked Examples are a kind of scaffolding consisting of a detailed set of guidelines for instructors to accomplish a task based on a demonstration (Atkinson, Derry, Renkl, & Wortham, 2000). As mentioned by Ayres and Sweller (2000), Worked Examples assist by addressing an extraneous cognitive load. Further, a study done by Mayer and Moreno (2003) suggested that *Worked Examples* are effective instructional strategies for addressing an extraneous cognitive load that deals with learning and problem-solving difficulties. Even more, recently Chen, Woolcott, and Sweller (2017) recommended that *Worked Examples* are the strategies to minimize an extraneous cognitive load.

Recently, Saravanan and Nagadeeps (2017) conducted a study in India in a Teacher Education Program with instructors and pre-service teachers to explore the barriers in technology integration. The authors found that the instructors had experienced an extraneous cognitive load during technology integration because they had to spend additional time to create a technology-integrated lesson plan. However, based on the findings of the study, most of the pre-service teachers benefited from technology-integrated instructions having high engagement within the classroom. Thus, the authors suggested that *Worked Examples* could be an effective instructional strategy for addressing instructors' extraneous cognitive load that could occur while creating and implementing technology-integrated instructions by providing step-by-step instructional demonstration of a skill or a task performance.

The problem which initiated this study was the need for a *Worked Examples* to consider three key elements of technology integration as: content, pedagogy, and technology based on a systems thinking approach within a generic micro level instructional design process to assist instructors in creating and implementing technology-integrated instructions for carrying-out technology integration during the classroom instruction.

In this study, *Worked Examples* was developed based on a Gagne's Nine Events of Instruction includes nine steps from attention to retention and transfer (Solanki, 2014), which is a class-room oriented Instructional Design Model to create a technology-integrated lesson plan. Thus, it is necessary to investigate how instructors in a Teacher Education Program could utilize a *Worked Examples* for technology integration in the classroom instruction. Further investigation needs to be carried out to understand the changes that could be found in the learning experiences of pre-service teachers because of technology-integrated instructions carried out by instructors based on a *Worked Examples*.

Instructional Design

ID is a procedure for developing an educational or training program, curricula, or courses in a sequential and authentic manner (Branch & Merrill, 2011, p. 8). This procedure enables instructors to create a lesson plan that involves the "systematic planning of instruction" (Smith & Ragan, 2005, p.8), ranging from instructional analysis to evaluation (Mager, 1984). It can also be referred to as a "systematic and reflective process of translating principles of learning and instruction into plans for instructional materials, activities, information resources, and evaluation" (Smith & Ragan, 2005, p.4). These definitions explored that ID is a framework which provides the process to create the instructions based on the necessity of a teaching and learning environment.

Thus, ID can be defined as a process to develop directions and specifications using learning and instructional theory to ensure the quality of instruction.

ID has also been perceived as both a science and an art to creating instructions from the planning to the evaluation stages in which revisions can be made after implementation of the program (Carr-Chellman & Reigeluth, 2009, pp. 5-9). Science and the arts are both core concepts of ID and are useful in creating and implementing instruction, a complicated process involving human ingenuity, software and hardware components (Piskurich, 2006, p.3). Essentially, ID is all about a set of rules constituting a chronological process. For instance, development of a training program involves a series of methods such as analyzing, designing, developing, implementing, and evaluating to create quality learning experiences and environments. In summary, the primary goal of the ID process is to generate the instruction to achieve the objectives of the program and training.

Creating a Technology-integrated Lesson Plan through Worked Examples

As discussed above, *Worked Examples* were provided to instructors to create a technology-integrated lesson plan, *Worked Examples* were offered to the three instructors. Explanation under technology integration was carried out based on the triangulating source of information such as: classroom observations, interviews, and reflective journals as described below:

Technology integration. Classroom observations revealed that the instructors utilized *Worked Examples* for indexing specific information a *topic of a lesson, pre-service teachers need to learn,* and *pre-service teachers need to understand at an end of the classroom instruction.* It was also confirmed by the reflective journals that all the instructors had developed their lesson plans and detailed notes about content, pedagogy, and technology. Since detailed guidance was provided in the *Worked Examples,* instructors had utilized the various pedagogies and technologies presented to gain attention and inform objectives, to recall and present the content, to perform and gather feedback, and to enhance retention transfer.

Interviews with the instructors clarified that based on the detailed information about content, pedagogy, and they had designed and developed a technology-integrated lesson plan. Instructor-1 mentioned that

> *"Since detailed guidance with a key purpose was provided, I had followed those guides to develop a technology-integrated lesson plan. Further, based on that plan, I created a required material for classroom instruction" (Interview, Instructor-1).*

The above statement of instructor-1 clarifies that *Worked Examples* provided the detailed guidance to integrate content, pedagogy, and technology for a technology-integrated lesson plan. Similarly, Instructor-2 further added:

> *"I just followed the Worked Examples to design and develop a technology-integrated lesson plan; however, sometimes I was unable to follow all the detailed guidance because I found it was too much" (Interview, Instructor-2).*

An interview with instructor-2 revealed that even if *Worked Examples* were self-guided instructions, the instructors might not cover all the detailed guidance. However, Instructor-3 revealed that

> *"I just follow"For a technical instructor like me, this type of Worked Examples is very helpful that provide detailed guidance (Interview, Instructor 3).*

Based on the above evidences, it was clarified that *Worked Examples* provided a detailed guidance which helped the instructors to design and develop a technology-integrated lesson plan.

Further, based on the interviews with three instructors, even if, they had practiced a technology-integrated lesson plan in the past, they still lacked the competencies needed to create a technology-integrated lesson and materials for classroom instruction. For example, Instructor-1 mentioned that

> *"Previously, I had used videos during classroom instruction to enhance the understanding level of pre-service teachers in terms of the contents, but I was not sure whether they were perceiving knowledge or not. However, Worked Examples to create a technology-integrated lesson and materials helps me to consider content, pedagogy, and technology simultaneously, which enhance the engagement level of pre-service teachers in the classroom instructions, further, it confirms their perceived knowledge too" (Interview, Instructor-1).*

The above statement by instructor-1 justifies that, the pedagogical strategies were not practiced previously to deliver a technology-integrated classroom instruction. The *Worked Examples* offered to the instructor-1, helped him to consider the content, pedagogy, and technology for carrying out technology integration. Further, it also assisted the pre-service teachers to internalize the delivered instructions. Similarly, instructor-2 added that

> *"Even if, I am aware of the potential of technology integration, however, I was afraid of using technologies during classroom instruction because of my low technical ability. In the past, I always have to request my colleagues for assisting in delivering a technology-integrated lesson. However, I became surprised by knowing smartphones could enhance vocabulary of pre service teachers and Facebook for sharing the opinions. I must have to say that it allows me a freedom to select my desired technologies" (Interview, Instructor-2).*

The instructors' reflections show that *Worked Examples* provide the freedom for instructors to select the appropriate technologies. Furthermore, Instructor-3 revealed that

> *"I used to teach technical subjects that modify often in terms of applications, software versions, and hardware tools. Worked Examples provide a roadmap to consider various instructional strategies to deliver required contents. However, even various pedagogical strategies could be considered but I was unable to utilize pedagogies in my classroom" (Interview, Instructor-3).*

Reflection by Instructor-3 revealed that *Worked Examples* could be much more profitable in a technical subject compared with non-technical subjects. Based on the classroom observations, it could be further elaborated that classroom instruction based on the *Worked Examples* provide a technology-integrated instruction in terms of content, pedagogy, and technology compared with the classroom instruction that was based on the typical instruction used previously.

Pre-service Teachers' Learning Outcomes

Learning outcomes of pre-service teachers were investigated based on their level of perceived knowledge and paper-based test. To achieve this, three instructors (In the study 3 cases was understood as class delivered by 3 instructors) divide their regular classes into two groups: treatment and control group based on random sampling for three weeks (18 class lectures), where treatment group of pre-service teachers were taught via *Worked Examples* and control group of pre-service teachers were taught via as usual instructions. The pretest and posttest were similar test instruments for perceived knowledge, which is adapted by Bajracharya (2015). It consisted of 33 items, which were on scale from one to five from strongly disagree as 1 and strongly agree as 5.

Pre-service teachers' perceived knowledge.

Table 1 shows the mean (M) and standard deviation (SD) of all three cases.

Table 1

Mean (M) and Standard Deviation (SD) of Pretest and Posttest for Treatment and Control Groups (N=28)

		Pretest		Posttest	
Cases		M	SD	M	SD
1	Treatment (n=14)	3.00	.555	3.64	.497
	Control (n=14)	2.71	.469	2.86	.143
2	Treatment (n=14)	3.43	.514	3.93	.267
	Control (n=14)	3.93	.267	4.07	.267
3	Treatment (n=14)	3.64	.497	3.93	.469
	Control (n=14)	3.71	.469	3.86	.535

Table 2 represents a paired t test analysis of the three cases. In Case 1, significant differences were not found in the scores between the treatment group (M = 3.00, SD = .555) and control group (M = 2.71, SD = .469), t (13) = 1.749, p = 0.104, d = 0.47. The effect size of this analysis was Cohen's d = 0.47 and was found to be a small effect d = 0.20. These results suggest that there were no differences in learning outcomes in the pretest between the treatment and control groups. The results also indicate that both the treatment and control groups were equal in ability for learning outcomes before a classroom instruction with a technology-integrated lesson plan based on a *Worked Examples* (the term intervention is used throughout the chapter in the place of classroom instruction with a technology-integrated lesson plan based on a *Worked Examples*).

However, statistical significance was found in the test scores of the pretest (M = 3.00, SD = 0.555) to posttest (M = 3.64, SD = 0.497), t (13) = -3.798, p = .002, d = 1.01. The effect size for this analysis was Cohen's d = 1.01 and was found to exceed Cohen's (1988) convention for a large effect (d = 0.80). These results suggest that the pre-service teachers in the treatment group performed significantly better in the posttest than in the pretest. It also indicates that the treatment group which gained classroom instruction based on an intervention was large in effect size. Further, the pretest and posttest for the control group were compared as pair 2. The analysis shows that there was no statistically significant difference in the scores for the pretest (M = 2.71, SD = 0.469) and posttest (M = 2.86, SD = 0.143), t (13) = -1.472, p = 0.165, d = 0.39. The size for this analysis was Cohen's d = 0.39 and was found as a small effect (d = 0.20). These results suggest that the effect of the perceived knowledge was also small.

Table 2

Paired t Test of Pretest and Posttest of Treatment and Control Groups (N=28)

Cases			Paired t test							
			Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		T	df	Sig. (2-tailed)
						Lower	Upper			
1	Pair	Pretest-treatment-pretest-control	-.286	.611	.163	-.067	.639	1.749	13	.104
	Pair1	Pretest-treatment-posttest-treatment	-.643	.633	.169	-1.009	-.277	-3.798	13	.002**
	Pair2	Pretest-control-posttest-control	-.143	.363	.097	-.353	-067	-1.472	13	.165

2	Pair1	Pretest-treatment-posttest-treatment	-.500	.519	.139	-.800	-.200	-3.606	13	.003**
	Pair2	Pretest-control-posttest-control	.143	.363	.097	-.353	.067	-1.472	13	.165
3	Pair1	Pretest-treatment-posttest-treatment	-.286	.611	.163	-.639	.067	-1.749	13	.104
	Pair2	Pretest-control-posttest-control	-.143	.663	.177	-.526	.240	-.806	13	.435

In Case 2, the pretest score of the treatment group ($M = 3.43$, $SD = 0.514$) to posttest ($M = 3.93$, $SD = 0.267$), $t(13) = -3.606$, $p = 0.003$, $d = 0.96$ revealed that there was a statistically significant difference with a large effect compared to the pretest score of the control group ($M = 3.93$, $SD = 0.267$) to posttest ($M = 4.07$, $SD = 0.267$), $t(13) = -1.472$, p ¬¬= 0.165, $d = 0.39$, which showed that there was no significant difference and effect size was also small. Their findings show that an intervention could bring a huge change in perceived knowledge of pre-service teachers.

Similarly, in Case 2, the pretest score shows that there was no statistical difference in the test scores from the pretest ($M = 3.64$, $SD = 0.497$) to posttest ($M = 3.93$, $SD = 0.469$), $t (13) = -1.749$, $p = 0.104$, $d = 0.46$ in treatment group, and test scores from the pretest ($M = 3.71$, $SD = 0.469$) to posttest ($M = 3.86$, $SD = 0.535$), $t (13) = -0.806$, $p = 0.435$, $d = 0.21$.The effect size revealed that even if the differences were not found to be statistically significant, the level of knowledge perceived by treatment group was high.

Pre-service teachers' paper-based test. The study involved three different cases and the mean scores of the paper-based test of Cases 1, 2 and 3 were measured to identify the specific content knowledge of the PST among the treatment and control groups. Table 4.3 represents the paper-based test scores; PST in the treatment group secured higher test scores in the posttests compared to that of the pretests. For instance, PST from the control treatment group scored 10% (pretest) to 67% (posttest) in Case 1, 15% (pretest) to 78% (posttest) in Case 2 and 18% (pretest) to 61% (posttest) in Case 3.

Accordingly, the increase in test scores was also found in the control group of PST. For example: 15% (pretest) to 31% (posttest) in Case 1; 19% (pretest) to 43% (posttest) in Case 2; and 19% (pretest) to 51% (posttest) in Case 3. These results indicate that the PST under the treatment group appeared to perform better than that of the control group. These findings justify that the pre-service teachers had performed better with an instructors' instruction with Worked Examples.

Table 3

Paper-based Test Scores

Cases	Treatment group		Control group	
	Pretest (%)	Posttest (%)	Pretest (%)	Posttest (%)
1	10	67	15	31
2	15	78	19	43
3	18	61	19	51

Discussions and Conclusions

This study attempted to develop and validate a *Worked Examples* to assist instructors in creating a technology-integrated lesson plan by providing the set of guidelines (Appendix A) to address an extraneous cognitive load of instructors.

Several studies suggest that *Worked Examples* is an effective instructional strategy to explain the several steps for novices (Clark, Nguyen, Sweller, 2006; Renkl, 2005; Salden, Aleven, Schwonke, Renkl, 2008). In the present study, *Worked Examples* were offered to assist instructors for creating technology-integrated lessons, found to be very effective as self-guided instructions. This finding reinforces the belief of Chi, Bassok, Lewis, Reimann, and Glaser (1989) and Kalyuga, Chandler, and Sweller (2000) that highlighted the idea that *Worked Examples* actively explained how to accomplish the tasks. Even more, Renkl (2005) added that both active and passive instructors need to be active with self-paced instructions such as *Worked Examples* in addressing an extraneous cognitive load.

The present study revealed that *Worked Examples* with various chunks in terms of key phases and key components assist instructors in creating technology-integrated lessons in carrying out technology integration during classroom instruction. As highlighted by Alber (2011), providing support by breaking information into the chunks is a crucial step for achieving concrete structure. The process of breaking such instructions into the chunks is termed as scaffolding (Alber, 2011). This concept was initially carried out by Wood, Bruner, and Ross (1976) in learning, who define it as a process to enable a novice in achieving a goal via self-guided instructions.

Furthermore, the study revealed that *Worked Examples* also save time in creating technology-integrated lessons, even for instructors with low technological competencies. The study done by Bauer and Kenton (2005) highlighted that instructors were not carrying out technology integration even if they were highly educated, skilled with technology and capable of overcoming obstacles because they still needed extra time for creating technology-integrated lessons. Thus *Worked Examples* can assist in carrying out technology integration.

As highlighted by Renkl (2005), *Worked Examples* consist of a well-structured step in accomplishing the final goal. Even more, Van Gog, Kester and Paas (2011) revealed that instructors can develop their skills to produce several strategies based on a well-structured step provided by *Worked Examples*. In the present study, findings from observations revealed that instructors design and develop the technology-integrated lessons/ and materials simultaneously instead of accomplishing in two phases as prescribed by *Worked Examples*. In addition, findings from the interviews also revealed that the present study provided *Worked Examples* having the integration of texts and diagrams assisted instructors to bring out such strategies, which was also found by Tabbers, Martens, and van Merriënboer (2000) and highlighted that such integration of text and diagrams are the key characteristics of an effective *Worked Examples*.

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Appendix A

Worked Examples

Course Name:	Chapter:	Duration of Class:

Lesson Objectives:	To know what the instructors needs teach and what pre-service teachers' need to learn and understand by the end of the class.

Topic of the lesson

Pre-service teachers need to learn

Pre-service teachers need to understand/ be able to do at the end of class

STEP 1

Gain Attention and Inform Objective:	• To ensure pre-service teachers are ready to learn while the instructors teaches the lesson. • To inform pre-service teachers of the objectives/outcomes to help them understand what they are to learn during the course.	*Time:*

Contents	*Pedagogies*	*Technologies*
• Lesson keyword • Lesson objective	Open questions, Ice breakers, Rubrics and many more.	Black-board, PowerPoint with over-head projector, YouTube videos, and many more.

STEP 2

Recall and Present the Content:	• To help pre-service teachers make sense of new information by relating it to something they already know or to something they have already experienced. • To present the content effectively.	*Time:*
Contents	*Pedagogies*	*Technologies*
• Preservice teachers' previous experiences/concepts • Organize and chunk content in meaningful way • Provide examples	Demonstration, Readings, Web discussion, Discussion, Lecture, Game, Peer work, Quizzes and many more.	Mobile phones, VCD, PowerPoint with over-head projector, YouTube videos, social network and many more.

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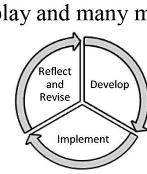
STEP 3

Performance and Feedback:	• To activate pre-service teachers' processing to help them internalize new skills and knowledge. • To confirm correct understanding for application and allow them to receive feedback on individual/group tasks.	*Time:*
Contents	*Pedagogies*	*Technologies*
• Elicit pre-service teachers' activities • Elicit recall strategies • Help preservice to integrate new knowledge. • Confirmatory feedback • Analytical feedback	Role play and many more 	PowerPoint with over-head projector, Word, Excel, Google application, YouTube videos and many more

STEP 4

Enhance retention transfer to new situations:	To help the pre-service teachers to internalize the information.	*Time:*
Contents	*Pedagogies*	*Technologies*
• Debrief the class on what had been learned. • Summarize the learning that has been occurred and apply it to a new situation • Write a reflection on their learning experience	Open Question, Quiz's, written comments and many more.	Comment sheet, PowerPoint with over-head projector and many more.