A Curriculum Development Utilizing TPACK as Content Framework to Enhance Digital Courseware Production Competency for Teachers

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Abstract

Regarding the lack of digital courseware, especially in the Social Studies subject which could well represent the Thai traditional society, social studies teachers must possess competency to create digital courseware based on local and learner's needs, situational adaptable, as well as uniquely different from other commercial or imported courseware. Therefore, it is very important to develop a curriculum to enhance digital courseware production competency for social studies teachers by applying the principle of TPACK as its content framework. This paper exhibits the experiment of applying a curriculum utilizing TPACK as the content framework to 11 social studies teachers in Punpin district in Southern Thailand. It is found that knowledge in applying social studies pedagogy to digital courseware production (adapted from PCK), knowledge in using technology to collect resources of social studies content (adapted from TCK) and knowledge in using computer program for digital courseware production (adapted from TPK) should be appropriately adapted based on existed knowledge and experience of teachers. In addition, the learning of the three knowledge areas should be integrated for better digital courseware production competency. It is recommended that knowledge in using technology to collect resources of social studies content and knowledge in using computer program for digital courseware production should be added in the learning management of knowledge in applying social studies pedagogy to digital courseware

production in order for the teachers to see the overall picture of digital courseware and to guide and plan for the better self-production of digital courseware. It is also noted that follow-up coaching and encouragement is necessary to keep teachers participating in the curriculum accomplishing their productions.

***Key Words**:* Competency; Curriculum Development; Social Studies Teacher; Teacher Development; TPACK

Introduction

The Office of the Basic Education Commission of Thailand (OBEC) (2010 P.25-32) identified curriculum and learning management as one of teacher's functional competencies. The key indicator for this competency is that a teacher must be able to use and develop technological media to manage the learning activities by implementing 3 behavior indications, including (1) the use of innovative and technological media to manage multi-learning which is appropriate with learning content and activities, (2) the information searching through internet networks to develop learning management, and (3) the use of computer technology to produce learning media or innovation. This competency is a guideline for teachers to develop their skills in using informational and communication technology (ICT) to produce learning media which could help enhance students' learning activities. The mentioned competency is consistent with teachers' competency proposed by UNESCO (2002) based on the principle of ICT Application in Subject Areas, which mentioned that teacher should possess basic knowledge and skills in applying ICT, including the use of necessarily fundamental devices and peripheral devices, to develop learning by integrating ICT and learning content altogether. It is also consistent with the thought suggested by Phelps et al. (2005 cited in Markauskaite, 2007) that teachers need the ICT-related skill development based on basic competency theory. Furthermore, currently there is a public interest in ICT literacy in the areas of technological integration for educational system, including conducting research on self-learning materials and learning media. (Markauskaite, 2006 cited in Agbatogun, 2010)

With the ultimate goal to develop teachers' competency, it can be assumed that teachers' competency in using and developing innovatively technological media for learning, including the ability to search information on the internet, is an appropriate guideline for teacher development in the digital age, which computer and internet inevitably play an important role in people's lives. Nevertheless, the promotion of subject matters which are local-oriented or consistent with Thai context should be considered in the areas of teacher competency development in using and developing computer and internet. This is based on a proposal proposed by Jaitip

Na-Songkhla (Na-Songkhla, 2004) which stated that Thailand should develop a curriculum for teachers in the digital age to develop their competency in (1) applying appropriate technology to the Thai context, (2) building up the knowledge-based society and local-oriented subject matters which are balanced with foreign culture, easy, and fast to learn, (3) analyzing the subject matters which will be appropriately and effectively transferred through technology, (4) managing digital learning environment in the areas of knowledge management, as well as the development of digital courseware and digital learning activities, (5) being a technological leader to appropriately and effectively create digital courseware for both teachers and students, and (6) creating an ambience to facilitate the use of technology for fostering learning, analysis, and creation.

According to the Department of Curriculum and Instruction Development's research regarding the computer use and development for teaching and learning in primary schools in Thailand which was conducted by Kannika Prampituk (Prampituk, 2002) digital courseware which was bought by schools or sold in the market is not consistent with subject areas or teachers' requirement. This thought is fully supported by another research conducted by Jaitip Na-Songkhla (Na-Songkhla, 2003) which exhibited that Thailand produces too little digital courseware and that which was produced is low quality. In Thailand, it is found that digital courseware is mostly imported from overseas so it is lack of Thai uniqueness, including language, culture, and thinking model. The mentioned research also suggested interesting solutions to solve the problem, which are (1) a technology management center should be established in each educational service area to coordinate with central unit in producing the digital courseware which possesses the same standard as textbooks which are better selected based on subject areas and written by teachers themselves, (2) teachers' skills in using technology to design and produce digital learning content should be enhanced by providing training courses or granting scholarships, and (3) students should participate in the production process of digital courseware. Furthermore, the Office of the Education Council's report on the performance assessment of the use of computer technology for education in primary educational institutes

indicated that teachers in Southern Thailand is the largest group, which requests for training courses on digital courseware production, and students in Southern Thailand is the only group, which requests for additional digital courseware to sufficiently satisfy their need.

Considering that Thailand lacks the digital courseware which is built on local context, teachers in Southern Thailand shows their preference to create digital learning content by themselves, and students in the same areas also requests for additional digital courseware, it is necessary to develop teachers' competency in using computer and internet to create media or innovation for learning management. Although relevant public agencies provided various training courses on the use of computer program for digital courseware production, there was no evidence-based practice which could prove that teachers would be able to create their own digital courseware after attending those training courses. Furthermore, the authors also found that the content provided at those general training courses solely focused on how to use computer program and did not mention how to integrate teaching techniques into digital courseware, as well as lacked the content on how to systematically design digital courseware so it could not help trainees to successfully create digital courseware further. Also, some parts of computer program, content, and skills which were trained were too complicated for teachers, particularly the use of advanced computer program.

Regarding all above-mentioned matters, the authors conducted a research and development of a curriculum using learning process approaches framework and 'TPACK' conceptual framework to enhance digital courseware production competency for social studies teachers. The research objectives are to develop a curriculum based on the mentioned frameworks to enhance digital courseware production competency for social studies teachers and to experiment digital courseware production competency of social studies teachers who are trained with the developed curriculum. This paper exhibits some parts of the aforementioned research by focusing on the use of TPACK framework to develop a curriculum to enhance courseware production competency for social studies teachers.

Literature Review

In order to develop this curriculum, the authors adopted two conceptual frameworks widely known as Learning Process Approaches Framework and Technological Pedagogical Content Knowledge Approach (TPACK) to design an appropriate curriculum by designating the curriculum's goals, selecting and arranging learning contents, and setting evaluation methods. The two concepts are detailed below.

Learning Process Approaches Framework

A curriculum development framework which focuses on learning process approaches views that a curriculum is not a tangible thing but is a relationship between teachers, learners, and knowledge. The learning management is a system for promoting thoughts and challenging to apply to practical part. Both learning process which occurs inside a learner and which can assume from learner's productivity will be assessed (Smith, 1996, 2000; Thongthew 2010). Stenhouse (1975 cited in Smith, 1996, 2000) is an expert in curriculum development who views a curriculum based on learning process approaches framework that a curriculum is an attempt to transfer basic principle and necessary characteristics by widely considering significant facts and enabling a transfer to effective practice. This is consistent with a thought of Sumlee Thongthew (2010) which mentioned about a curriculum based on this mentioned framework that, although a curriculum is printed in a paper-based form, that paper must not be used as a regulation which would be strictly implemented but should be used as a framework or an outline which proposes a guideline for a user to thoroughly think and try to figure out a method to take it into concrete action. In terms of the implementation based on contextual conditions including community and learner condition, researchers involved in the areas of learning process approaches framework concluded that curriculum development significantly focuses on learning process development of learners by depending on several principles as follows:-

1) Determine a goal which is widely open for learners' development;

2) The scope of content is broad principle or concept which

learners can further apply on their own;

3) Determine and analyze the classification of relationship between activities/tasks and competency which should be further developed;

4) Organize learning experience including situations, tasks, or activities which have some meanings to learners to create an opportunity for learners to develop working process on their own; and

5) Evaluate learners by considering their competency between learning and use their productivity to reflect the occurred learning process.

Technological Pedagogical Content Knowledge Approach

Technological pedagogical content knowledge approach (TPACK) is a necessary framework for teachers to integrate technology into learning activities. This framework focuses on new knowledge which is the complex interplay of three primary forms of knowledge, including technology (TK) pedagogy (PK) and content (CK), in 4 ways (Koehler 2011: online) which are (1) Pedagogical Content Knowledge (PCK), (2) Technological Content Knowledge (TCK), (3) Technological Pedagogical Knowledge (TPK), and (4) Technological Pedagogical Content Knowledge (TPACK).

Pedagogical content knowledge (PCK) means knowing what teaching approaches fit the content and knowing how elements of the content can be arranged for teaching. This is the integration between content and pedagogy on how content elements are well arranged, applied, and expressed for teaching and learning. The important factor is methods or ways to adapt content to pedagogy which would take place when teachers interpret the content, find a different way to present it, and make it accessible for learners.

Technological Content Knowledge (TCK) means knowledge about the method or the manner in which technology knowledge (TK) and content knowledge (CK) are reciprocally related to each other. Although technology limits types of expression which might occur, new technology is mostly more compatible with new and different expression, as well as more flexible. Teachers need to not only know about subject content which they are teaching, but also the method or the manner which that content would be adapted by applying technology.

Technological Pedagogical knowledge (TPK) means knowledge of the components, and capabilities of various technologies when they were used in preparing teaching and learning, as well as an understanding on the scope of tool existing for a particular task, the ability to choose appropriate tools, strategies for using the tool's affordances, and knowledge of pedagogy strategies and ability to apply those strategies to the use of technology.

Technological pedagogical content knowledge (TPACK) means knowledge occurring from the integration of technology, which teachers must try to understand, and the management of relationship between PCK, TCK, and TPK. Teachers' ability in management this relationship might be differently expressed based on teachers' skills.

The authors adapts TPACK framework to be consistent with the context of the development of social studies teachers. In this case, as the educational institutes in Thailand lack of digital courseware with local-oriented content, social studies teachers, who have responsibility to teach traditional knowledge and Thai culture to students, must develop their competency on digital courseware production (Table 1; Figure 1; Figure 2)

Table 1 Exhibits scope of knowledge for teacher development

Scope of Knowledge for Teacher Development Based on TPACK Framework	**Scope of Knowledge for Teacher Development Adapted by the Authors Based on TPACK Framework**
Pedagogical Content Knowledge (PCK)	⇨ Knowledge in applying social studies pedagogy to digital courseware production
Technological Content Knowledge (TCK)	⇨ Knowledge in using technology to collect resources of social studies content
Technological Pedagogical Knowledge (TPK)	⇨ Knowledge in using computer program for digital courseware production
Technological Pedagogical Content Knowledge (TPACK)	⇨ The competency of social studies teachers to produce digital courseware

Knowledge in applying social studies pedagogy to digital courseware production (adapted from PCK) means knowing how to determine elements of social studies learning management (learning objectives, content, and evaluation) in digital courseware, as well as knowledge in choosing teaching method which is suitable for content and digital courseware presentation, such as arranging content based on the chosen teaching methods.

Knowledge in using technology to collect resources of social studies content (adapted from TCK) means the use of computer, internet, and peripheral devices (such as digital camera and microphone) to collect resources (content, photo, motion picture, and sound) which are related to local content. This might be internet searching or self-record of real picture and sound, as well as saving and using these collected resources for further customized adapting or editing.

Knowledge in using computer program for digital courseware production (adapted from TPK) means the use of Adobe Captivate Program to arrange prepared/collected content and resources to produce digital courseware based on elements of learning management.

The competency of social studies teacher to produce digital courseware (adapted from TPACK) means knowledge and ability in producing quality digital courseware based on process analyzed by social studies teachers themselves. This process should be built on learning process approaches and TPACK framework by integrating knowledge gained from a curriculum into digital courseware production which has elements as follows: - (1) designing digital courseware, (2) collecting digital courseware resources, and (3) using a courseware production program to produce digital courseware. The application of TPACK to develop a curriculum to enhance digital courseware production competency for social studies teachers can be exhibited as appeared in the following diagrams.

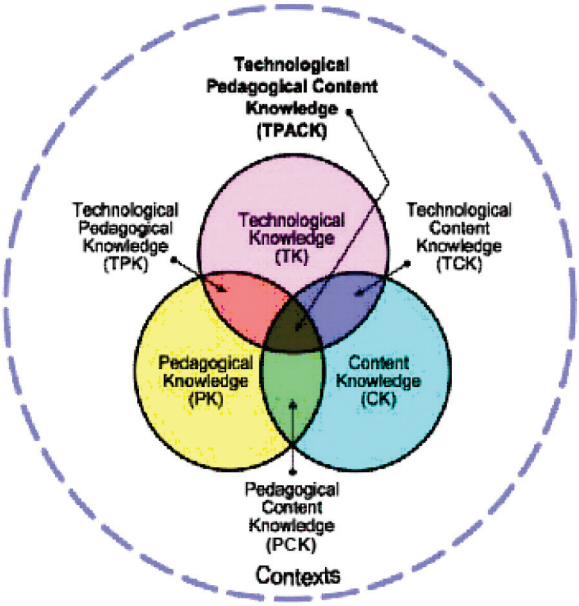


Figure 1 TPACK Framework (Resources: http://www.tpck.org/)

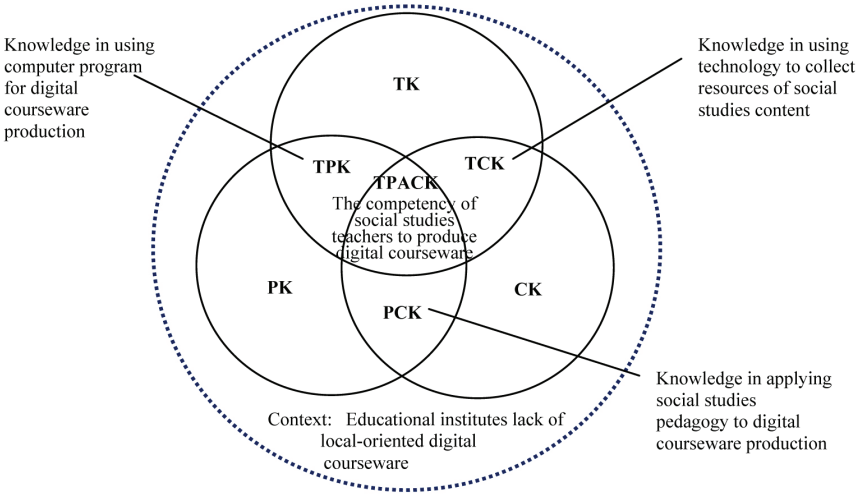


Figure 2 Adapted TPACK Framework by the authors

Research Methodology

A curriculum research and development based on learning process approaches and TPACK framework to enhance digital courseware production competency for social studies teachers was conducted by collecting fundamental information, then analyzing and synthesizing it for further details which are consistent with content elements (R1). This preliminary result would be further used to develop a drafted curriculum, which would be proposed to the experts to consider content elements and implementation possibility. Then, the concluded result built on experts' views would be considered for developing drafted curriculum (D1) which would be further experimented with research sample. Next, the implementation outcomes would be analyzed and concluded (R2) for developing the finalized curriculum (D2). As mentioned earlier, there were 4 research processes as follows: -

R1: the researcher studied relevant conceptual frameworks, analyzed, and synthesized preliminary information to develop curriculum outline, content, and learning management. The researcher also synthesized competency framework for digital courseware production, behaviors, and tasks and proposed to experts to evaluate consistency between these 3 things by using Index of Consistency (IOC). Then, the researcher created an appropriate survey on learners' knowledge and computer-skills background, as well as expectation and needs for digital courseware production, in order to apply this information to prepare experience, create content materials, and provide content examples to satisfy social studies teachers' expectation and needs.

D1: the researcher applied R1 result to draft a curriculum and proposed it to 5 qualified experts for their consideration by using curriculum evaluation forms developed by the researcher. The 5 qualified experts included 3 experts in the areas of curriculum development based on learning process approaches, and 2 experts in the areas of digital courseware production and TPACK framework.

R2: the researcher experimented a drafted curriculum adapted based on experts' comments with a sample, which is 11 social studies teachers in the

Suratthani Primary Educational Service Area Office 2 in Southern Thailand. The sample was between 27-58 years old and had social studies teaching experience between 1-36 years, as well as expressed their need to produce digital courseware with a concrete target in terms of local-oriented content. The subject areas included Bulrash Mat weaving, rubber farming, Visakha Bucha Day, and The Suan Mokkh International Dharma Hermitage. In terms of this pilot test, the researcher invited a qualified and experienced expert in the field of social studies teaching and digital courseware production and a qualified expert in the field of ICT, digital courseware production, and a courseware production program, to be the speakers by following a developed curriculum which totally took 30 hours (6 hours a day for 5 days). For computer practice, the researcher invited 3 technicians who possess experience in applying a courseware production program to accommodate the sample. The research site was the meeting room of the Suratthani Primary Educational Service Area Office 2, Punpin District, Suratthani Province. During the test, the sample took pre-, formative, and summative evaluation, as well as was observed and interviewed in between and after the test. The sample was also assigned activities to conduct in each learning subject and the researcher recorded significant circumstances such as time usage in each subject learning, addition or reduction of content in real situation, and sample's learning behavior.

D2: the researcher used the conclusion from R2 to develop the finalized curriculum.

Results

Based on the four steps of research described earlier, the authors present the results of each step as the followings:

Results of Step 1 (R1): The researcher applied knowledge of teacher development based on TPACK and learning process approaches framework to synthesize digital courseware production competency framework for social studies teachers and curriculum development scope. The TPACK application details are exhibited (Figure 3)

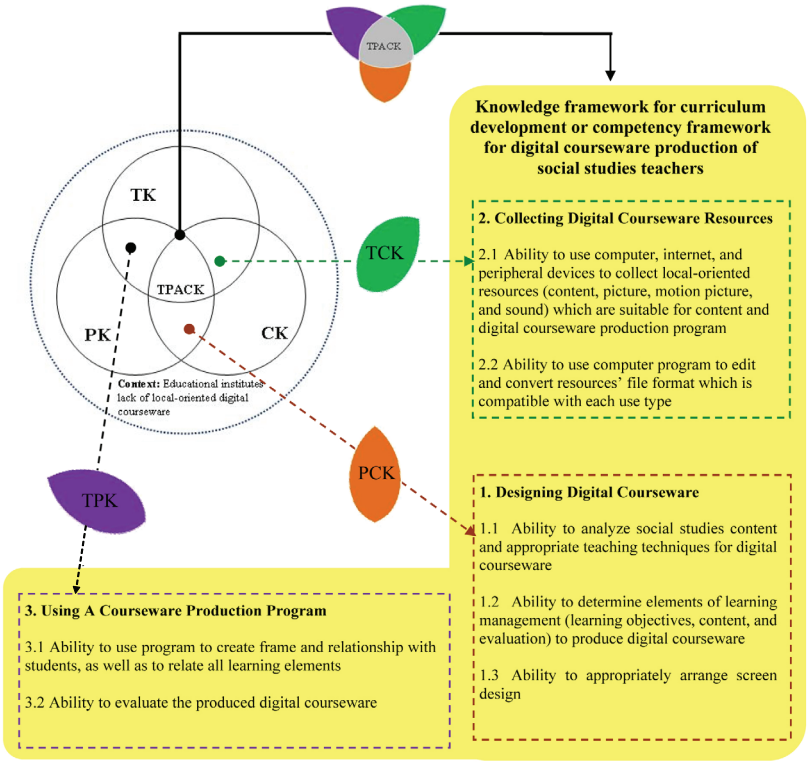


Figure 3 Exhibits the application of TPACK framework in curriculum development

The researcher applied TPACK framework by disseminating the flower, so called TPACK flower, into the format of curriculum development to enhance digital courseware production competency for social studies teacher. The knowledge framework in each part of curriculum is synthesized from 3 petals of TPACK flower. The objective is to enable social studies teacher to integrate knowledge in each part to develop digital courseware, which is represented by the pollen of TPACK flower.

From the first step, the competency framework of digital courseware production was developed for further adapting to knowledge framework in developing a curriculum. The details are as follows: -

1) Designing Digital Courseware: includes 3 sub-components which are (1) ability to analyze social studies content and choose appropriate

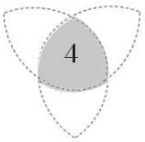
teaching techniques within digital courseware, (2) ability to determine learning elements (learning objective, content, and evaluation) within digital courseware production, and (3) ability to appropriately arrange screen design;

2) Collecting Digital Courseware Resources: includes 2 sub-components which are (1) ability to use computer, internet, and peripheral devices to collect local-oriented resources (content, picture, motion picture, and sound) which are suitable for content and digital courseware production program, and (2) ability to use computer program to edit and convert resources' file format which is compatible with each use type; and

3) Using A Digital Courseware Production Program: includes 2 sub-components which are (1) ability to use program to create frame and relationship with students, as well as relate all learning elements, and (2) ability to evaluate the developed digital courseware.

Results of Step 2 (D1): The researcher developed curriculum and learning materials based on the determined competency framework. The drafted curriculum included 4 lessons as follows (Table 2): -

Table 2 Exhibits curriculum outline to enhance digital courseware production competency for social studies teacher

UNIT	CONTENT	DURATION (HOURS)		
		THEORY	PRACTICE	TOTAL
	**Transferring Social Studies Pedagogy to Digital Courseware Production** 1.1 Selecting and implementing social studies teaching methods within the design of a social studies digital courseware; and 1.2 Determining and designing learning elements in a digital courseware.	**3**	**3**	**6**
	**Using Technology as a representative of Social Studies Content Resources** 2.1 Searching and saving internet resources; 2.2 Recording and saving resources via peripheral devices; and 2.3 Using programs to edit resources to be compatible with each use type.	**3**	**3**	**6**
	**Using The Digital Courseware Production Program** 3.1 Creating frame including resources; 3.2 Creating a test in digital courseware with 7 answer types; 3.3 Relating content framework; and 3.4 Publishing a digital courseware.	**3**	**3**	**6**
	**Producing Digital Courseware** 4.1 Integrating knowledge into self-production of digital courseware; and 4.2 Evaluating a self-produced digital courseware.	**-**	**12**	**12**
Total		**9**	**21**	**30**

Results of Step 3 (R2): The researcher used the drafted curriculum with the sample of 11 in-service primary social studies teachers at the meeting room of the Suratthani Primary Educational Service Area Office 2, Punpin District, Suratthani province for 5 days continuously. The key findings for curriculum development were as follows: -

Unit 1: The duration should be reduced because social studies teachers had some existed experience in this matter prior to the test.

Unit 2: The duration for internet resource searching and digital camera recording should be reduced; while the duration for video editing program as well as sound recording and editing should be added.

Unit 3: The overview information of digital courseware production program should be introduced on the first day so the teachers would be able to design digital courseware which is compatible with program specifications.

Unit 4: The review of Unit 2, 3, and some unclear matters should be conducted prior to practicing session. Furthermore, in terms of computer-related learning practice, there should be technicians to accommodate and give some advices to social studies teacher when problem occurred in the ratio of 1 technician per 3 teachers.

Results of Step 4 (D2): The researcher developed the finalized curriculum outline based on information gained from earlier steps. This led to the improvement of TPACK flower by changing the weight of each petal. The new ratio among knowledge in using social studies pedagogy for digital courseware production: knowledge in using technology to collect social studies content resources: knowledge in using digital courseware production program: digital courseware production competency of social studies teachers is 4:6:8:12 of teaching hours (totally 30 hours) or 1:1.5:2:3 in ratio. Furthermore, the introduction of unit 2 and 3 should also be introduced on the first day of curriculum. This can be concluded as follows (Figure 4): -

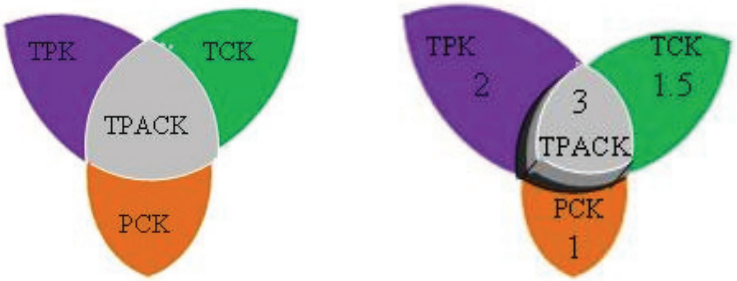


Figure 4 Exhibits TPACK Flower before (left) and after (right) researcher's adaptation

Discussion and Conclusion

The use of TPACK framework in developing a curriculum to enhance digital courseware production competency of social studies teachers is to frame the course contents based on TPACK's elements, including PCK, TCK, and TPK, and create a new TPACK scope, which hereinafter is digital courseware production competency, as a key target for social studies teacher development. A curriculum is for managing the learning of PCK, TCK, and TPK; while TPACK is for conducting context and accommodating learners to work on their own. The competency of each social studies teacher can be developed differently and can be increased based on time which each person spent on practicing both inside and outside the training. This theory is different from the curriculum development of Doering et al. (2009) which used TPACK to develop a curriculum by framing content in the areas of TK, PK, and CK, focusing on the integration of geospatial technologies in education, as well as using TPACK framework for teacher's self-evaluation. This theory is also different from the curriculum development of Niess et al. (2010) which created online curriculum to develop sciences and mathematics teachers in using spreadsheet program in learning activities by designing some parts of a curriculum from PCK and extending to TPACK knowledge of teachers.

In terms of the ratio of curriculum outline, considering the elements of PCK, TCK, and TPK, the duration for PCK should be reduced as social studies teachers already had existed experiences on social studies teaching.

However, the duration for TCK should be partly added in the areas of using computer program to edit resources. Particularly, the duration for TPK should be significantly added because it is the new and complicated knowledge for teachers. This is consistent with the research finding of Doering et al. (2009) regarding the size of circles representing TK, PK, and CK, which stated that it is not necessary that the 3 circles must be the same size. For example, secondary-school teachers should have bigger TK and PK circle than CK one; while high-school teachers should have a bigger CK circle than the other ones.

In terms of the arrangement of learning content for the use of curriculum, although the outline of curriculum exhibits separated content based on elements (PCK, TCK, and TPK), a curriculum should be applied by introducing some parts of TPK and TCK on the first day of curriculum which should be all-integrated with PCK in order to accommodate learners to see the overview of digital courseware which they will be further produce.

It is also noted that we rethink the ways in which we are characterizing TPACK for this particular project. The TPACK is needed and expressed as the competency of social studies teachers to produce digital courseware, so the application of content, pedagogical, and technological knowledge would be expressed within the resulting social studies software, rather than the lesson plan or unit completed by students in the classroom. The TPACK necessary to produce content-based digital courseware would be the same as the TPACK needed to select and use materials and types of learning activities in the classroom.

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