Teacher readiness in accommodating the TPACK framework to meet teacher competence the 21st Century

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Abstract. One of the advantages of digital technology (internet) as the 21st century characterizes learning is the availability and accessibility of teaching materials. The purpose of the study was to formulate specific competencies and measure the readiness of teachers to face 21st-century learning. Based on four teachers’ competencies and three TPACK components, it has been defined as a specific competency attribute for 21st-century teacher competences. The research phase begins with the FGD process and concludes with expert justification. 21st Century teacher formula tested through survey techniques to get the level of acceptance or readiness of teachers in the field. The survey was conducted on 360 teachers in North Sumatera. The level of teacher acceptance was descriptive analysis. The results of this study are the competency profiles of 21st-century teachers who are based on digital learning and are synched with the TPACK framework. The teachers in North Sumatera received and ready to face 21st-century learning. Data collection is done through online surveys. Data analysis using descriptive analysis. The results showed that teachers in North Sumatra were ready to face the demands of 21st-century learning.

1. Introduction

When compared to the number of Indonesian professional teacher competencies with Malaysia, teachers in Malaysia have two more competencies. Besides, the formulation of competencies has accommodated the development of 21st-century technology. Teacher competencies in Malaysia include mastery of (1) content, (2) 21st-century pedagogy, (3) evaluation, (4) psychology skills; (5) counseling, and (6) information technology[1]. Technological and pedagogical advances in the 21st century have been accommodated. Rusdin has determined that technology and pedagogy are the demands of 21st-century teachers for more effective learning, so teachers must prepare and use technology systematically and selectively [2]. The integration of the mastery of technological knowledge, pedagogy, and content is an inseparable unity in learning. In the 21st century, which is synonymous with the era of communication technology, it is very important student-teacher communication that learning in physical classes and online classes can be effective [3].

To synergize the four teacher competencies within the TPACK framework, specific competency formulations are needed. To be able to formulate specific competencies can be done by inventorying competency attributes derived from Teacher competencies and associated with the TPACK component. Referring to Matthew J. Koehler et.al, the TPACK framework can be used to measure the readiness of teachers and prospective teachers to be able to teach assisted technology effectively [4].
As communication technology develops, the teaching profession must be able to adapt and accommodate learning needs (students) [5]. In the end, the teacher must have operational competencies that are in line with the needs of the students of his time. The operational capabilities needed by the teacher in selecting content, delivering material, evaluation and evaluation techniques require specific competency attributes. This research was conducted to formulate 4 (four) specific professional teacher competencies in line with the TPACK framework as a 21st Century Teacher formula. After the 21st Century Teacher Profile was formulated, each item of specific competence was validated as the readiness of Teachers in school.

2. Research Method
The research method used in this research is research and design. The 21st-century teacher profile formulation stage is conceptual, research begins with a literature study, followed by the Delphi process and validation by expert judgment. The results of the conceptual formulation were tested through survey techniques to get the level of teacher acceptance or readiness in schools. The survey was conducted on 360 teachers in North Sumatra to obtain teacher acceptance and readiness for 21st-century learning. The level of teacher acceptance and readiness was processed using descriptive statistical analysis.

The research stage showed in Figure 1. Literature reviews are used to input competency attributes aligned with 21st-century learning characters that are reviewed based on TPACK (technological, pedagogic, content knowledge). A list of specific competency attributes is consulted by panelists to be validated in the focus group discussion (FGD) process. Based on panelists' opinion results, researchers set specific competencies presented in matrices. The FGD process is an effort that reinforces the opinions of experts who can be very useful in educational policy [6]. The FGD process is an effort that reinforces the opinions of experts who can be very useful in educational policy. The specific competency formulation is defined as the concept of the 21st Century Teacher competency profile based on the TPACK framework. Conceptual formulation results are consulted to experts for justifications.

After the justification of the concept formulation of the 21st-century teacher, a profile conceptual was revealed to be a questionnaire for surveys. The objective of the survey is to get the response readiness of teachers in schools facing the demands of competence such as concepts that have been formulated.

3. Result

3.1. Teacher Competencies in the TPACK Framework
To align the four competencies of Indonesian teachers with the TPACK framework, conceptually it can be presented in 12 (twelve) cells which are slices of 4 x 3 (four times three). The keywords of each cell are defined from the suitability of Indonesian teacher competency items with the TPACK framework. Keywords that are defined are specific competencies of teacher competencies. Table 1 shows the specific competency points of teacher competency according to the TPACK framework.
Table 1. Specific Teacher Competencies in the TPACK Framework

| Component       | Technology            | TPACK Framework       | Content                      |
|-----------------|-----------------------|-----------------------|------------------------------|
| Professional    | computerized learning| comprehensive         | coverage                     |
| Pedagogic       | use of multimedia     | cyber pedagogic       | unique and interesting       |
| Social          | wise in social media  | interactive           | filter information           |
| Personality     | ICT update            | patron                | tolerance                    |

3.1.1. Professional Competence in a Technology Framework
Professional teacher competence or academic competency based on technological framework should be able to use computers. That is, a teacher in this era must be able to use applications or software as a tool to complete work in the field of science. The teacher of Drawing Engineering at SMK should be able to draw with Autocad or the like. Accounting teachers must be able to apply Excel applications for financial management.

3.1.2. Professional Competencies in Pedagogical Framework
Professional competence (academic) is aligned with the pedagogical framework requiring teachers to be able to orient learning on the achievement of competencies, not on the acquisition of knowledge. The choice of teaching materials by a teacher on one basic competency may be different, meaning that for parallel classes the teacher can provide different materials.

3.1.3. Professional Competence in the Content Framework
Professional teacher competence or academic competency based on technological framework should be able to use computers. That is, a teacher in this era must be able to use applications or software as a tool to complete work in the field of science. The teacher of Drawing Engineering at SMK should be able to draw with Autocad or the like. Accounting teachers must be able to apply Excel applications for financial management.

3.1.4. Pedagogical Competence in a Framework Technology
Professional competence (academic) is aligned with the pedagogical framework teacher competence, when aligned with the technological framework, provides an opportunity for teachers to be able to use learning media in a variety of presentation formats (multimedia). In the digital age, teaching media are very easily developed or obtained openly, both in the form of offline (online) or online (online). Computer-based technology can be used for a variety of pedagogical tasks, such as research, communication, use and creation of media [4].

3.1.5. Pedagogic Competence in the Pedagogical Framework
Pedagogic competence is harmonized with the pedagogical framework requiring teachers to be able to implement cyberspace-pedagogics. Siber-pedagogic is learning that is synonymous with the use of internet technology to enable communication and academic transactions online. Teachers and students can enter cyber classrooms in the Collaborative Cyber Community platform [7].
3.1.6. Pedagogical Competence in the Content Framework
Pedagogically competent teachers, when aligned with the content knowledge framework, provides opportunities for teachers to develop unique and interesting teaching materials. Unique and interesting teaching material in substance and packaging teaching material is very easy to develop or obtain from online sources.

3.1.7. Social Competence in the Technology Framework
One dimension in DCA (Digital Competence Assessment) that teachers must have is the ethical dimension [8]. The ethical dimension is closely related to the use of social media which directly or indirectly influences social behavior. Connections due to the use of social media have a number of negative impacts, as reported by the mass media, intimidation, loss of privacy, hoaxes, isolation, etc. [9]. 21st-century teacher's social competence to be wiser in social media to avoid negative influences.

3.1.8. Social Competence in the Pedagogical Framework
Being a teacher in the digital age should be more interactive. The availability of various kinds of communication media must be used in the utilization and increase in the intensity of student and teacher communication.

3.1.9. Social Competence in the Content Framework
Socially, teacher competence in the digital era must be selective in choosing content. The use of internet-based media and social media that is very broad and massive requires teachers to be able to filter out negative content and can filter invalid information. Teachers should be able to act as a filter of information that will reduce the adverse effects on students.

3.1.10. Personality Competencies in the Technology Framework
Personality teacher competence that is very important in the era of digital technology is the competence to always update the latest applications or software as a tool in strengthening competencies. Computer-based technology is flux and protean, so computer software and applications change quickly and become obsolete. Mastery of previous technology is capital to adapt to new technologies [4].

3.1.11. Personality Competencies in the Pedagogical Framework
Teacher personality competencies related to pedagogical framework (PK) for the role of teachers to be mentors and companions for students. The role of mentor and companion for students is a counterweight to the social behavior of students who tend to isolate themselves and are individuals because of their preoccupation with playing with gadgets. One effect of using gadgets on children is isolation from social life and lack of emotional management. This results in a lack of interaction and communication [10]. One of the negative effects of using gadgets on children is dependence and anxiety [11]. To reduce the adverse effects, 21st-century teachers must be a guide and student companion in maintaining the adverse effects of using gadgets.

3.1.12. Personality Competencies in the Content Framework
The professional teacher needed in the digital age is to be tolerant and accept individual differences. Individual differences in students that result in learning achievement must be accepted by the teacher wisely. The availability of open learning resources allows students to better master the material (content) according to individual student interests. For this reason, teachers must open opportunities for students to choose their own teaching materials while still referring to targeted competencies.

3.2. Profile Respondes
The survey was conducted for one week in October 2019. All respondents in the province of North Sumatra with profiles based on position such as (figure 2a) most (80%) were teachers, some (50%)
taught in secondary education (SMA / MA / SMK) and some teach in basic education (elementary and junior high) (figure 2b).

![Profile of respondents based on position](image1)

![Profile of respondents based on place of teaching](image2)

**Figure 2.** Profile of respondents based on their position and teaching location

When viewed based on work experience (figure 3a), it shows that some (54%) of the respondents are young teachers and the rest are senior teachers. Based on their educational background (figure 3b) most (88%) of respondents had a bachelor’s education.

![Profile of respondents based on work experience](image3)

![Profile of respondents based on education](image4)

**Figure 3.** Profile of respondents based on work experience and education

### 3.3. Teacher Readiness in 21st Century Learning

#### 3.3.1. Teacher Readiness

From the results of a survey of 360 teachers in North Sumatra (98%) stated they were ready and very ready. Teacher readiness in this study is the teacher agrees with the profile of 21st-century professional teachers who refer to the TPACK framework. Specific competencies in 21st-century learning are digital-based, almost all teachers declare ready to do.

![Teacher Readiness](image5)

**Figure 4.** Teacher Readiness

#### 3.3.2. Online Learning Readiness

To find out the readiness of teachers in implementing cyber-pedagogic through online learning (e-learning), the researcher submitted a statement: “Teachers simply do learning in class”. Most of the teachers (63.6%) stated that not enough learning was only done in the classroom, but some teachers (24.3%) stated that learning in the classroom was sufficient (figure 5a).
To find out the readiness of teachers in the application of online learning, researchers submit statements in other items: "Teachers should do online learning (e-learning)". Most (74.1%) teachers are ready to apply online learning, but there are still teachers who are in doubt (19.6%) and not ready (6.4%) apply online learning (Figure 5b). Based on these two data, it shows that teachers in North Sumatra are quite ready to apply online learning.

### 4. Conclusions and Recommendations

From the results of this study it can be concluded:

1. Teacher's professional competence according to the TPACK framework should be computerized, learning outcome orientation, and comprehensive material coverage.
2. Teacher's pedagogical competence according to the TPACK framework, should be based on multimedia, applying cyber-pedagogic, and unique and interesting material.
3. Teacher social competency according to the TPACK framework, teachers should be wise in social media, be interactive with students, and be a filter of information.
4. Personal competence of teachers according to the TPACK framework, teachers should always update ICT, be protective, and tolerant of students' choices.
5. Teachers in North Sumatra are ready to face the demands of 21st-century learning.

Based on teacher readiness in the form of approval of the specific professional competency demands according to the TPACK framework, further research is needed to find out the real readiness for digital learning abilities and skills. Teacher competency assessment in digital literacy needs to be measured by using the Digital Competence Assessment (DCA) test to get the real competence of teacher digital literacy.

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