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Development of TPACK and EQ-based 21st century learning through the teacher certification programme in Indonesia

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The aim of the research reported on here was to identify teachers' comprehension of technological pedagogical content knowledge (TPACK) integrated with emotional quotient (EQ). We used mixed-method research with an explanatory model. The subjects of this research were 30 teachers who participated in the teacher certification programme and 30 who did not participate in the programme. Purposive sampling was used to select the sample. Data were collected through questionnaires and interviews. We used descriptive statistics and *t*-tests of the quantitative data analysis, while qualitative data analysis was carried out by reduction. The findings of the research point out that programme comprehension had an effect on TPACK integrated with EQ. These findings were supported by the average score of the teachers who participated in the programme, which was higher than those who did not participate in programme. In this regard, the factor was not only the experience of teachers at school but also the interactions between teachers in the process of the programme. Based on the research findings, the authors recommend all teachers to participate in programme.

Keywords: 21st century learning; emotional quotient (EQ); technological pedagogical content knowledge (TPACK)

Background

In the 21st century technology has become a reference for all aspects of life. The demands for the needs of the 21st century cannot be separated from the use of adequate technology, therefore, education must be the main support in preparing citizens who are ready to use technology to meet its needs. The implementation of technology in schools is deemed effective in forming students who are ready to use technology in facing the challenges of the 21st century (Iskandar, Sastradika & Defrianti, 2019).

The success of integrating technology is in accordance with the content curriculum, learning processes related to the content, and intelligence in the use of technology (Harris & Hoffer, 2011; Harris, Mishra & Koehler, 2009). To integrate lesson plans effectively, it requires technology related to the curriculum, student learning needs, and the availability of technology. The need for planning is known as technology, pedagogy, content, and context knowledge (TPACK) (Harris & Hoffer, 2011).

Mastery of technology in the 21st century is important for teachers as learning must be integrated with the uses of technology, and they have no choice but to implement learning based on TPACK. TPACK is an emergent form of knowledge that goes beyond all three "core" components (content, pedagogy, and technology); this comprehension can emerge from interactions of content, pedagogy, and technology knowledge (Koehler, Mishra & Cain, 2013). The TPACK model offers a framework that can be implemented by teachers to assist pre-service special education teachers to make effective decisions regarding integrating technology into the instruction (Anderson, Griffith & Crawford, 2017; Lyublinskaya & Tournaki, 2014; Tournaki & Lyublinskaya, 2014). TPACK is considered as a base for teachers to understand the concepts using technology, pedagogical skills, the ability to analyse concepts that are difficult to be learned and to develop technology to overcome problems faced by students.

In the implementation, TPACK can be integrated with EQ. EQ is the ability to recognise individuals' and other's feelings and emotions, to differentiate among them; EQ can further be used as information to guide individuals' thinking and actions (Anwar, Zaki & Khan, 2013). EQ is defined as part of a collection of social quotients that involves the ability to understand feeling and emotion, either to themselves or others, being able to make good decisions and to apply information as guidance of thought and action (Masyithoh, 2017). EQ is assumed to affect the teacher's ability to apply TPACK.

Much research on TPACK has been conducted by various researchers, such as (1) identifying the decisions made by pre-service special education teachers and the types of knowledge that they used for making those decisions while integrating iPad apps into lessons with students who had mild disabilities, and determining the participants' perceptions on the process implementation of iPads (Anderson et al., 2017); (2) pre-service

teachers' beliefs in different domains measured through self-assessed knowledge connected with their attitudes toward simulations (Lehtinen, Nieminen & Viiri, 2016); (3) the contribution of content, pedagogy, and technology on the formation of science teachers' TPACK ability (Yulisman, Widodo, Riandi & Nurina, 2019). However, not much research has been done on TPACK integrated with EQ. Therefore, to be able to apply learning based on TPACK integrated with EQ, it is necessary for teachers in training to develop knowledge about TPACK and EQ.

The focus of this research was to help teachers develop TPACK knowledge through controlling emotional intelligence to help prepare citizens that are ready to compete in the 21st century (Güven & Gökdağ Baltaoğlu, 2017; Tanak, 2018). The teacher will guide students in constructing comprehension and creativity to prepare them to face the challenges of the 21st century, one of which is the use of technology. Teachers are required to guide students in the use of technology and provide insights about technology. Therefore, teachers must know how to apply the right technology in the learning process based on the analysis of the character of the material and the analysis of pedagogical aspects. This is with the aim of optimising the application of TPACK in learning. The problem seems to be teachers' poor knowledge of technology that can be used in learning. The importance of technology in educational systems has become a policy choice in public and private educational development. This is due to the fact that conventional or traditional teaching and learning approaches cannot cope with the high demand for education (Lye, 2013).

Based on this issue and its significance, with this research we aimed to provide information on

(1) teachers' comprehension of TPACK integrated with EQ before and after attending the Teacher Certification Programme, and (2) the effect of the programme on the teachers' comprehension of TPACK integrated with EQ.

Literature Review

The significance of TPACK in the 21st century

TPACK is complex knowledge and very important for teachers, since it is the knowledge that enables teachers to use technology appropriately, based on the analysis of the material, characteristics, and aspects of TPACK pedagogy that requires multiple unique interactions and compatibility between material, pedagogy, and technology (Mishra & Koehler, 2008). This theory was developed from the pedagogical theory of content and knowledge (PCK) proposed by Shulman (1987) by adding technological content to aspects of PCK.

The results of several previous studies show that the implementation of learning based on TPACK in schools had a positive impact that could facilitate the development of skills for the 21st century (Kereluik, Mishra, Fahnoe & Terry, 2013). Furthermore, it can help teachers to develop quality learning, so that learning can strengthen the understanding of concepts and other scientific skills needed to solve problems (Feladi & Puspitasari, 2018; Srisawasdi, 2012).

TPACK consists of seven aspects, namely technological knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), pedagogy content knowledge (PCK), technology pedagogical knowledge (TPK), technology content knowledge (TCK) and TPACK (Koh & Chai, 2016; Mishra & Koehler, 2008). The relationship between the seven components is shown in Figure 1.

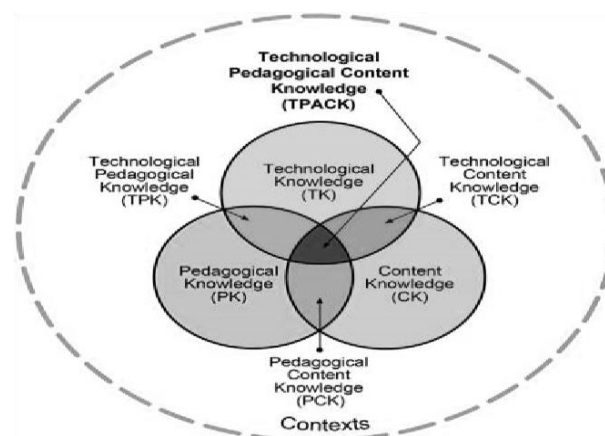


Figure 1 TPACK components (adapted from Mishra & Koehler, 2008)

TK covers all knowledge in terms of using tools related to information and communications technology (ICT), PK is knowledge of teaching, learning, evaluation, and students, CK is

knowledge related to the subject matter, PCK is knowledge which combines subject matter and teaching and learning activities that can help students in the learning process, TCK is knowledge

about the use of ICT and combines with the understanding of learning material, while TPACK is an incorporation of all knowledge about technology, pedagogy, content, and knowledge (Koh & Chai, 2014; Mishra & Koehler, 2006, 2008; Wang, 2019).

The significance of EQ in the 21st century

The challenge of implementing TPACK must be combined with EQ since it enables teachers and students to understand and control their and others' emotions to effectively achieve learning goals and reduce the negative impact of using technology (Wang, 2019). EQ is the ability of a person to regulate his/her emotional life with intelligence, maintaining emotional harmony, and its disclosure of self-awareness skills, self-control, self-motivation, empathy and social skills (Goleman, 2004). EQ is also needed to develop a positive learning environment (Singh, Manser & Mestry, 2007). EQ is not acquired quickly – it requires a process of learning in which the environment plays a major part (Goleman, 2003).

A person's ability to act according to his/her profession is needed in adapting to various conditions and fulfilling one's potential and one's ability to accept challenges as these change according to circumstances. This requires readiness and stability of one's emotions, understanding of one's emotions, control of emotions, understanding other people, the ability to build and foster communication with others, and the ability to determine success in the field of education (Iskandar, Majzub & Mahmud, 2009). An individual's success of achieving desired goals is determined by one's ability to manage emotions associated with understanding themselves, the ability to manage or control themselves, the ability to motivate themselves, the ability to understand others and the ability to build and foster relationships with others (Goleman, 2004). Therefore, teachers need to involve EQ on an ongoing basis to be able to develop student leadership traits in directing interactive learning where students are the centre of learning (Jansen, Moosa, Van Niekerk & Muller, 2014). Thus, the goal of implementing learning based on technology can be achieved.

A person's EQ is associated with the development of technology and information, which currently greatly affects life of the global society, especially in the field of education as a forum to educate people who are adaptive to use technology and information as the main support in the learning process. The interaction between educators and students can no longer follow the traditional and conventional approaches but should incorporate technology and information devices that have become a trend or lifestyle need of the digital communication era. The advances of science and

technology, especially in the field of communication and information, have changed the order of people's lives and can have a negative or positive impact, especially in the field of education. Therefore, information and communication technology must be used to provide moral value and meaning in the learning process through integrating the ability to manage emotions in using ICT as a tool for educators and students to develop knowledge and technology to become independent, smart, superior, and globally competitive.

Hardianto (2008) conveys that intellectual intelligence cannot function properly without a participant's awareness of the learning material presented. The balance between intellectual intelligence and EQ is key to the success of a learning process. The educational process does not only develop intellectual intelligence but it also develops students' EQ. In terms of developing EQ in learning, educators and students must understand and integrate the elements of EQ in the learning process. The use of ICT without integration of EQ may disadvantage students' intellectual development (Mustafa, Ismail & Buntat, 2014).

EQ is the main factor that determines one's success in all aspects of life, especially in the field of education. This assumption has been proven by various studies conducted by psychologists throughout the world. Much research has been done on EQ in education as EQ plays an important role in successfully following the educational process (Goleman, 2001; Iskandar, 2008; Syafrimen, Ishak & Erlina, 2017).

Method

In this research we used mixed methods with explanatory models (Creswell & Plano Clark, 2007). The research subjects were teachers who participated in the Teacher Certification Programme (a programme aimed at improving the quality of teachers in Indonesia to enhance the quality of education) and those who did not participate in the Teacher Certification Programme (hereafter referred to as the programme). The total population was from Islamic education teachers in the Jambi province, Indonesia. The total sample of 60 teachers was divided into two groups of 30 (nine male and 21 female) who participated in the programme and 30 (11 male and 19 female) who did not participate in the programme. The sample selection was done through purposive sampling (Creswell & Plano Clark, 2007). Sampling for the test and interviews was based on the consideration of the teachers who participated in the programme and those who did not participate in the programme.

The teacher's comprehension of the development of TPACK was carried out by adopting the structure for the use of TPACK (Tanak, 2018), which contains three phases in

building comprehension of TPACK combined with

EQ development (see Figure 2).

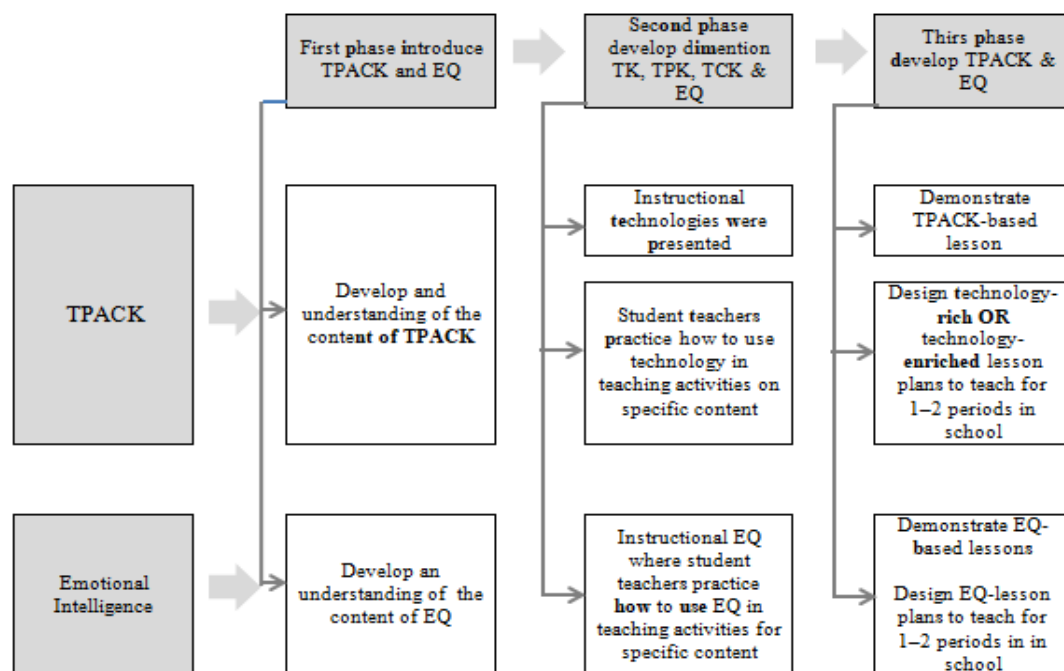


Figure 2 Structure of implementing TPACK and EQ

The first phase was an introduction to TPACK where the teacher was provided with knowledge about TPACK and EQ content. The second phase was the development of TK, TPK, and TCK where the teacher designed learning using technology and further simulations of technology in learning and providing the teachers with knowledge about how to apply EQ in learning. The third stage was the development of TPACK and EQ where the teachers demonstrated learning based on TPACK and could design and implement learning based on technology as outlined in the form of lesson plans based on the comprehension of TPACK and EQ.

Data in this study were obtained through tests and interviews. TPACK tests with seven indicators in 33 questions and EQ tests with six indicators in 36 questions were carried out. The use of a questionnaire was aimed at obtaining complete information about Islamic teachers' TPACK knowledge and EQ. Before being used in the research, the items passed prior expert validation to determine the validity of the questions. Based on the results of the expert validation, all questions were declared valid, although the validator suggested some improvements. After having analysed the test results, we continued with the interviews. The interview guideline consisted of questions put to a group of students based on answers provided in the tests. The purpose of the interview was to support quantitative data.

The quantitative data were analysed as follows: (1) collecting data from test results,

(2) testing the test results and presenting them in a descriptive analysis, and doing a *t*-test. The final step was summarising the description of TPACK knowledge and EQ of Islamic education teachers. Qualitative data analysis of Islamic teachers' TPACK knowledge and EQ was carried out based on interviews with the teachers. The analysis process was undertaken by reducing the data from the interviews through records that were adjusted to the results of the quantitative data before the interview. We aimed at obtaining clearer and more complete data related to teachers' knowledge. The results of the data reduction were encoded. The coding process was carried out to categorise the level of the teachers' comprehension on TPACK integrated with EQ.

Result and Discussion

The Descriptive Knowledge of TPACK and EQ of Islamic Education Teachers

Knowledge development on the programme for Islamic Education Teachers was carried out for 16 hours of learning. The purpose of this research was to determine Islamic Education Teachers' comprehension of TPACK and EQ in developing technology used in learning. The descriptive results of the teachers' TPACK and EQ are presented in Tables 1 and 2.

There was a difference in the average comprehension of TPACK for teachers who participated in the programme and those who did not. The results show that teachers who participated

in the programme had better TPACK knowledge compared to those who did not participate in the programme. We assumed that this was not merely a result of the teachers' teaching experience but also due to the interactions between teachers in the programme activities. This result is supported by the results of the analysis which indicate that there

was a significant influence of the programme on teachers' TPACK knowledge (p -value $0.019 < 0.05$). Teachers who participated in the programme had the opportunity to develop learning based on TPACK as opposed to the teachers who did not participate in the programme.

Table 1 The descriptive knowledge of TPACK

TPACK aspects	Certified teachers	Uncertified teachers
Technological knowledge (TK)	80.20	74.86
Content knowledge (CK)	82.47	80.15
Pedagogical knowledge (PK)	80.80	78.70
Pedagogical content knowledge (PCK)	68.10	66.80
Technological pedagogical knowledge (TPK)	71.68	61.50
Technological content knowledge (TCK)	70.89	66.93
Technological pedagogical content knowledge (TPACK)	64.50	56.80
Score average	74.09	69.39

Based on Table 1, the difference in each indicator is clear. The biggest difference lies with the TPK indicator. Based on the results from the interviews, there were several main causes for the difference in TPK between teachers who participated in and those who did not participate in the programme. The reasons include the following: (1) there was still a lack of policies that required technology-based learning, (2) some schools lacked technological facilities and infrastructure and (3) a lack of training for teachers. For TCK, it shows that Islamic teachers who participated in the programme had learnt about integrating technology in learning as opposed to those who did not participate in the programme. Furthermore, teachers who participated in the programme had better knowledge than those who did not participate. The reasons for this were the same as for TPK. With regard to PK and CK, the average teacher's knowledge was not significantly different, as all Islamic education teachers had good CK and

pedagogy. However, the integration of Islamic education teachers' knowledge was still not good. This was clear from the PCK aspect as Islamic education teachers experienced difficulties in applying CK and pedagogy in learning. Due to the Islamic education teachers not being able to understand the characteristics of the material, it was difficult to choose the learning approach that was suitable for the material to be taught. With regard to the TPACK aspect, Islamic education teachers who participated in the programme and those who did not had different perceptions indicating that the knowledge of TPACK and its implementation in learning lessons had to be improved. Due to the lack of knowledge in implementing TPACK the Islamic education teachers' knowledge on the integration of technology was still low. Thus, further development is needed to increase knowledge and ongoing efforts to apply technology in schools.

Table 2 The descriptive knowledge of Islamic teachers' EQ

TPACK aspect	Certified teachers	Uncertified teachers
The dimension of self-awareness	76.50	70.00
Dimension of self-control	78.80	76.50
Dimension of self-motivation	94.50	78.50
Dimension of empathy	80.50	75.09
Dimensions of social skills	90.20	78.85
Score average	84.10	75.79

The descriptive analysis of EQ knowledge in Table 2 shows that the average teacher had high EQ, but that differences in EQ still existed between teachers who participated in the programme and those who did not use the TPACK learning approach. Significant differences were found in the dimensions of self-motivation and social skills. Teachers who participated in the programme had much better motivation and social skills than those who did not participate in the programme. This is

because teachers who follow the programme master the concepts and practices of emotional dimensions integrated with technology in learning, which allows them to increase self-motivation and communication. There were small differences with regard to the dimensions of emotional self-awareness and self-control. This indicates that self-awareness and self-control in the use of technology for learning needed to be improved to overcome problems in achieving learning objectives. The

results of the *t*-test (p -value $0.02 < 0.05$) show that teachers who participated in the programme had better EQ skills than those who did not participate. This shows that the programme influenced teachers' EQ.

Discussion

Teachers' perceptions on TPACK knowledge can be improved through strengthening the comprehension of learning design and technology mastery (ICT) (Koh & Chai, 2014). Teachers who have a high TPACK understanding can facilitate students in online learning and blended learning, because teachers' comprehension of TPACK will facilitate the design and use of technology in the teaching learning process (Koh & Chai, 2014, 2016). The implementation of online and blended learning does not necessarily require the use of learning applications, but can also be used with social media (Moodley, 2019; Wendt & Rockinson-Szapkiw, 2015). The implementation of online and blended learning can improve communication between students and students or between students and teachers due to increased access (Mayisela, 2013).

The blended learning model is effective for the implementation of TPACK integrated with EQ, with a combination of limited learning in school classrooms with an interactive online learning system. This learning demands that teachers and students use technology through computer or smartphone tools and features or applications related to the learning needs. The features and applications can be developed based on the requirements of the content or teaching materials as learning media, with the design of the learning process approach. The relevant content learned is connected with information technology and integrated learning processes with the ability to understand the psychological and biological characteristics of teachers and students and the learning environment with an emotionally based approach.

TPACK can be integrated to improve EQ. The implementation of the TPACK framework can be linked to CK, teaching practices, and the simultaneous use of adequate technological methods which also increase learning effectiveness (Wang, 2019). By implementing TPACK integrated with EQ, it helps students to learn anywhere, especially additional learning at home. Teachers can control student learning systematically through features and applications that are simple or complex so that they can support students to learn quickly and facilitate the mastery of learning material.

The implementation of TPACK-based Islamic education learning is incomplete if it is not integrated with the teacher's mastery of EQ knowledge, since it has a positive and significant

effect on teachers' performance. This signifies that teachers who have good EQ can motivate themselves, have empathy and foster good relationships between school members, can control stress at work, and are high performers (Mangkunegara & Puspitasari, 2015). Teachers' EQ knowledge can also prepare students to face the impact of advances in information technology so that the dimensions of emotional self-awareness and awareness and understanding of others' emotions must collectively be integrated with learning. Thus, the role of Islamic teachers is not only to transfer knowledge or construct information and technology-based knowledge, but also to develop student-centred learning in the classroom. Therefore, teachers must be able to develop learning tools that are in accordance with TPACK integrated with EQ.

Teachers who possess TPACK knowledge and EQ will assist in developing learning tools that are in accordance with the students' needs. It shows that teachers can provide opportunities for students to develop the ability to use technology (Sholihah, Yuliati & Wartono, 2016). In increasing the teachers' perceptions of TPACK, the practices of developing learning design are needed and teachers are required to create professional development for the integration of ICT (Koh & Chai, 2014).

We suggest that future studies focus on the increase of the use of technology and to develop models that are more practical and cater for the characteristics of students, the environment, and the material. Because of the limited use of technology in the school environment, teachers argue that they have poor knowledge of using technology for learning, especially in combining learning strategies and models with technology, and collaborating between subject matter and technology (Safitri & Suparwoto, 2018; Sastradika & Jumadi, 2018). By increasing the implementation of technology in schools and the development of appropriate learning models, it is expected that the use of technology can be applied efficiently for all subjects to prepare people with high digital literacy.

Conclusion

With this research we indicated that teachers who participated in the Teacher Certification Programme possessed better TPACK knowledge and EQ than those who did not participate in the programme. This is shown by the higher average of teachers who attended the programme compared to those who did not participate. In addition, the results of this research also show that the teachers who participated in the teacher certification programme gained higher value of TPACK and EQ than those who did not participate. In this regard, the factors were not only the teachers' experiences at school but also interactions between teachers in the process of following the teacher certification

programme. These results were supported by the results of the *t*-test which signified that there was an influence of teacher certification programme activities on teachers' TPACK knowledge and EQ. The comprehension and implementation of TPACK integrated with EQ in schools is considered an appropriate solution to prepare future citizens with high ICT literacy.

Teachers as professionals are faced with the dynamics of change and the development of transformation in the era of digitalisation, which requires of them to have complex knowledge and competencies, especially the mastery of TPACK in learning and integrating knowledge and psychological competencies based on EQ. The results of our study assert that the 16-hour programme was effective to provide insight into the use of TPACK to meet the knowledge content, teaching practices, and the use of technology integrated with the dimension of EQ, in which teachers recognise self-emotion, control self-emotion, are aware of self-motivation, recognise the emotions of others, and have communication skills that can increase the effectiveness of learning. Teacher are expected to be able to design models based on TPACK knowledge and EQ so that these can be applied in learning. Integrating the multiple aspects of TPACK and EQ is also expected to improve teacher professional teaching in the achievement of students.

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Authors' Contributions

Iskandar designed the study, coordinated data collection and analysis, contributed to the research report. Jumadi gave advice on the theoretical framework. Dedi Sastradika contributed to the collection and analysis of the data. Denny Defrianti contributed as field officer and surveyed the research data collection.

Notes

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