Framework TPACK using Quick Response (QR) code to promote ICT literacy students in learning physics

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Abstract. Teachers are an important instrument in finding a new role that is more contextual and relevant to 21st century learning concepts offered a demanding professionalism of teachers in integrating technology, pedagogy and content knowledge (TPACK) in learning. This research aims to design a learning device in accordance with the framework using technology TPACK Quick Response (QR) Code to promote ICT literacy skills of students. The subjects were 95 students menangah school (high school) class X at SMAN 6 Yogyakarta. These results indicate that the instrument developed ICT literacy test had a reliability 0.84. Criteria for each item has a value of 0.98 with the criteria infit meansquare grains fit with the model of Rasch (meansquare infit ≤ 0.77 ≤ 1.33) with both criteria. Cohen's interpretation of the value of f at 0:33 in the category of large effect size. TPACK Framework Using Quick Response (QR) Code that was developed has a positive effect with the high category in enhancing ICT literacy of students.

1. Introduction
Professional teacher of the 21st century is always open and responsive to change, especially in the field of profession. Professional teacher should be prepared to deal with these changes. As the paradigm of teacher-centered to student-centered change. 21st century learning concepts require complex skills development of students. Standard skills students need to have in the 21st century include the ability to think critically, problem-solving skills, creativity, metacognitive skills, communication skills-collaboration, digital literacy and technology [1]. The concept of learning 21st century is marked by training and developing the skills of the 21st century, innovation skills, as well as information, media and technology capabilities [2].

The digital era environment gives a positive atmosphere towards the use of technology in the lives of students both at school and at home. Therefore the role of the teacher to create a learning environment that is integrated with the technology becomes easier. Instructional teaching in the 21st century can be optimized in various ways. Integration of ICT in the learning process into a support element of the 21st century ICT skills can be used as a tool of cognitive, metacognitive, epistemic to support the ability of critical thinking, creative thinking and innovative, and help solving problems that are also part of the 21st century learning [3]. Some research suggests that the development of learning environments using the technology provides a dynamic learning environment for teachers and students, and encouraging active students use technology through an innovative learning [4,5].

Framework (Technological Pedagogic And Content Knowledge) TPACK become a major terminology of technological, pedagogical, and mastery of the material / content should be controlled
by the teacher while teaching. TPACK provide a framework for how teachers can integrate technology into classroom learning. Integration of technologies developed should be structured or creatively designed to be used in accordance with certain specific characteristics (both in material and teaching methods) [6]. Based on the above explanation, TPACK framework developed by Mishra and Koehler explains how pedagogic content knowledge of teachers integrated with TPACK. While this framework provides specifications for the kinds of teacher knowledge involved during integration technology, how teachers, educators, and researchers can create more technological pedagogical content knowledge need to be further unpacked [7].

Professional teachers are effectively able to develop technological expertise and integrate them into the learning process [8]. Technological developments have also been many positive impacts in education, although it has not resulted in large-scale transformation [9]. Although the idea of the use of ICT in the learning process is not a new thing, but utilizing ICT to create an environment of digital literacy in schools is still limited. Teachers feel they have little time to learn, plan, and implement instructional technology in their daily instruction. in step with the results of this study indicate that the professional educators are aware and interested in implementing technology into the learning process, but the problem is they are not confident in selecting, managing, and implementing it [10].

Technological pedagogical and content knowledge (TPACK) is a framework for thinking about the knowledge teachers need for making instructional decisions with respect to integrating digital technologies as learning tools. TPACK Framework specifically explain what is required of teachers to integrate technology in learning, but it does not explain how the process occurs [11]. In other words, teachers have to be creative to design your own desired learning more specifically and teaching materials and methods that will be performed using TPACK framework that has been developed. Planning learning activities should be was prepared by the teacher before teaching. Constraints faced by teachers when integrating technology in learning is part of the development and planning. Lack of time to create and apply technology in learning. Some teachers feel less understand the use of technology. The next obstacle is the lack of school support in the application of technology in learning [12]. Based on the above, further studies need to be done to develop a learning device TPACK framework to encourage the use of ICT literacy and scientific communication skills of students in physics. Illustration of the relationship between the skills of the 21st century, TPACK framework, ICT literacy and skills of scientific communication is shown in Figure 1.

![Figure 1: Illustration of the relationship between the skills of the 21st century, TPACK framework, ICT literacy and skills of scientific communication](image-url)
Figure 1. Relations Between Design (Technological pedagogic Content Knowledge) TPACK teacher, Technology, and ICT Literacy and Scientific Communication Skills

2. Methods
This research is the development of learning tools with TPACK framework to assist teachers in the planning process of learning. Technology Knowledge (TK) that is deployed using a barcode system Quick Response (QR) Code. Pedagogical Knowledge (PK) used are Guided Inquiry learning model. While Content Knowledge (CK) delivered is basic competence (KD) 3:10 and material KD.4.10 Impulse and Momentum. The subjects were students of class X at SMAN 6 Yogyakarta. The data collection technique using the test and non-test.

2.1 Technology Pedagogical content knowledge of teachers in using Quick Response(QR) Code
In this study, students develop ICT literacy of knowledge Technological Pedagogical Knowledge (TPK) teachers in using technology Quick Response (QR) Code during the learning. ICT literacy of students developed from the Pedagogical Content Knowledge (PCK) of teachers using student worksheet (LKPD) with guided discovery learning model (guided inquiry) and technological knowledge (technology) technology using Quick Response (QR) Code. LKPD learning device in the form of technology developed by incorporating Quick Response (QR) Code therein. Quick Response (QR) Code serves to provide diverse representation of the concept of impulse and momentum are studied. Variety representation presented interactively to display videos, animations directly observable learning students.

3. Results and Discussion
This research is the development of learning tools using TPACK framework to encourage the ICT literacy of students on the material impulse and momentum. Instructional design with technology integration quick response (QR) code in LKPD help develop Technological Pedagogical Knowledge (TPK) teachers in using technology Quick Response (QR) Code during the learning. Development of ICT literacy instrument consists of 30 multiple-choice test questions. The results indicate that the developed learning tools such as ICT literacy test instrument. ICT literacy test instrument had a reliability Summary of case and Estimates Summary of items 0.84 and 0.97. Criteria for each item has a value of 0.98 and 0.97 infit meansquare with grain criteria fit with the model of Rasch (meansquare infit ≤ 0.77 ≤ 1.33) with both criteria. Based on the measurement results of the instrument that was developed has fit the criteria according to Rasch models. The higher the value the reliability of the item instrument developed increasingly fit [13-14]. MNSQ Infit value, SD, and instrument reliability of ICT literacy and scientific communication can be shown in Table 1.

| Instrument      | Item Shape          | Number Of Items | Reliability | Infit MNSQ | Outfit MNSQ | Infit t | Outfit t |
|-----------------|---------------------|-----------------|-------------|------------|-------------|---------|----------|
| ICT Literacy    | 30 Multiple Choice  | 3 Summary of case Estimates | .84         | .98        | 1:25        | -.06    | .15      |
|                 | Questions           | Summary of items Estimates | .97         | .97        | 1:25        | -.17    | .44      |

After the development of the instrument, then the instrument that has been developed is used to measure the ICT literacy of students in the subjects of physics of matter impulse and momentum. Teachers use instructional design framework to integrate technology TPACK barcode scanner (QR) code. In the learning process QR Code is used to provide a visualization / visual representation in the form of video lessons that can be directly observed by the students. Comparison of the results of
pretest and posttest ICT literacy test students each experimental class 1, class 2 experimental and control of each class are shown in Table 2. Graph improved results of ICT literacy skills of students can be seen in Figure 2.

![Figure 2. Result Increase ICT Literacy In The Three Experimental Class](image)

Based on Figure 2, the average value of pretest the experimental class 1 is 64.00, the experimental class 2 are 54.65 and 54.88 in the control class. Furthermore, the results of each posttest experimental class 1 is 80.75, the experimental class 2 are 74.19 and 72.88 in the control class. Increasing ICT literacy test scores of students can be seen from the value of the gain (g) the average score of the experimental class 1 is 0.43, the experimental class 2 are 0.55 and 0.46 in the control class. The gain (g) of the three experimental class 1, class 2 experimental and control classes in the medium category.

The results of the analysis General linear models (GLM) using multivariate shows the results of significance increase positive student ICT literacy. The average difference of dependent variables between groups of ICT literacy Quick Response (QR) Code (experimental class 1), Power Point (experimental class 2) and textbooks (grade control) are shown in Table 2.

| Dependent Variables | Group (I)     | Group (J)     | Mean Difference (IJ) | Sig. |
|---------------------|---------------|---------------|----------------------|------|
| (ICT Literacy)      | Quick Response (QR) | Power point  | 4,722 *              | .010 |
|                     | Textbook      |               | 6,611 *              | .000 |
|                     | Quick Response (QR) | power point | -4722 *              | .010 |
|                     | Textbook      |               | 1,889                | .699 |
|                     | Textbook      | Quick Response (QR) | -6611 *              | .000 |
|                     | power point   |               | -1889                | .699 |

Furthermore, the large effect size or the impact that ICT literacy dependent variable for each group of Quick Response (QR), Power Point, and textbooks do-Test Analysis Of Between-Subject Effects. Partial eta squared value for the dependent variable ICT literacy by 0105. Cohen's interpretation of the value of $f$ at 0.33 in the category of large effect size. Based on the research that has been done, the use of barcode scanners (QR) code can function as a matter apersepion and measurement tools.

![Table 3. Barcode Scanner Quick Response (QR) Code as perception and Measurement Tools](image)
Barcode scanner (QR) code makes it easy for teachers to develop Technology Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK) in the framework of learning with TPACK. Usage (QR) code is very easy and dynamic to be used in learning. Quick response (QR) code could serve as a bridge to deliver a dynamic learning media in one scan. Teachers can be helped with the QR code, the QR code can also function as a measurement tool to test students. Convenience provided QR code makes the teacher does not have to prepare a booklet very much and stacked. Only with one scan students can start work on the problems without having to use a lot of paper. Students' motivation have also increased with the use of QR codes in LKPD. Students can explore the ICT literacy skills and scientific communication with the help of the QR Code technology used by teachers. On the other hand teachers have also been implementing the learning in accordance with TPACK with optimal frame. In the future use of the QR code can be developed for all subjects at school. Then, the implementation of the exam students can switch to a barcode scanner system using quick response (QR) code that is more effective and efficient.

4. Conclusion

These results indicate that the developed learning tools such as ICT literacy test instrument had a reliability of 0.84. Criteria for each item has a value of 0.98 with the criteria infit meansquare grains fit with the model of Rasch (meansquare infit ≤ 0.77 ≤ 1.33) with both criteria. Based on the measurement results of the instrument that was developed has fit the criteria according to Rasch models. The gain (g) the average score of the experimental class 1 is 0.43, the experimental class 2 are 0.55 and 0.46 in the control class. Partial eta squared value for the dependent variable ICT literacy by 0.0105. Cohen's interpretation of the value of f at 0.33 in the category of large effect size. So it can be concluded that the instruments developed ICT literacy has a positive effect with the high category in enhancing ICT literacy of students. Technological Pedagogic And Content Knowledge (TPACK) teacher with the integration of barcode scanner technology can be an opportunity to improve student learning achievement. Teachers can use a barcode scanner (QR) code technology to support learning activities.

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