THE EFFECTIVENESS OF ICT UTILIZATION ON COGNITIVE ACHIEVEMENT IN THE VOCATIONAL EDUCATION DURING THE COVID-19 OUTBREAK IN INDONESIA

Efektivitas Pemanfaatan TIK terhadap Hasil Belajar Pendidikan Vokasi dan Kejuruan selama Pandemi Covid-19 di Indonesia

Yudha Aditya Fiandra¹, Ambiyar², M. Giatman³, Usmeldi⁴, Nurhasan Syah⁵

¹²³⁴⁵Program Doktoral, Pendidikan Teknologi Kejuruan, Universitas Negeri Padang
Pos-el: yudhaaditya1994@gmail.com¹, ambiyar@ft.unp.ac.id², giatman@ft.unp.ac.id³, usmeldi@fmipal.unp.ac.id⁴, nurhasan@ft.unp.ac.id⁵

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ABSTRACT:
In the current Covid-19 transition period, it is very necessary to use innovative vocational learning models in digital models. The number of vocational learning models using ICT as the main tool during the pandemic needs to be studied further on how the model is implemented and its effectiveness. The problem that arises is that we do not know whether the use of ICT tools in vocational learning is effectively used. This study aims to empirically verify the effectiveness of ICT in vocational education learning during the Covid-19 transition period. Meta-Analysis is used as a method to conduct this research. There are 30 latest articles reviewed during the year of 2020 to 2021. All articles are classified based on the author, year of publication, the ICT device or application used, and the results of the post-test experimental and control classes. The results are obtained after the calculation using the effect size (ES) formula. The calculation results show that the learning using ICT as a tool during the Covid-19 pandemic has a high effect (1.28) on cognitive achievement in vocational education. The conclusion of this study is that ICT-assisted learning has a high level of effectiveness and is suitable for learning in the vocational field. Then, the dominant multimedia device or application used in the vocational learning in Indonesia is the computer technology network and it is the most widely used for the application of ICT in learning.
INTRODUCTION

Education is important in building the order of human life, especially in terms of improving the quality of human resources (Coombs et al., 2021). Humanity was shocked by the emergence of CoronaVirus Disease (Covid-19) in early 2020 and until now, it is still a global pandemic (WHO, 2019). All governments around the world are making various efforts to prevent or suppress the spread of this epidemic. Especially in Indonesia, the government implements various rules, ranging from implementing strict health protocols, physical distancing, to quarantine in several regions in Indonesia (Thorik, 2020).

The presence of the Covid-19 pandemic has had a major impact on many sectors, especially in the education sector. All schools and colleges in all countries are affected. However, Covid-19 can also be a good opportunity to accelerate the digitalization process in education (Almetwazi et al., 2020; Luyben et al., 2020). This good opportunity is not wasted by many educators.

Many educators are starting to take advantage of the ease use of supporting devices and applications based on the Information and Communication Technology (ICT) in their learning. The objective of utilizing ICT is to overcome the learning barriers, especially those caused by the current Covid-19 (Carolan et al., 2020; Fuller et al., 2020; Madrazo, 2020; Nguyen et al., 2020).

Efforts to apply information and communication technology in the field of education are marked by the presence of ICT-based media in educational institutions (Kozlova & Pikhart, 2021). The utilization of ICT-based media is a must in terms of supporting the era of global competition.

In learning, the media that are often used are audio, audio-visual, and internet media (Fransisca, 2017; Halidi et al., 2015). The greatest hope is that the application of ICT in education will be one alternative solution to improve the quality of education amid the current Covid-19 pandemic. The application of ICT in education is perceived to be very helpful during the current Covid-19 pandemic. ICT can be an alternative solution in implementing physical distancing as a way to prevent the spread of the epidemic (Adisel & Prananosa, 2020; Komalasari, 2020; Pakpahan & Fitriani, 2020).

The use of either online ICT media or other offline media by the internet connectivity that exists in each region in Indonesia is expected to be a way out for the sustainability of educational institution activities during the pandemic.
In the world of education, ICT plays a very important role in supporting the teaching and learning process (Anshori, 2019). Even after this pandemic ends, ICT will continue to be used in education, especially e-learning or blended learning (Mali & Lim, 2021).

Many terms exist to define what ICT is. In 2010 long before the internet became a necessity as it is today, UNESCO has outlined the scope of ICT in learning. Terms that are often used include Communication devices including their applications, radio, and television, cell phones, computers, and networks. The various application services related to these devices are no exception, such as distance learning, and video conferencing. The main function of ICT is the delivery of information in the form of data, video, audio, and so on (Onwuagboke et al., 2015). For more details, see the following Figure 1.

In Figure 1, it can be seen that dozens of devices can be classified as ICT-based supporting devices or applications. With the internet and its massive use today, the definition of ICT tools will continue to grow and increase. The world of education will increasingly utilize the invasion of ICT devices; and accordingly, teachers and students in Indonesia must quickly adapt themselves to this condition.

The great hope for the use of ICT in education is to accelerate efforts to develop Indonesian human resources to catch up with other countries. It was noted that Indonesia's Global Competitiveness Index based on the World Economic Forum 2020 was in the rank of 50 out of 141 countries (Schwab & Zahidi, 2020). This indicates that Indonesia is still weak in terms of the use of technology and efficiency of human resources.

Regarding the workforce, the government is currently struggling to overcome the unemployment that exists and keeps on increasing during this pandemic (Indayani & Hartono, 2020). One of the biggest contributors to the open unemployment rate is the level of vocational education, especially Vocational High School (SMK) (Churiyah & Sakdiyyah, 2020; Fiandra et al., 2017; Utama & Sukaswanto, 2020). The quality of
SMK graduates is currently still seen as far from the expected quality of graduates. One of the weaknesses of SMK graduates today is due to the weak digital literacy of students, especially at the SMK level.

In line with the development of ICT, educators are expected to be able to become facilitators as well as collaborators in the teaching and learning process in SMK, so that students can play a more active role (Prajana & Astuti, 2020). In addition, ICT integration is also said to be able to produce new learning experiences because, in the process, educators and students will act as technology users in a Virtual Learning Environment (VLE). VLE is a place for collaborating and interacting to deliver and utilize learning contents needed in the learning process (Wang et al., 2020). For this reason, this study examines and discusses the effectiveness of the use of ICT on cognitive achievement in the vocational education during the Covid-19 pandemic.

METHODS

The research method used in this study is a meta-analysis using secondary data. The secondary data in this study came from the post-test scores of the experimental and control classes in vocational education and some other articles implementing ICT-assisted learning during the Covid-19 pandemic.

The research articles reviewed are from national and international journals from the year of 2020 up to 2021 (Covid-19 started in the early year of 2020 and is still an epidemic when this article was written). There are 30 articles from research that used students’ research subjects in the vocational field. The stages in this meta-analysis research can be divided into several stages as shown in the following Figure 2.

Figure 2. Meta Steps (Akhter et al., 2019)

Preparation

Preparation is the initial stage in meta-analysis. This stage is important because it determines the direction of the search and data collection afterward. At this stage, it will be determined what keywords will be used, what journals will be reviewed, and what variables will be used in collecting data based on keywords.

The following is an explanation of each stage in this preparation stage, namely:
1. Sources of data from Google Scholar on several vocational education journals published in the year of 2020 and 2021.
2. Keyword data based on the use of research variables, namely: independent variable: ICT integration in learning and dependent variable: cognitive achievement or learning outcomes.
3. Use the keywords: "ICT, ICT Integration, Multimedia, Virtual Learning Environment, Virtual Simulation, E-learning, Mobile Learning". Then each of these keywords is combined with the learning achievement keywords: "Learning Outcomes, Cognitive, Learning Ability, Competencies, Achievement".

**Implementation**

At the implementation stage, several steps will be carried out, namely:

Firstly, data collection. The data collection is based on the initial plan stated at the preparation stage. The data collection is carried out by entering the keywords specified for the analysis. Secondly, the data is collected and coded to make it easier to be read and process.

**Analyzing Data**

The analyzing data is the last stage as well as an important stage in the meta-analysis. At this stage, the data will be calculated and analyzed so that the data will become useful information. The collected data is calculated using the following effect size formula:

\[ ES = \frac{M_e - M_c}{SD} \]

Explanation:

\( ES \) = Effect Size Value  
\( M_e \) = The average of the exp. class  
\( M_c \) = The average of the cont. class  
\( SD \) = Pooled standard deviation

\[ SD = \sqrt{\frac{(N_e - 1)SD_e^2 + (N_c - 1)SD_c^2}{N_e + N_c - 2}} \]

After the "SD pooled" value is obtained, then the average value of the experimental class is reduced by the average control value, then divided by the standard deviation.

The calculation results will obtain a value, which is then interpreted with an effect size category table, which will be based on the results of this interpretation, the effect category of treatment is obtained.

In this case, the treatment is the application of ICT in learning in the vocational fields.

**Table 1. Effect Size Criteria**

<table>
<thead>
<tr>
<th>Effect Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 – 0.20</td>
<td>Weak Effect</td>
</tr>
<tr>
<td>0.21 – 0.50</td>
<td>Low Effect</td>
</tr>
<tr>
<td>0.51 – 1.00</td>
<td>Medium Effect</td>
</tr>
<tr>
<td>&gt; 1.00</td>
<td>High Effect</td>
</tr>
</tbody>
</table>
RESULT AND DISCUSSION

After conducting a review of 30 research articles using ICT tools in vocational learning, the post-test results were obtained. Based on the researches conducted during the year 2020-2021 (during the Covid-19 pandemic), the post-test data obtained from each control and experimental class is presented in the following Table 2.

Table 2. Meta-Analysis Data

<table>
<thead>
<tr>
<th>No.</th>
<th>Author</th>
<th>Year</th>
<th>ICT Tool</th>
<th>Educational Level</th>
<th>Post Test</th>
<th>Exp.</th>
<th>Con.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>(Rifai et al., 2020)</td>
<td>2020</td>
<td>Multimedia (Elect. Design Automation)</td>
<td>POL – AP</td>
<td>80,60</td>
<td>77,40</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>(Satria &amp; Basir, 2020)</td>
<td>2020</td>
<td>Multimedia (Macromedia Flash)</td>
<td>SMK - TKJ</td>
<td>85,00</td>
<td>77,40</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>(Syawaluddin et al., 2020)</td>
<td>2020</td>
<td>Multimedia (Interactive CD)</td>
<td>SMK - TKJ and RPL</td>
<td>87,57</td>
<td>83,70</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>(Novita &amp; Harahap, 2020)</td>
<td>2020</td>
<td>Multimedia (Adobe Director 11)</td>
<td>SMK - TKJ</td>
<td>87,96</td>
<td>82,42</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>(Nurdalilah &amp; Desniarti, 2020)</td>
<td>2020</td>
<td>Unknown</td>
<td>SMK - TKJ</td>
<td>88,67</td>
<td>45,76</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>(Utama &amp; Sukaswanto, 2020)</td>
<td>2020</td>
<td>Unknown</td>
<td>SMK - TKR</td>
<td>80,70</td>
<td>77,45</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>(Raini, 2020)</td>
<td>2020</td>
<td>Simulation (Virtual Lab. &quot;PhET&quot;)</td>
<td>SMK - Farm</td>
<td>74,81</td>
<td>70,60</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>(Rahayu &amp; Prayitno, 2020)</td>
<td>2020</td>
<td>Multimedia (Video-Audio)</td>
<td>SMK - TKR</td>
<td>88,90</td>
<td>86,10</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>(Purosad et al., 2020)</td>
<td>2020</td>
<td>Mobile Learning (Android)</td>
<td>SMK - OTKP</td>
<td>84,67</td>
<td>59,17</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>(Irmanyanti et al., 2020)</td>
<td>2020</td>
<td>Simulation (Comp. Aided Design &quot;CAD&quot;)</td>
<td>VOK - D3 TB</td>
<td>86,67</td>
<td>76,67</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>(Churiyah &amp; Sakdiyyah, 2020)</td>
<td>2020</td>
<td>App (P-Cash based on Ms.Access)</td>
<td>SMK - OTKP</td>
<td>91,34</td>
<td>86,00</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>(Tohadi et al., 2020)</td>
<td>2020</td>
<td>Simulation (4E-FTE Engine Simulator)</td>
<td>SMK - TKR</td>
<td>82,36</td>
<td>80,55</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>(Hafizza et al., 2020)</td>
<td>2020</td>
<td>Multimedia (3D PageFlip)</td>
<td>SMK - Farm</td>
<td>82,53</td>
<td>71,20</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>(Wardani &amp; Harwanto, 2020)</td>
<td>2020</td>
<td>Internet (E-learning, Schoology)</td>
<td>SMK - TKJ and MM</td>
<td>75,11</td>
<td>61,51</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>(Shafira &amp; Akmal, 2020)</td>
<td>2020</td>
<td>Multimedia (Projected Motion)</td>
<td>SMK - JB</td>
<td>88,57</td>
<td>68,57</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>(Karisoh et al., 2021)</td>
<td>2021</td>
<td>Internet (e-learning)</td>
<td>SMK - MM</td>
<td>89,20</td>
<td>76,70</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>(Wahyudi et al., 2021)</td>
<td>2021</td>
<td>Multimedia (Powerpoint)</td>
<td>SMK - TKJ and MM</td>
<td>90,31</td>
<td>88,16</td>
<td></td>
</tr>
</tbody>
</table>
19. (Wahyudi et al., 2021)  2021  Simulation (Cisco Packet Tracer)  SMK - TKJ  81,25  75,25
20. (Chandra Asmaradhan & Churiyah, 2021)  2021  Mobile Learning (Ispring Suite 9)  SMK - OTKP  86,00  62,00
21. (Purnamasari & Kusdiyanti, 2021)  2021  Mobile Learning (Ispring Suite 9)  SMK - Unknown  90,00  77,00
22. (Zulhelmi, 2021)  2021  Multimedia (Kvisoft Flipbook Maker)  SMK - TAV  73,38  65,00
23. (Febrinawati & Arief, 2021)  2021  Multimedia (Kvisoft Flipbook Maker)  SMK - OTKP  88,39  79,75
24. (Nailufar & Susilowibowo, 2021)  2021  Multimedia (Mind Mapping)  SMK - AK  85,00  78,00
25. (Robbi & Churiyah, 2021)  2021  Mobile Learning (Flip Pdf Pro Maker)  SMK - OTKP  87,00  73,00
26. (Oktarina et al., 2021)  2021  Multimedia (Flip Book)  SMK - TKJ  76,14  71,34
27. (Badruttamam & Hadromi, 2021)  2021  Multimedia (Android-Based Int. Job sheet)  SMK - TKR  72,07  71,30
28. (Fatahillah et al., 2021)  2021  Multimedia (Macromedia Flash)  SMK - TKJ  93,06  51,13
29. (Pangkerego et al., 2021)  2021  Internet (e-learning)  SMK - TKJ  73,40  65,30
30. (Meidyanti et al., 2021)  2021  Multimedia (Mobile-Smartphone)  SMK - AK  94,00  89,00

| Average | 84,38 | 72,34 |

Description:

After the data has been compiled and the average value of the experimental and control classes found, the next step is to look at the general comparison of the post-test scores between the experimental and control classes.

To easier analyze the post-test data, the post-test data collection is presented in the graphical form shown in the following Figure 3 and Figure 4.

Figure 3. Post Test Score Comparison

Figure 4. Post Test Score Tabulation
After the posttest value data for the experimental and control classes were collected, the average value for the experimental class was known to be: 84.38, the control class average score: 72.34, and the pooled standard deviation was to be: 9.36. Then, the final value of the effect size is calculated using the effect size formula. The result of the final value was 1.28. The value of 1.28 is interpreted as a high effect (>1.00).

The calculation is as follows.

\[ SD = \sqrt{\frac{(N_e - 1)SD_e^2 + (N_c - 1)SD_c^2}{N_e + N_c - 2}} \]

\[ SD = \sqrt{\frac{(30 - 1)6.17^2 + (30 - 1)11.71^2}{30 + 30 - 2}} \]

\[ SD = \sqrt{87.72} = 9.36 \]

\[ ES = \frac{M_e - M_c}{SD} = 1.28 \]

Looking at ICT devices or applications that are often integrated into learning, it can be seen in Figure 5 below.

Figure 5 says that multimedia devices or applications are dominantly used in vocational learning in Indonesia (Kuswanto & Walusfa, 2017). Multimedia is a combination of more than one type of media such as text (alphabetical or numeric), symbols, images, audio, video, and animation usually presented with the help of technology that aims to improve understanding (Abdulrahaman et al., 2020). This was followed by the use of mobile learning to support the use of ICT in the learning stated by almost 17% of the total 30 articles analyzed in this study.

Then, the second largest is the mobile learning which is also widely used in terms of supporting cognitive achievement in vocational education, especially at the SMK level. Learning models utilizing mobile learning is different from the traditional learning models because they provide a great opportunity to make the learning environment more lively, portable, connected, and individualized (Mac Callum et al., 2014).

Taking into consideration the education level and the major use of ICT integration carried out in learning, the data is then generated as shown below. It can be seen that the vocational education level with the most ICT integration based on 30 articles collected and analyzed in this
study is in the vocational education level, in which the Computer and Network Engineering (TKJ) major is in the top position.

According to the researcher’s interpretation, the reason for being a lot of ICT-assisted learning in the TKJ department is because TKJ is a cluster of technological expertise, specifically computer engineering and informatics (Untari et al., 2015). ICT-assisted education level data is presented in the following Figure 6.

![Figure 6. Education Levels Apply ICT](image)

Researchers assume that applying computer-assisted learning in learning in the TKJ department, will be very easy because the students have been familiar and accustomed to the information technology. It means that the students will have no difficulty in understanding the steps of how to interact in a virtual, simulated, or digital environment.

**CONCLUSION**

The effectiveness of using ICT in learning vocational education has a high effect. This is based on the result of data analysis which comes out with an effect size value of 1.28. If the effect size value is more than 1.00, it is classified to be high. Then, the ICT tools and applications frequently utilized are multimedia-based which of course combined with images, audio, video, and animation.

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