Integration of Web Media and Pedagogical Content Knowledge in Learning During the Pandemic

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Abstract. A pandemic period in 2020 presents its challenges for the world of education, the rules set to do home learning are the best solution that has been issued by the government, as a result, teachers must be able to upgrade their abilities to develop their competence. The use of technology-based interactive learning media is a solution for distance learning systems. Technology-based learning media is expected to foster students' interest in learning so that integration between pedagogical content knowledge and the web is required in distance learning methods. Student cognitive is an ability that starts from the ability to remember until creating. The approach used is qualitative using a case study design. Data collection is done by interviewing techniques, observation, and documentation studies. Data analysis techniques include data collection, data reduction, data display, and verification. The results and conclusions of this study are the use of web media as a learning medium in collaboration with pedagogical content knowledge teachers is one of the alternatives that teachers can choose to maximize the process of transferring knowledge to their students.

Keywords: Distance Learning · Web · Pedagogical Content Knowledge · Pandemic Impact on Introduction

1 Introduction

Education is the key to the formation of superior human resources, to achieve this it takes the right and maximum process and collaboration of various elements of education. One of the collaborations needed to create superior human resources is to combine models, media, methods, and abilities of teachers in carrying out learning, hopefully, the collaboration can improve the cognitive abilities of students in learning conditions that require to be done from home due to the pandemic. Education with a distance learning system provides solutions to various obstacles in achieving educational goals and targets students in achieving higher levels of education, such obstacles include the economy and geographical and social location of students (Knox, 2013).

The pandemic period in 2020 presents its own challenges for the world of education, the rules set to do home learning is the best solution that has been issued by the government in addressing this global problem. This decision has a very significant impact

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on the learning patterns carried out, teachers who originally used more conventional methods switched to distance learning methods, as a result, teachers should be able to upgrade their abilities and come to terms with the advanced technology media in conducting learning activities so that teachers can eventually develop their competencies. Activities that teachers can do as a start in improving their professional skills are by selecting learning media that is integrated with technology media and adapted to the materials and characteristics of students (King, 2002).

Distance learning or distance education is a method that provides many challenges for a teacher in transferring knowledge in learning, not only by using various and interesting media and models but teachers are also faced with infrastructure facilities owned by students during teaching and learning activities with distance learning methods. The distance learning method requires adequate technological tools as a means of supporting learning, but not all students have the completeness of the infrastructure, this limitation should be addressed by teachers so that a model and media are found appropriate in conducting learning with distance learning methods but by not reducing the maximum reach of understanding by students. Distance education allows teachers and students to stay connected with the help of technology media, teachers and students can continue to communicate with each other even if they are not in one place in real-time, but they can agree on a set time together to meet each other in cyberspace by using technology-based learning media to conduct teaching and learning activities (Keegan, 1996). In addition, the advantage of learning by using distance learning methods that utilize technology-based interactive learning media is that it allows students to access lesson materials that have been uploaded or uploaded by teachers in the media without limited time and place (Astra et al., 2015).

Interactive learning media based on technology is expected to foster students' interest to be active in learning, this is intended to improve students' cognitive abilities even with distance learning methods. Learning media is a tool that can be used by teachers in transferring knowledge to students in the form of messages that can stimulate the students' thoughts, attention, and interests to generate feelings or desires of students in following the process of teaching and learning activities following the learning objectives that have been designed and set by the teacher (Sukiman, 2012). This is because, all types and forms of learning media, are basically used by teachers to provide stimulus or learning stimuli to students in teaching and learning activities (Ninghardjanti et al., 2021).

Not only the use of appropriate methods, media, and learning models in bringing up students' cognitive abilities also required the ability of teachers in understanding and transfer the right science as well. Integration between pedagogical content knowledge, methods, media, and models in learning is indispensable in the distance learning method. Pedagogical content knowledge is an ability about combining knowledge and learning. Pedagogical knowledge contains classroom knowledge, assignment of planning of the learning process and learning of students, while content knowledge contains knowledge of a concept, idea, theory of thought framework, evidence, and methods of proof (Depaepe & König, 2018). The most important component of effective teaching is the ability of teachers in mastering pedagogical content knowledge, this is because, with the mastery of pedagogical content knowledge skills, teachers have been able to master the

content and management of the class appropriately so that the learning objectives can be achieved optimally (Park et al., 2010; Baumert et al., 2010; Jüttner et al., 2013).

Cognitive students themselves are an ability that students have that begin with the ability to remember, the ability to understand materials and concepts, the ability to apply materials and concepts, the ability to analyze the results of the application of materials and concepts, the ability to evaluate problems and the latter is the ability to create solutions to problems created from materials and concepts. In the concept of taxonomy, students' cognitive abilities start from the ability to memorize to the ability to transfer the knowledge that has been obtained to daily actions. Therefore, cognitive ability in the revised taxonomy concept consists of the ability to remember, the ability to understand the concept, the ability to apply the concept, analyze the advantages and disadvantages, evaluate and create, whether it is creating a solution or a product (Krathwohl & Anderson, 2010; Watts & Hodgson, 2019). For students' ability to remember, understand, apply, analyze, evaluate and create solutions during learning with distance learning methods in pandemics to be maximized, teachers need to use interactive media in learning. In addition to the methods used, the accuracy of the selection of learning media is another determining variable that teachers can use in the success of transferring science to students during teaching and learning activities (Wati & Handayani, 2020). The purpose of writing this article is to describe how effective distance learning and pedagogical content knowledge of the cognitive of Vocational High School students when viewed from the perception of teachers. This is because, many problems occur in the field related to the policy of learning at home to cope with the pandemic that is happening in 2020, especially in the East Java region.

2 Methods

The approach used is a qualitative approach with case study design, this design determination is because this research is intended to answer the problem of a case that arises in the field by providing direct observation and careful analysis. Case study research makes it possible to investigate a particular event, situation, or social condition and to provide insight into the process that explains how a particular event or situation is (Hodgetts & Stolte, 2012).

The subjects in this study numbered 60 respondents taken from vocational high school teachers spread across East Java. The criteria for taking subjects in this study are all teachers who have the task of teaching productive subjects and teachers who use interactive internet-based learning media in supporting distance learning during the pandemic. The time required for data retrieval for 6 months and conducted in three randomly selected places, namely SMK Negeri 1 Bondowoso, SMK Pawyatan Daha 1 Kediri, and SMK PGRI 2 Kediri. The data collection method in this study consists of interviews, observations, and field documentation. While analyzing the data adopted the concept of (Miles & Huberman, 1994).

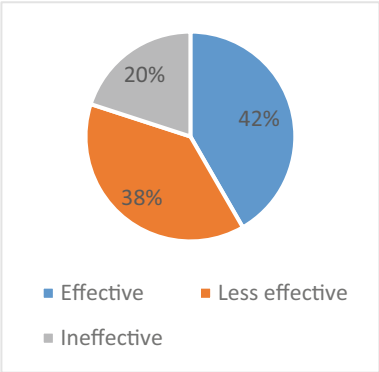

Fig. 1. Effectiveness of Using Distance Learning Methods in Learning

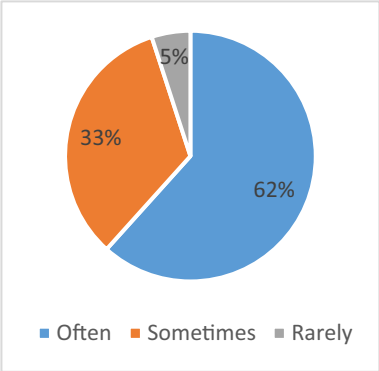

Fig. 2. Use of Internet Media in Learning

3 Results and Discussion

3.1 Distance Learning

From the results of field studies and analysis, it is known that distance learning methods can be said to be effective in improving students' ability to understand the subject matter. The results of the study can be seen in Fig. 1.

From the pie chart above seen from the interview process with respondents, 25 respondents out of a total of 60 respondents or 42% stated that distance learning methods are effective to improve students' ability to understand the subject matter. While the remaining 23 respondents 38% and 12 respondents or 20% stated that distance learning is less effective and ineffective if used to improve students' ability to understand the subject matter. In addition, the distance learning method is known to be very effective if applied in the learning process during the pandemic, this is because in the distance learning method we can use asynchronous and synchronous media in learning (Fig. 2).

From the pie chart above known as 37 out of 60 teachers or as many as 62% have used internet-based media in continuous learning, while the remaining 20 teachers or 33%

and 3 teachers or 5% sometimes and rarely use internet-based media in learning. Media Whatsapp, Edmodo, Google Meet, and Zoom are popular applications used by teachers in learning, while the media used for online evaluation of teachers are many who use quizizz. Even so, many teachers also use other media, such as Google Form, Telegram, E-Learning Madrasah, E-mail, Moodle, and Instagram. Many reasons that teachers find when sometimes or rarely using internet-based learning media, reasons are presented as diverse and classical, one of which is that they are not able or constrained in operating the media to the maximum, or it can be concluded they are not technologically literate. The next reason is that they are uncomfortable if they teach face-to-face because they think learning is never effective if it is not done directly.

Effectiveness in the use of distance learning media when learning is also accompanied by obstacles that not only arise from the teacher's side but also arise from the student's side. When viewed from the teacher's side, the problem that arises in learning by distance learning method is the lack of creativity in the selection of online-based learning media, this is because the concept of learning that has been done is using the concept of behavioristic that emphasizes on teachers in learning, while currently, teachers are asked to be able to switch and apply the concept of behavioristic and constructive learning simultaneously. In addition, the findings in the field mentioned that if the preparation of the material is not presented with interesting content, then students are less interested and tend to get bored, as a result when it will be given the material next students will assume that the material to be delivered will not be as interesting as the previous material.

In addition to the lack of creativity in managing the learning contingent, the results of field studies also found other obstacles that arise in the learning process of this distance learning method, namely the lack of infrastructure used, this is also the main obstacle for students and teachers. If from the teacher side, the constraints of infrastructure facilities may not be a serious enough obstacle, as has been found in the field, to overcome the lack of infrastructure owned by teachers in supporting the implementation of the learning process by distance learning methods, schools or agencies have facilitated teachers to do this distance learning. This means that teachers can use school facilities to support distance learning if they teacher does not have enough technological infrastructure to conduct distance learning independently. The problem of the lack of infrastructure will be more complex when on the student side.

The results of field studies on distance learning variables mention that infrastructure facilities, especially facilities owned by students are obstacles to distance learning. The use of quota or internet network package is the main reason for the lack of maximum distance learning method when viewed from the shiva side, in addition to the unstable network because it is also used by students to not be maximal in participating in learning activities by remote methods. As a result, schools and teachers must think of the right solutions to keep the learning going without neglecting the achievement of learning objectives.

3.2 Pedagogical Content Knowledge

Pedagogical content knowledge is the ability of educators to collaborate pedagogical knowledge and content knowledge. As a result of interviews and field studies, it is known

that teachers have noticed and applied the components of pedagogical knowledge and content knowledge. It is evident from the interview process that teachers before carrying out learning activities, first understand the core competencies, basic competencies, indicators of learning achievements, and learning objectives that will be used to determine the learning materials or content. In addition, teachers have also divided materials that are adapted to the academic calendar contained in the annual program and semester program, so that the material on the subject is complete and achieves the objectives to the maximum.

In addition to preparing learning tools in the form of annual programs and semester programs, the level of student development is a factor that has also been considered by teachers in setting materials or content, so that teachers can easily determine methods, models, and strategies in the design of learning implementation by student characteristics and ongoing learning sessions. The results of field studies also found that teachers have applied various methods, strategies, and approaches creatively in face-to-face classes with distance learning methods. The strategies that have been applied by teachers in learning using distance learning methods include textual, contextual, problem-solving, demonstration, teaching factory, and so on. The use of various learning strategies is always associated with the life or social environment of students, hopefully, students will be able to directly implement the material that has been shared by teachers in the learning session in daily life. The results of field studies also found that teachers who have productive subjects must be more creative and innovative in maximizing pedagogic and content skills, this is because in productive subjects there are practical activities that must be done by students, while in pandemic conditions students cannot learn by practical methods directly in school. To address this, teachers with productive subjects who have practical activities in their learning design, use a hot-based problem-giving learning model (Higher Order Thinking).

3.3 Cognitive Students

The results of the field study mentioned that the cognitive level of students has two findings, namely inversely proportional to the effectiveness of the use of distance learning by teachers and some are aligned with the effectiveness of the use of distance learning. This is because at the time of learning with distance learning method most students are even less serious in learning, so when given an evaluation with a game evaluation model that uses quizizz application many results from students who are less satisfactory or below the standards that have been set. The reasons for their seriousness in learning with distance learning methods are also diverse, some mention that they do not have the infrastructure to support learning activities, then some give the reason that with distance learning methods they still cannot understand the material clearly, and some even reveal if the learning activities are not done in school then they will do other activities such as petrifying parents or more time used to study than follow full online learning.

In addition to the results that are inversely proportional to the effectiveness of the use of distance learning by teachers, from the interview process it is also known that the development of the cognitive level of students provides positive results and aligns its achievements with the effectiveness of the use of distance learning. This is evident from the track record of evaluations conducted by teachers, that there are also students who

are very enthusiastic when learning distance using technology media. The enthusiasm of these students encourages them to be more active in responding to various problems given by teachers by having more communicative discussions both with teachers and with peers. In addition, another form of students' enthusiasm in distance learning that uses technology-based media is the flexibility they have in finding and adding relevant literature and used to analyze and find solutions to problems raised by teachers. The impact felt by both teachers and students with the collaboration of distance learning methods with the use of technology-based learning media is the development of students in understanding and analyzing a problem with a more complex way of thinking.

From the results of interviews with teachers, it is also known that to maintain the cognitive aspects of students in the pandemic using distance learning teaching methods, teachers have developed skills in the field of teaching. One of the alternatives chosen by teachers to maintain the achievement of cognitive aspects of students in learning is to make tutorials on learning materials that are then uploaded on youtube, Instagram, Facebook, and WhatsApp channels. The goal is for students to be able to understand the learning materials thoroughly. In addition, some cases found that during the pandemic, to maintain the achievement of learning objectives and material understanding because students are in huts that do not allow carrying and accessing electronic-based learning media at all times, then every two times a week, teachers will deliver materials and assignments to students and take assignments that have been submitted at a previous time.

4 Discussion

Sharing the problems that occurred in the field during the pandemic, does not make the world of education worse. Spearheading fields in the field of education are teachers, in the pandemic, they have made a variety of solutions to keep the learning process going and the ability of students in receiving learning when viewed from the cognitive aspect is still achieved to the maximum. During teaching and learning activities, teachers play two main roles that affect the results and quality of learning in the classroom, namely as directors and also as an actor. This is because teachers should be able to design learning scenarios as effectively as possible without having to eliminate the main objectives of the learning materials. As an actor, teachers must be able to transfer knowledge appropriately to students for learning and still pay attention to the characteristics of students (Kim et al., 2017). One of the activities that teachers can do to keep the learning going to the maximum is to upgrade their ability in creating interactive learning media so that teachers should strive to maintain students' interest and motivation towards learning and provide persuasive answers to questions asked during the teaching and learning process (Salleh et al., 2020; Saka, 2021). It is known from the results of the research, that students need creativity and innovation from teachers for them to be challenged to keep up with the learning. If the teacher only applies a monotonous learning model, it will have an impact on the motivation that students have in following this distance learning, while control over distance learning activities is very minimal. Activities in designing good learning media by teachers will greatly affect the ability of students in understanding the lesson materials provided optimally when teaching and learning activities because the media

is a tool that teachers can use to touch students' understanding of material effectively (Muhson, 2010). Therefore, in designing good learning media, teachers are required to be able to include the principles of VISUALS (Visible, Interesting, Simple, Useful, Accurate, Legitimate, and Structured) when developing learning media. This needs to be done because the pre-designed learning media will help teachers in optimizing student learning outcomes (Nurseto, 2012).

The accuracy of the selection of technology-based media that will be used is indispensable for teachers in teaching and learning activities, either face-to-face learning activities or learning activities in the classroom with distance learning methods. This is because The use of learning media in the teaching process can arouse new desires and interests, motivations, and stimuli in conducting learning activities in learners resulting in improved understanding and learning outcomes for learners (Wati & Handayani, 2020), in addition, learning media can be used in supporting the effectiveness of the learning process and the accuracy of teachers in transferring knowledge to students, the measure is by the student's understanding of the material delivered. Therefore, learning media there is never to be separated from the process of teaching and learning activities, so teachers should be able to utilize various forms of learning media and collaborate with existing methods and media to improve the quality and achievement of learning objectives (Tafonao, 2018). One solution in learning during the pandemic is to use web media in teaching and learning activities. The policy is not allowed to conduct face-to-face learning activities for a while in the red zone making teachers should be able to collaborate between pedagogical content knowledge, media, and learning materials appropriately while paying attention to various elements supporting learning activities. The use of website media in learning will help teachers and students in obtaining additional information quickly in the form of text, graphics, images, photos, animations, audio, and video tailored to the learning materials (Rijal & Jaya, 2020; Sagita & Khairunnisa, 2019). By using web media in distance learning students can learn independently, and independence in learning will give rise to a more creative and innovative attitude in solving problems. In addition, by using the media website in learning, teachers can train students more independently in solving problems with the help of online media, in addition to being used in finding referrals to solve existing problems, this website media can also be used by teachers to develop aspects of activeness, problem-solving process, participation and social of students (Marienko et al., 2020; Kucirkova & Flewitt, 2020).

Self-reliance created by teachers in learning by collaborating constructivism approaches, distance learning methods, web media, and pedagogical content knowledge can change students' behavior in learning, one of which is the change in the behavior of learners in understanding and making decisions on problems in learning, both problems in the simplest form to problems in the most complex form. Self-learning that is identic with the distance learning method requires students to be able to create concepts according to their mindset without getting out of the context of the material presented, therefore, students need to explore the learning materials provided, analyze learning materials and problems, reflect and evaluate material comprehension activities and problem-solving that arise independently (McLoughlin & Lee, 2010). The role of teachers in collaborating pedagogic skills and content skills is indispensable for the implementation of independent learning by students at the time of pandemics in particular. This is because

pedagogical content knowledge is an effective learning method to describe the material (content knowledge)and learning knowledge (pedagogical knowledge) makes the material difficult to learn becomes easy to learn (Eggen & Kauchak, 2015; Koyyada, 2020). In addition, pedagogical content knowledge can also be said to be a must-have ability for teachers in adjusting learning content to student characteristics (Sri et al., 2021; Shofwa et al., 2021).

Understanding core competencies and basic competencies are activities that must be done by teachers before conducting learning activities, then continued by dividing materials tailored to the academic calendar and the level of development and characteristics of students. By doing these activities, teachers can determine the learning materials or content, media, and learning models appropriately so that the completion and achievement of learning can be done to the maximum. Teacher activities in understanding core competencies, and basic competencies, and designing learning tailored to student characteristics will have an impact on students' learning outcomes and students' ability to apply the knowledge gained during learning in the environment or life (EACEA, 2012; Neumann et al., 2019). The ability of teachers in transforming their knowledge for students will be a clear differentiator between professional teachers and not. This ability is not only seen in the completion of learning and high student learning outcomes, but also in the ability of students in reapplying the material that has been explained by the teacher. Therefore, expert or professional teachers will transfer their knowledge with a strong teaching style, adaptive, using a variety of learning models, and still paying attention to the background of students, to manage the classroom effectively and efficiently (Myers et al., 2017; Ozmantar & Akkoç, 2017).

In addition to the use of the content, teachers are also required to master class management or commonly referred to as pedagogical knowledge, this is intended so that teachers can transfer knowledge to students easily. Pedagogic skills owned by teachers are used to organize the progress of learning in the classroom to run effectively, which starts with transferring knowledge to problem-solving both at a simple level and a more complex level (Ozmantar & Akkoç, 2017).

The ability of teachers in composing content and mastering classroom management well is necessary for learning by distance learning methods, this is because teachers must be able to explain in detail and in virtual classrooms so that students can understand the material optimally and by the learning objectives. Cognitive ability in students is one of the three abilities that students must have in supporting the learning process, students are required to be able to think from the easiest level to a more difficult or complex level. The cognitive ability itself consists of several levels or levels. The simplest level of cognitive ability is the ability of students in remembering learning materials, this level requires students' ability to retrieve information both specific and general in a precise and appropriate learning purpose. While the highest level in the cognitive ability of these students is the ability of students in creating. At this level, students are required to be able to produce an understanding according to their point of view of the problems that occur (Azlan et al., 2019; Baghaei et al., 2020).

In detail, there are six levels or levels in students' cognitive abilities after revision of Bloom's taxonomy cognitive ability, namely remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6). In addition to the

level of cognitive ability that should get the teacher's attention in determining learning materials, there is a dimension of knowledge that will accompany the cognitive abilities of students that need to be considered also by the teacher, namely factual dimensions, conceptual dimensions, procedural dimensions and metacognitive dimensions (Krathwohl & Anderson, 2010; Baghaei et al., 2020). By paying attention to the cognitive level and dimensions of knowledge that the student has, the teacher can easily perform an analysis and assessment of the student's understanding. So that teachers can determine the next step towards classroom management in achieving optimal levels of student material understanding.

5 Conclusion

Based on the assessment of material and media experts, M-VFTs have excellent feasibility so that they can be tested in schools. Furthermore, based on the teacher's and students' assessment of MAN 2 Tulungagung, M-VFTs have excellent criteria. So, based on the validation results, M-VFTs are suitable for learning Geography in schools, especially on the material for the Conservation of Flora and Fauna. This media can increase students' learning motivation and curiosity about flora and fauna conservation material. However, this media still requires content design and instruction optimization in the future. M-VFTs require integration with appropriate learning models. The suggested learning model is student-centred, so the teacher only functions as a guide. In addition, in optimizing the content design, it is possible to add stop sites from increasing student options in virtual visits to recognize the geographical characteristic of Baluran better.

Based on the most crucial factors that have been identified in this study, it was found that internet-based learning media (web, social media, and others) combined with pedagogical content knowledge owned by teachers, turned out to be able to help teachers in overcoming problems in distance learning during the pandemic. For this reason, it is hoped that the results of this study can support subsequent studies in finding other learning media, especially for researchers who focus on research in the field of distance learning. The hope is that it will be able to create the right learning media in remote learning activities.

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