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Difficulties in the Material of Skeleton Systems and the Application of ICT in Learning Natural Sciences (IPA)

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ABSTRACT

The research was conducted to determine the difficulty of the material science learning and implementation technology in the teaching learning process of high students in junior schools. The conducted at study was SMP Negeri 28 Pekanbaru, Al-Azhar Syifa Budi Middle School, Metta Maitreya Middle School and Bukit Raya Pekanbaru Middle School. The research methods using descriptive qualitative which is obtained using Likert scale questionnaire sheets and interviews. Data were analyzed using descriptive analysis toolpak. The results showed that Skeleton System Material included in the category of Fairly Difficult with an of average 25% and the Application of Information, Communication and Technology (ICT) in Schools is still low due to inadequate. Based on the results of the analysis it was concluded that the application of ICT in junior high schools was still very low, so the development of disruptive so, the development of disruptive technology media is needed such as Tech Teacher that it was expected to improve student learning outcomes.

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1. Introduction

Education in schools experienced opposition to the industrial revolution era 4.0, especially in learning Natural Sciences (IPA). Kemenrisetdikti (2018) explains that learning in schools requires disruptive technology to deal with developments from the results of the industrial revolution 4.0, namely the combination of Biology, Technology and Physics. The aim of learning technology can be to improve visual literacy, time efficiency, be competitive in discussions, and improve students' critical thinking George et al (2010), Alimisis (2013), Li et al

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(2016), Richa et al (2018) and Ertan et al (2019) as well as student learning motivation (Puji et al 2019).

The problem faced is that the application of science learning technology is still lacking, this shows that the difficulty of developing learning media namely disruptive technology is not reached. Based on the analysis carried out in four new dipekan schools, Al-Azhar Syifa Budi Middle School, Metta Maitreya Middle School, Bukit Raya Middle School and Pekanbaru 28 Middle School, the use of learning media in the category is very low. The constraints faced by the teacher are weaknesses in the making of instructional media and the time for the media to be created. In accordance with disclosed by Bambang (2012) that teachers have obstacles in the use of technology.

The following analysis is conducted on natural science learning materials, namely Basic Competence 3.1 Material Skeleton System shows that the category of material is quite difficult. This is because students still have difficulty remembering the shape and function of the skeletons as well as muscle performance, and students cannot explain the function of organs if given visuals in the form of 2-dimensional, 3dimensional and torso images. Michael et al (2018) mentioned that students cannot explain human organs if given 2 images namely 2D and 3D.

Difficulties of students in the Skeleton System material with the category Quite Difficult because the use of learning technology is still lacking, so learning tends to be centered on the teacher and the delivery of material in abstract form. As a result of the theoretical abstract about human organs, students make the wrong drawing, differ in the articulation of meaning, do not know the purpose of the organ, organ linkages, organ function with one of the causes, namely the teacher and students are less using technology in learning (Mintzes et al 1984, Buckley 2000, Reiss et al 2001, Gatt et al 2006, Tracana et al 2012, Ozgur 2013, Allen and Zulfiani 2014, Haßler et al 2015, Wahyuni 2016, Putri et al, Moonhyun et al and Akik et al 2017, Michael et al, Refni et al al and Della et al 2018, and Angela et al 2019).

The design of disruptive technology, which is Tech Teacher, is expected to improve pedagogical accessibility, explain abstraction information, and improve student science acquisition. The application of Tech Teacher technology can improve student science education such as in Singapore (Huminca 2016). This study aims to analyze the difficulty of the Skeleton system material in humans, animals and plants as well as the application of information and communication technology in classroom learning so that a disruptive technology can be designed such as Tech Teacher in order to improve students' understanding in learning science.

2. Methodology

The study was conducted with a descriptive analysis design analyzed using Excell-assisted Toolpak consisting of two stages. The first stage is analysis by questionnaire data collection, observation and interviews with teachers and students including SMP Negeri 28 Pekanbaru, Al-Azhar Syifa Budi Middle School, Metta Maiterya Middle School and Bukit Raya Pekanbaru Middle School.

Data Analysis Techniques are performed as follows:

Analysis of National Examination Data

The National Examination obtained from the Ministry of Education and Culture page, was analyzed using Toolpak by sorting the smallest to the largest IPA average score with a total of 146 schools, then determining the interval scale of the average national exam scores for all schools, namely 30 to 80. Determination of schools by taking a median from each school.

Analysis of Questionnaire Data

Questionnaire data obtained from the results of a questionnaire given to Teachers and Students, obtained an average of the most difficult material and difficulty of teaching media if more than 50%, the school as a follow-up trial.

Analysis of Interview Data

Interviews were conducted at the school results of Questionnaire data, so that the interview sheets were given to the teacher to determine the feasibility of testing. If the scale of 1 is greater than 2 then the Decision Not Interested, if the scale of 1 and 2 is greater than 3 then the Flexible Decision Increases, if the scale of 1, 2 and 3 is greater than 4 then the Decision Interested.

Analysis of Observation Data

Observation data were obtained from Observation of Student Learning Outcomes and Teacher Questionnaire as a determinant of the difficulty of the Natural Sciences material. The range of scales in the observation consisted of 4 namely 0.00, 0.10, 0.20, 0.30 and 0.40. If the observation results pass a scale of 0.20, it is categorized as Difficult and appropriate to develop instructional media according to the results of observation.

The second stage is the design of the Tech Teacher media development model using several Software features, namely Power Point, Aurora 3D, Open Sankore, Jarvis, and Braina. Whereas Hardware in the form of Mixed Reality and other learning support such as Laptops and Infocus.

3. Results and Discussion

Analysis of Learning Materials

Material Analysis of Skeleton System is needed to find out how high the level of material difficulty faced by several schools in Pekanbaru. The results of the analysis can be seen in Figure 1.

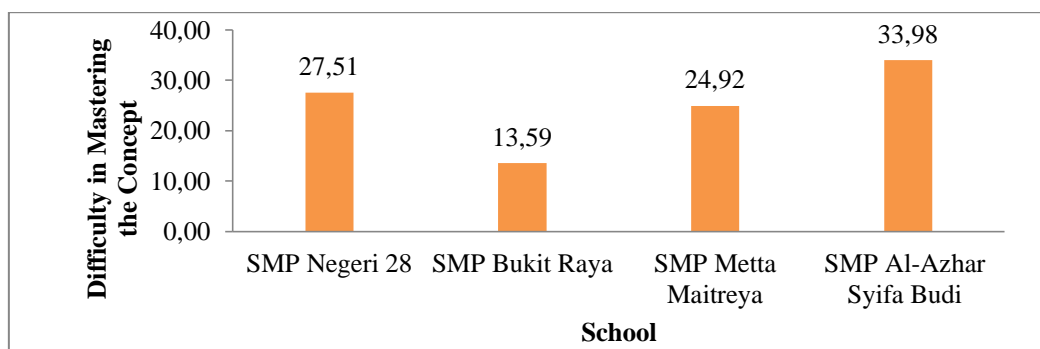


Figure 1. Difficulty level of Skeleton System Material

Figure 1 shows that SMP Negeri 28 Pekanbaru and Al-Azhar Syifa Budi Pekanbaru SMP have a high difficulty value in the Skeleton system material (ie SMP 28 Pekanbaru 27.51 and Syifa Budi Al-Azhar Middle School 33.98). At Metta Maitreya Middle School, the figure was 24.92 and the lowest level was at Bukit Raya Middle School. This shows that the difficulty of the Skeleton System material including the category is quite difficult so that follow-up is needed to improve student understanding.

Material Skeleton System is quite difficult because students are still difficult to distinguish the type of frame, joints and muscle mechanism. (Moonhyun et al 2017 and Ozgur 2013) explain that students have difficulty in knowing the purpose and function of organs. The most difficult material according to Zulfiani et al 2014, Wahyuni 2016, Akik et al 2017, Refni et al and Della et al 2018 so that appropriate handling is needed so that the Skeleton System material is not included in the Difficult categories.

Learning Media Analysis

Analysis of instructional media in schools is needed to determine the level of use of instructional media in the learning process in class can be seen in Figure 2.

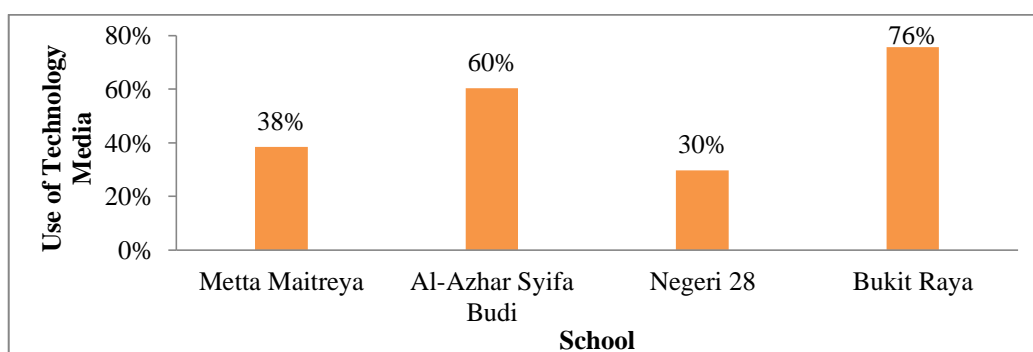


Figure 2. Level of Use of Learning Technology

Figure 2 shows that the lowest technology use at Pekanbaru 28 Public Middle School is 30%, and Metta Maitreya 38%. While the highest use of media, namely Bukit Raya by 76% then Al-Azhar Syifa Budi 60%. At SMP Negeri 28 Pekanbaru has the lowest percentage because the use of technology is still lacking in the category of factors in the form of inadequate learning tools.

The use of technology affects the computerized learning system in the teaching and learning process, but based on the survey results it shows that students and teachers are still lacking in applying technology-based learning systems. Hebler et al. 2015 and Angela et al. 2019 explained that one of the causes of the low ability of students is the lack of use of technology in learning. Analysis is also done on the desires of students in the use of technology, this is needed to determine student learning modalities can be seen in Figure 3.

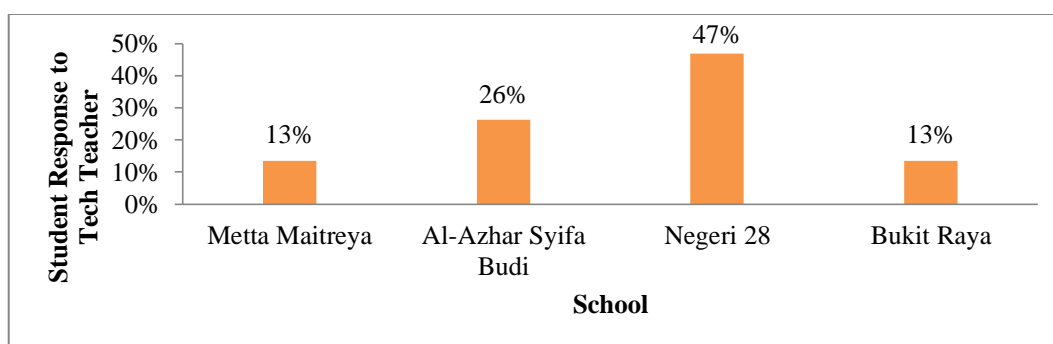


Figure 3. Students desires to use Tech Teacher

Figure 3 shows that SMP Negeri 28 Pekanbaru has the desire to use learning technology in their schools with a percentage of 47%, as well as Al-Azhar Syifa Budi's 26%. These two schools show that the modality of students tends to be Visual N in the sense that the desire to use instructional media is more dominant. Whereas in Metta Maitreya, students have Kinesthetic N and Bukit Raya characteristics. Students tend to be Auditorial O.

Results of Analysis of Material, Media and Student Modalities show that the use of technology in the learning process is still in the category of lacking so it is necessary to innovate instructional media oriented to teachers and students with

the development of disruptive technology that is Tech Teacher with the hope that it can be applied in schools like the results of research conducted by Herdini et al 2018.

Media Tech Teacher Design

The mechanism of media design can be seen in Figure 4.

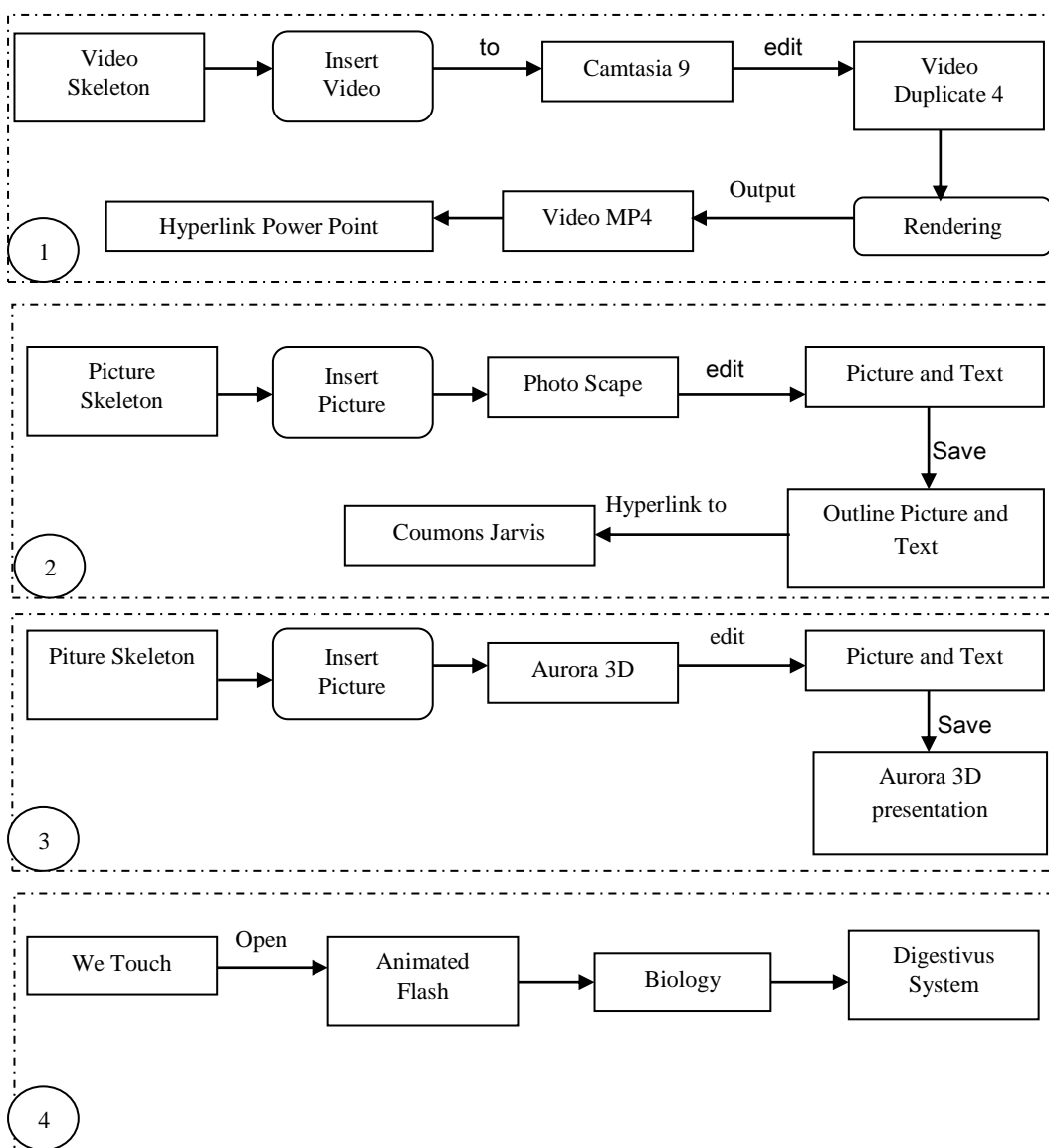


Figure 4. The mechanism of the Tech Teacher media design. (1) Mixed Reality Pyramid Hologram, (2) Jarvis (3) Aurora 3D, (4) We Touch.

Design Media Tech Teacher by making hardware first. Media development consists of 3 sub media, namely Mixed Reality (Pyramid Hologram), We Touch, Jarvis, and Slide presentations (Aurora 3D, and Power Point).

Mixed Reality (Pyramid Hologram)



Figure 5. Pyramid Hologram wake table

Figure 5 is the first design to make a building space for 32-inch television with a length of 40 cm and width of 70 cm. Build a television table made of iron as an enforcer and ACP aluminium composite panel as a television cover. As forming the appearance of Mixed Reality requires Pyramid Hologram made of acrylic glass with a thickness of 2mm. Each acrylic is attached using a special acrylic glue so that the union between the sides becomes more perfect.

Running an animation, a Camtasia version 8 program is needed to separate the video into 4 sides. The reflection of the animation on the video will make the display become 3 dimensional. Videos are obtained from available sites such as Youtube and some come from 3D animations created with the 2010 version of 3D Studio Max, Adobe Audition, Adobe After Effect and several other design software seen in Figure 6.

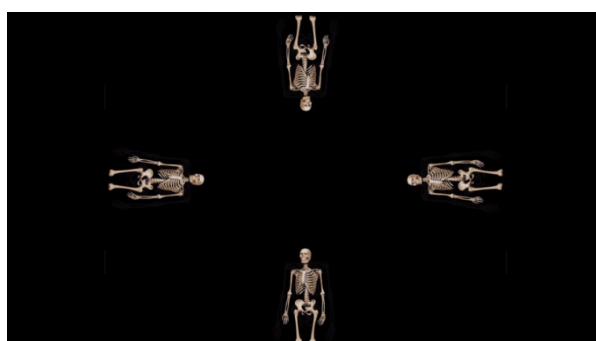


Figure 6. Display of Mixed Reality animated video

WeTouch

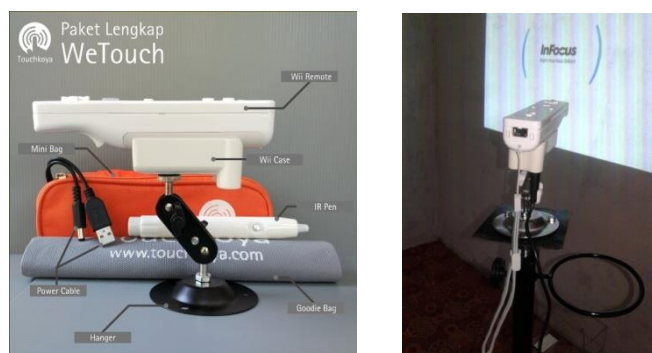


Figure 7. WeTouch Hardware Equipment

Wetouch (Figure 7) is a set of Touchscreen devices that can follow commands with the help of some equipment so that any display can be run with the help of the Wii Remote. The hardware in Figure 3 was purchased with 1 package and some software is needed to run the command as shown in Figure 8



Figure 8. Pentabulous and Smoothboard Air with Duo

Running a command, the user must first activate Pentabulous or Smoothboard Air with Duo to calibrate the infocus screen. It is intended that the command from the IR Pen does not error when run. The difference is Pentabulous is sensitive touchscreen and Smoothboard can be used as a place to write a sketch substitute for a whiteboard that uses markers.

J.A.R.V.I.S



Figure 9. J.A.R.V.I.S

Figure 9 is a Jarvis application that is a software that is able to recognize the voice or voice of the user. This application can run the desired needs so that it looks like programming a robot on a PC or Laptop seen in Figure 10.

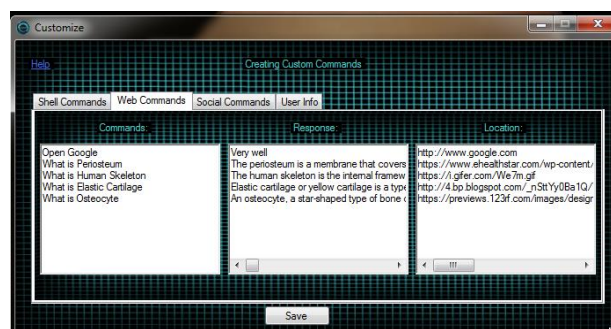


Figure 10. Display of the Custom Commands Main Menu

To run commands with a high level of complexity, we need an application called Macro Record which can record user commands on a PC or Laptop so that this application is seen as nerve from Jarvis as shown in Figure 11.

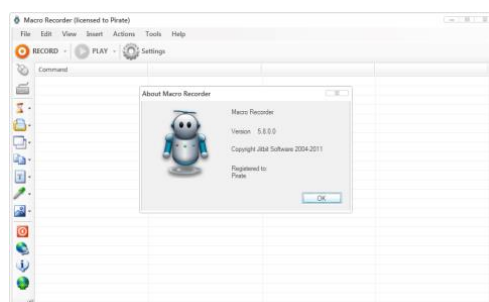


Figure 11. The main menu of Jitbit Macro Recorder

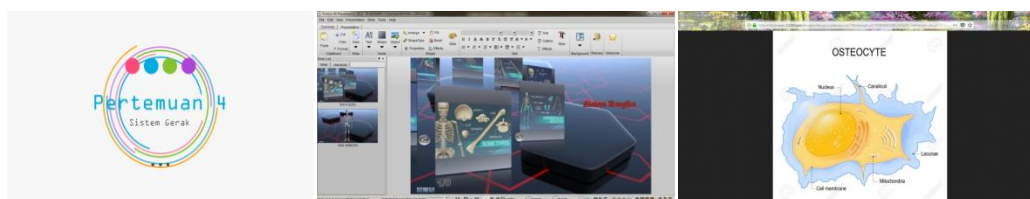
Power Point, Aurora 3D Presentation and HTML

Figure 12. Power Point, Aurora 3D, and HTML

The application on Figure 12 consists of Power Point, Aurora 3D, and HTML, so that the media can be run offline. All learning activities have been synchronized at the power point so that with one power point file can run all available applications. Media designed can make Skeleton System Material look semi-virtual with 3D display. The form of media that has been arranged based on learning activities can be seen in Figure 13 below.



Figure 13. Media Tech Teacher Display

Figure 13 is a media design on the material of the human Skeleton system. Each icon is already connected with other applications such as Aurora 3D, offline picture, Pyramid Hologram, We Touch, Jarvis and all learning activities such as apperception, motivation, and LKPD have animated videos based on the environment faced by everyday students.

4. Conclusion

The results showed that the Motion System Material for the junior high school level in Pekanbaru in the category was quite difficult and the implementation of teaching media in the learning process was still not optimal. The low ability of students in the Motion System Material due to lack of use of learning media so abstract material that is difficult to display in different visuals makes the ability to remember students to be low so it is necessary to develop learning media by using

disruptive technology namely Tech Teacher with the hope that it can improve student learning outcomes.

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