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The Development of HOTS-Based Physics Learning Media Application for Junior School

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ABSTRACT

Learning outcomes can be influenced by learning models, learning styles, and learning media. The accuracy of the learning media used can increase students' thinking abilities even to higher levels of thinking. High-level thinking students can be trained through learning in classrooms. Suitable learning media for teaching material can help students in thinking at a high level or HOTS so learning media are needed in the teaching and learning process. This study aims to create learning media and try out these media. Learning media developed using the Borland Delphi application. The learning media developed were tested in junior high school grade 8 in Medan. The research sample was taken by cluster random sampling where each school had the same opportunity to become a research sample. Samples were divided into categories group A and group B. Group A and group B were subjected to the normality and homogeneity tests. This study uses research instruments in the form of multiple-choice questions as many as 15 questions and questionnaires on students' opinions on the learning media used. The results showed that the learning process by using instructional media produces better or higher learning outcomes than the learning process without the use of instructional media. The average posttest students in the class using media developed higher than the average posttest students in the class who do not use instructional media. The results of the student questionnaire argue that the media need to be designed to be more interesting so that students are happier to use it.

1. Introduction

Developed countries in 2045, exactly 100 years of the independence of the Republic of Indonesia, is our common dream. To realize this dream, the government has done many ways, one of which is improving the quality of education in Indonesia. The government has made Presidential Regulation number 57 of 2017 as a legal umbrella to achieve the Sustainable Development Goals (SDGs) agreement "Ensuring the quality of inclusive and equitable education and increasing lifelong learning opportunities for all" (Kemendikbud, 2018). This was done because education plays a very important role in the progress of a country (Afifah, 2015). In achieving the dream of 2045, Indonesia is still a big task for us together. This is because in 2018 the 2015 PISA research report, Gurria (Gurria, 2018) stated that the order of achievement of Indonesian students was ranked 62 out of 70 participating countries with an average achievement of 493 Indonesia reaching a score of 403. This means that learning abilities (Mathematics, reading, and science) Indonesian students still really need to be improved. Likewise in previous PISA research, Schleicher (Schleicher, 2014) made a report in 2014 on the 2012 PISA study stating that the order of Indonesia's achievement was ranked 62 out of 64 participating countries with a mean score of 501 and the average achievement of Indonesian students was 382.

A way to improve the quality of education in Indonesia, the government has designed a learning and assessment system oriented towards higher-order thinking or Higher Order Thinking Skills (HOTS) (Permendikbud, 2018). This is still far from what happened in the field. Tarigan's research (2009) states that classroom learning tends to use conventional learning. The use of conventional learning, especially in Medan

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City reached 74.8%. Kristianingsih (2010) states that as a result of the learning model which provides more lectures or product delivery, students are less trained to develop their thinking power in developing the application of concepts that have been learned in real life.

Daryanto's research (2010) states that in a teaching and learning process, a very important element that cannot be separated is the learning media. The choice of learning media greatly affects student learning outcomes. Nurseto research (2011) states that teachers are required to create interesting and entertaining learning so that they are not inferior to information technology and increasingly sophisticated entertainment. In research, Priyanto (2009) states that the use of media in teaching can help achieve success in learning. Wuryandari's research (2012) states that the learning process needs to be supported by learning media, one of which is electronic media such as the use of LCD projectors, computers, and so on. The use of learning media must be relevant to the learning objectives to be achieved, according to the competence and teaching materials, so that with the use of media in learning students can capture the objectives and teaching materials more easily and quickly (Riyana, 2009).

A preliminary study conducted that the learning process uses lectures, discussion of sample questions, and discussion of questions. As many as 53% of students prefer learning other than Physics, Mathematics, Indonesian. As many as 58% of students want a way of learning that is varied or different from what they are used to. Judging from the students' physics learning outcomes, it was found that students had scores below 40 by 24%, above 40 to 64 (under KKM) as much as 52%, and the rest above the KKM (Siregar, 2019).

The accuracy of the learning media used can stimulate and even create student thinking to a higher level. Higher-order thinking processes can be trained in the learning process in the classroom. For students to have high-order thinking skills, the learning process also provides space for students to find activity-based knowledge concepts that can encourage students to develop creativity and critical thinking. HOTS takes higher thinking and tends to encourage someone to think according to the conclusions they get (Widodo, 2013). HOTS is a complex thought process in describing the material, making conclusions, building representations, analyzing, and building relationships by involving the most basic mental activities. Furthermore, higher-order thinking skills or HOTS are a process of analyzing, reflecting, providing reasons (arguments), applying concepts to different situations, composing, and creating. In other words, high-order thinking is the ability to solve problems (problem-solving), critical thinking skills, creative thinking, the ability to reason (reasoning), and the ability to make decisions (decision making) (Dinni, 2018). For this reason, it is necessary to build a learning media to foster student abilities and be able to solve HOTS-oriented evaluation questions to improve student learning outcomes (Azizah, 2015). Learning media can be developed with various computer applications (Suppa, 2015).

2. Methods

This research is a quasi-experiment, which was carried out on the 8th graders of SMPS Hang Kesturi Medan and SMPS Santo Thomas 1 Medan. The purpose of this study was to make physics learning media for junior high school level and to test the learning media developed by researchers. The research design in the media trial involved two groups, namely group A as the experimental group and group B as the control group. Group A conducted learning using instructional media applications developed using the Borland Delphi application. The research instrument consisted of 15 questions of multiple-choice types to measure students 'understanding of the content of the lesson and a questionnaire to determine students' interests and opinions on the media being developed. Then the research was carried out. After the instrument data was collected, the results were analyzed. Instrument data consisted of pretest and posttest. Result analysis was performed by t-test. Before testing the t-test, first, the normality and homogeneity test of the research sample was carried out. The questionnaire data is used by researchers for the development and improvement of the media made.

3. Results and Discussion

3.1 Learning Media

The learning media is designed using the Borland Delphi application. Several variables are created and adjusted according to the submenu to be selected. The resulting media consists of several sub-menus, namely: (1) regular straight motion, (2) straight change in order, (3) vertical upward motion, (4) free line motion, (5) parabolic motion. Making this sub-menu is to provide a choice of motion to be simulated s that students understand more easily. The sub-menu in question is shown in Figure 1.

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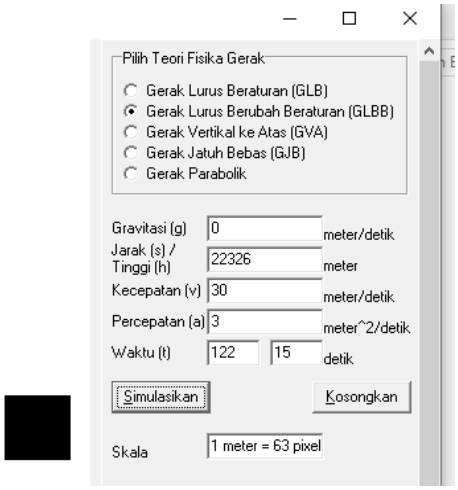

Fig 1. Display media sub menu design

The momentary view when the application is used is shown in Figure 2, where a black box is an object that experiences motion.

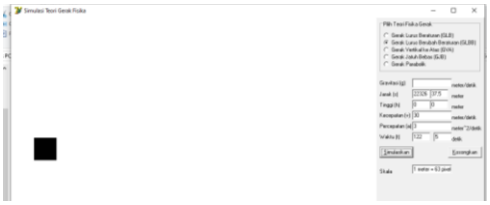

Fig 2. Display when the application is used

The coding used in this study is as follows (partial coding).

```
procedure TFrmFisikaGerak.TampilkanLaju();
begin
 TxtHitungWaktu.Text:=IntToStr(Hitung);
 if RBGLB.Checked then
  TxtHitungJarak.Text:=FloatToStr(Kecepatan*Hitung)
 else if RBGLBB.Checked then
  TxtHitungJarak.Text:=FloatToStr(Percepatan*Hitung*Hitung/2)
 else if RBGVA.Checked then
  TxtHitungTinggi.Text:=FloatToStr(Gravitasi*Hitung*Hitung)
 else if RBGJB.Checked then
  TxtHitungTinggi.Text:=FloatToStr(Gravitasi*Hitung*Hitung/2);
end;

procedure TFrmFisikaGerak.BtnKosongClick(Sender: TObject);
begin
 (*RBGLB.Checked:=false;
 RBGLBB.Checked:=false;
 RBGVA.Checked:=false;
 RBGJB.Checked:=false;
 RBParabolik.Checked:=false;*)
 TxtGravitasi.Text:='9.8';
 TxtJarak.Text:='0';
 TxtTinggi.Text:='0';
 TxtHitungJarak.Text:='0';
 TxtHitungTinggi.Text:='0';
 TxtHitungWaktu.Text:='0';
 TxtKecepatan.Text:='0';
 TxtPercepatan.Text:='0';
 TxtWaktu.Text:='0';
 HentikanSimulasi();
 GroupBox1.Enabled:=True;
 GroupBox1.SetFocus();
end;
```


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3.2 Student learning outcomes

Student learning outcomes (pretest and posttest) are presented in Figure 3 below. The pretest learning outcomes were tested for normality test and homogeneity test. This test is intended as a condition for researching samples that have the same abilities before learning.

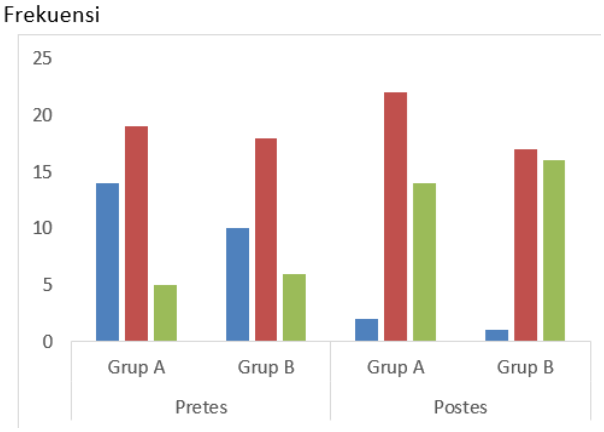

Fig 3. Student learning outcomes

The normality test of the instrument results shows normal data ($L_{count} < L_{table}$) and is shown in Table 1 below.

Table 1
Normality Test

No	Data Grup	L_{count}	L_{tabel}
1	Pretes grup A	0,1419	0,1437
2	Pretes grup B	0,1447	0,1519
3	Postes grup A	0,1346	0,1437
4	Postes grup B	0,1506	0,1519

The homogeneity test of the instrument results shows homogeneous data ($F_{count} < F_{table}$) and is shown in Table 2 below.

Table 2
Homogeneity Test

No	Data	Varians	F_{count}	F_{tabel}
1	Pretes grup A Pretes grup B	81,54 82,81	1,02	1,57
2	Postes grup A Postes grup B	11,52 10,92	1,11	1,57

The t-test in both groups was carried out before learning and after learning. The t-test before learning shows the abilities of the two groups are the same ($t_{count} < t_{table}$) and is shown in Table 3.

Table 3
Pretest Ability Test

No	Data Grup	Mean score	t_{count}	t_{tabel}
1	Pretes grup A	32,98	0,20	2,02
2	Pretes grup B	32,55		

The t-test in both groups was carried out after learning and after learning. The t-test before learning shows the abilities of the two groups are different (tcount > ttable) and is shown in Table 4.

Table 4
Postest Ability Test

No	Data Grup	Mean score	t_{count}	t_{tabel}
1	Postes grup A	74,91	5,41	1,69
2	Postes grup B	63,33		

3.3 Discussion

The results obtained are processed and presented in Table 1 to Table 4. From the above calculations, it can be said that there are differences in student learning outcomes using learning media built with the Borland Delphi application against student learning outcomes who do not use learning media. This is in line with research Priyanto (2009) states that the use of media in teaching can help achieve success in learning.

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Likewise, Daryanto's research (2010) states that in a teaching and learning process, learning media greatly affects student learning outcomes. Siregar's research (2019) also states that learning using media can increase student interest in learning. Anisah (2018) also stated in her research that teaching materials in the form of HOTS can improve students' problem-solving abilities. Likewise, Sumaryata's research (2018) states that assessments involving students 'HOTS abilities will automatically increase students' problem-solving abilities. Fanani (2018) in his research stated that the HOTS-shaped assessment will increase student learning motivation. This is because in the HOTS assessment the lessons carried out in the classroom are related to the realities in student life.

4. Conclusion

The results of learning using media and without using different media. Learning outcomes using learning media produce better learning outcomes than learning outcomes without media. Likewise, student interest in learning increases with the media used. The media used in this study is a learning application developed by researchers. Learning media was developed using the Borland Delphi application. The student questionnaire stated that the media needed to be improved/developed in terms of media appearance. Students hope that media impressions are made more attractive, including the appearance of attractive designs and colors.

5. References

[1] Afifah N., 2015. *Probelatika Pendidikan di Indonesia*. Lampung. **1** (1) 41-47
[2] Anisah, Lastuti, S., 2018. *Pengembangan Bahan Ajar berbasis HOTS untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Mahasiswa*. Semarang. **9** (2) 191-197
[3] Azizah, R., Yuliati, L., Latifah, E. 2015. *Kesulitan Pemecahan Masalah Fisika Pada Siswa SMA*. *Jurnal Penelitian Fisika dan Aplikasinya (JPFA)*. **5** (2): 44-50
[4] Daryanto, 2010. *Media Pembelajaran Peranannya Sangat Penting dalam Mencapai Tujuan Pembelajaran*. Yogyakarta: Gava Media
[5] Dinni, H. N. 2018. *HOTS* (*High Order Thinking Skills*) *dan Kaitannya dengan Kemampuan Literasi Matematika*. PRISMA, Prosiding Seminar Nasional Matematika, **1**: 170-176
[6] Fanani, M. Z. (2018). *Strategi Pengembangan Soal HOTS Pada Kurikulum 2013*. *EDUDEENA*, **2** (1), 59-76
[7] Gurria, A. 2018. *Pisa 2015 Technical Report*, Paris: OECD
[8] https://www.kemdikbud.go.id/main/blog/2018/11/kemendikbud-dan-unicef-luncurkan-laporan-garis-acuan-tpb-tujuan-4-untuk-indonesia
[9] https://www.readingrockets.org/article/how-increase-higher-order-thinking
[10] Kristianingsih, D. D. 2010. *Penginakatan Hasil Belajar Siswa Melalui Metode Pembelajaran Inkuiri dengan Metode Pict oral Riddle pada Pokok Bahasan Alat-alat Optik di SMP*. Jurnal Pendidikan Fisika Indonesia, **6** (1): 10-1
[11] Nurseto, T. 2011. *Membuat Media Pembelajaran yang Menarik*, Jurnal Ekonomi & pendidikan, **8** (1), hal 19-35. doi: media pembelajaran 2011
[12] Permendikbud No.20 tahun 2018 tentang penguatan pendidikan karakter pada satuan pendidikan
[13] Priyanto, 2009. *Pengembangan Multimedia Pembelajaran Berbasis Komputer*. Insani: pemikiran alternatif kependidikan
[14] Riyana. 2009. *Media Pembelajaran*: *Hakikat, Pengembangan, Pemanfaatan, Penilaian*. Bandung : CV. Wacana Prima
[15] Schleicher, A. 2014. *Pisa 2012 Technical Report*, Paris: OECD
[16] Siregar, S. D. 2019. *Studi Pendahuluan*: Tidak diterbitkan
[17] Siregar, S. D., Panjaitan, B., Girsang, E., & Dabukke, H. *Learning Media Using Discovery Learning Approach to Improve Student Learning Outcomes*. *Jurnal Pendidikan Fisika*, *8*(2), 120-125
[18] Suppa, R., Jasruddin, Aziz, A. 2015. *Pengembangan Media Animasi Fisika Berbasis Adobe Flash pada Materi Gerak SMP Kelas VII*. Jurnal KIP **3** (3): 633-644
[19] Sumaryanta, (2018). *Penilaian HOTS dalam Pembelajaran Matematika*. Indonesian Digital Journal of Mathematics and Education, **8** (8), 500-509
[20] Tarigan, R. 2009. *Pengembangan Perangkat Pembelajaran Fisika Berbasis Model Pembelajaran Konstruktivis untuk Memberdayakan Kemampuan Berpikir Analitis, Kreatif Siswa SMA*, Medan: FMIPA Unimed
[21] Widodo. 2013. *Psikologi Belajar*. Jakarta : PT Rineka Cipta
[22] Wuryandari, N. H. 2012. *Media Design for Learning Indonesia in junior High School Level*. Social and Behavioral Sciences, 490-499

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