

## THE DEVELOPMENT OF LIGHT REFLECTION PROPS AS A PHYSICS LEARNING MEDIA IN VOCATIONAL HIGH SCHOOL NUMBER 6 TANJUNG JABUNG TIMUR

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**ABSTRACT:** Physics is the one of thinking rationally media and systematically and also train the ability of learners to be used to solve a problem that exist around them, so that they can develop their potentials and resources, therefore, physics learning should be constantly improved to achieve a better quality level. On the results of begining observation and the interview conducted at vocational high school (SMK) number 6 Tanjung Jabung Timur, gained the information in that school that have not had any light reflection props yet and also the laboratory, thus the learning process is not maximum and caused the low in mastery of the concepts on the reflection of light material. This matter showed that the existence of the props (media) in the study of physics is very important. By used the ADDIE method, this reseach got the testing validation and field validation, so the third assessment aspect such as suitability, convenience and attractiveness then it can be affirmed that the light reflection props that have been developed had the level of suitability, convenience and high attractiveness. Thus the tool is fit for use, especially for Physics learning material of SMK and students at the same level in General.

**KEYWORDS:** Development, Light Reflection Props, Physics Learning Media, Vocational High School.

### 1 INTRODUCTION

Physics is the one of thinking rationally media and systematically and also train the ability of learners to be used to solve a problem that exist around them, so that they can develop their potentials and resources, therefore, physics learning should be constantly improved to achieve a better quality level. Because, as with the improvement of the learning outcomes of physics expected have the positive impact to the educational enhancement and development of technology in Indonesia. With an increase of the education quality, then Indonesia will have progressed and develop rapidly both from the aspect of science and technology, either in economy aspects.

But in the education matter, physics is the one of the lessons that was less interest of the learners. Generally, they reason is because it has many formulas used in learning. Therefore, of course it necessary needs by the overcome steps to solve this problem, by the one way is provide the teaching methods and the using of interesting props, distinct, effective, and efficient. So it will produce the comfortable teaching and learning situation that is easy and not bored and also students will be easy to acquire the explanations of physics subjects.

On the results of begining observation and the interview conducted at vocational high school (SMK) number 6 Tanjung Jabung Timur, gained the information in that school that have not had any light reflection props yet and also the laboratory, thus the learning process is not maximum and caused the low in mastery of the concepts on the reflection of light material. This matter showed that the existence of the props (media) in the study of physics is very important.

The importance of props or media in learning physics has also been presented by the education experts, for example; Ashyar, (2012), conveyed that: 1. The learning media can provide the information that is accurate and up-to-date. 2. The

Learning Media can add the attractiveness of the material, so it can increase the motivation and the proclivity. Then it can take the student's attention to focus on following the material presented, so it also expected the learning effectively will be increased. 3. The media can stimulate the students to think critically, used their imagination, have an attitude and be further developed, thus it will utter the creativity and innovative works.

In addition, Notoatmodjo (2009) mentioned that the media as an assist tool in the education matter that has any functions to help in demonstrating something in the process of teaching. The same thing that also delivered by Sitanggang (2013), that the props were part of the learning media that defined as all objects (can be either human or inanimate object, object) as an intermediate used in the process of learning.

By observing to the regard of the importance of education media and there have not the media or the learning props on the concept of light reflection yet in SMK number 6 Tanjung Jabung Timur, its need to development the architecture and that props. According to Jogiyanto (2005) the architecture is a stage of after an analysis of the cycle the development system, that is the definition of any functional needs, as well as describes how a system formed which may include to depict, planning and making sketches or setting of some separate elements in a whole unified and functioning, including to configure from the hardware and software components of a system.

The development of props on the light reflection concept was feeling very important, considering the characteristics of the light reflection concept itself. In the concept of Light reflection involved two elements at once simultaneously, i.e. the concrete elements (visible) and the abstract elements (not visible). Whereas the learning concept of light reflection during this was only done by involving the abstract elements, i.e. through the speech and picture sketch about the way light of the main beam which passes through the mirror. Thus the concrete elements in the process of reflection of light (motion on main beam) do not look for real. Sure, That fact would reduce the meaning in physics learning as the real knowledge .

Some research showed that the props in the teaching and learning process was very important. That research, for instance; Ahmad Kasan Manuri, (2013) in his research entitled " the development of gravitational acceleration measurement tool with a variation distance between the sensors on the free fall motion through the control display based on micro processor " concluded that there is an expert validation result based on the indicator of assessment by practical basic physics expert and the design of the measuring instrument obtained the percentage of 78,75%, and by delphi 7 programmer expert obtained percentage about 75%, so that the average value amount 76,88% by the assessment of the criteria is very good (Manuri, 2013). In addition, according to the results of research Eni Yulianti (2009) "the development of the props using the series-parallel to do the logic mathematics in SMK number 2 Palembang about X class student in SKJ on mathematical logic subject", it concluded that there is an impact on student learning outcomes in vocational high schools number 2 Palembang if that props have a positive effect to student learning outcomes, this can be seen by corelation that quite positive between the activeness of the learning with the students value and achievement up to 78,38%. Other related research is Izzah Mardliyah (2013), entitled "the development of Multimedia Learning Arabic for Madrasah Ibtidaiyah V Class" concluded that the developing of multimedia of learning Arabic and knowing the quality of its product. The development model that used were the procedural development, that is the description models that described the slot or the procedural steps to be followed to produce a particular product. The Procedural steps namely planning, organizing, executing and assessment. Based on these assessments, the multimedia learning Arabic is worthy to be use as a media of instruction. (Mardliyah, 2013)

To make development of the architecture of light reflection tool needed by some major equipments; 1. flat mirror, that is a mirror by the reflections surface is plane and made from the glass that one of its surface coated with the silver amalgam. The nature of produced shadow by the flat mirror is the transparent could not seen by screen, as big as symmetrical, the upright of shadow direction equal to its thing direction, the flank of shadow changed by the side of the object, the distance of the shadow to the mirror is equal to the distance of objects against to mirror. as the concept of law of reflection on flat mirrors are: a. the coming ray, reflection rays, and normal line lied on one surface. b. Coming angle ( $i$ ) = angle of reflection ( $r$ ) or ( $\theta_i = \theta_r$ ).

The second tool needed in developing props of light reflection tool is a concave mirror. Concave mirror is a mirror that the surface is curved like the inside of the ball. (Cider; 2009). If a beam of line light falling on a surface concave mirror, the rays that reflected will gather at some point. So, the concave mirror has the quality to collects the light (convergent) and also known as positive mirrors. Conceptually, there are three exceptional rays on a concave mirror. Three exceptional rays are used to painting the formation of shadows on a concave mirror. The Three exceptional Rays are: a. the coming rays that aligned with the main axle of mirror will be reflected through the foccuss point. b. the coming rays that through the foccuss point of the mirror will reflect in align with the main axle. c. The coming rays through a curvature central point of the mirror will be re-reflect through the same point.

The third tool is a convex mirror. A convex mirror is a mirror by surface that same with the outer part of ball ". (Sari 1009). If the parallel rays fall on a surface of convex mirrors, the beam reflected will be spread. so a convex mirror has the quality to spreading rays (diverging) or call the negative mirror. Conceptually, there are three exceptional rays of convex mirrors, i.e.;

- the coming rays that aligned with the main axle of the mirror will reflect as though from the focuss point,
- The coming Ray that through a transparent foccuss point of mirror will reflect in align with the main axle,
- The coming rays through a central point of curvature mirror will be re-reflect as though from the same point.

## 2 RESEARCH METHODS

This research used the ADDIE method because it can be used for a variety of development product such as models, learning strategies, learning methods, learning media and learning materials. According to Buharuddi (2012) the ADDIE method was the one of instructional design model where the one of its functions is to be a guidelines in building the devices and infrastructure of training programs that effective, dynamic and can support the performance of training program itself.

On this research, the instruments used for testing product is in the form of close questionnaire or Check list. "Check list is a list where the respondents are only need the sign (v) in the appropriate column (Arikunto, 2010). Check list is used to determine the perception of lecturers, teachers and students toward the architecture of props light reflection as a learning medium.

The Datas that resulted from the products evaluation were in the form of qualitative that quantitiving. "Likert Scale " used to measure the attitudes, opinions and perceptions of a person about social phenomena in the study, its social phenomenon has been specifically defined by the researchers, that inafter called as the research variable " (Sugiyono 2012). Likert scales used in evaluating the light reflection props on the mirror were five scales which are:

- strongly agree (SS) with score 5
- agree(S) with score 4
- neutral (N) with score 3
- disagree (TS) with score 2
- strongly disagree (STS) with score of 1

The Score obtained from the results of the recapitulation were modify in the form of percentage by using the following calculation.

$$\frac{\text{Total of respondents score}}{\text{Total of maximum score}} \times 100\%$$

Explanation: the criteria of score interpretation

Number of 0%-20% = very weak

Number of 21%-40% = weak

Number of 41%-60% = quite

Number 61%-80% = Strong

Number of 81%-100% = very strong (Riduwan 2012)

## 3 RESULT AND DISCUSSION

### 3.1 THE DEVELOPMENT OF PRODUCT/TOOL

The Product or props that produced by this research is in the form of light reflection props. This tool used as a media of learning physics on the light reflection material and used to prove the Snelius' law of the light reflection concept to the flat mirror ( $\theta_i = \theta_r$ ), determining the focal length, the distance of shadow, exceptional rays on concave and convex mirror in the light reflection props where there a box glass made from clear glass that used as a container of the smoke media in order to help the eyesight the beam of laser light. The materials used to make the smoke media were a type of aluminum cans and the materials used to make beams of laser light were equipped with plastic boxes to place/position of a laser beam which there are 3 pieces of lasers beams by completing with the 3 scalars and the formation of this laser is in parallel shaped, whereas the strains used amount 4.5 DC. The light reflection props is also completed with a worksheet, needle, ruler, bow, power supply, spritus, flat mirror, concave mirror, and convex mirror.

After the preparing of tools and materials finished, then the proses of making light reflection props in the mirror by following steps:

#### THE PRODUCING OF GLASS BOXES

The producing of clear glass box with a length of 45 cm and a width of 30 cm in 2 pieces, length 17 cm width 45 in 2 pieces, and a length 30 cm and width 17 cm in 2 pieces. After measurement has done, cut the glass by using the glass cutters then clung it by beam pattern. After it complete then create a glass lis in order not dangerous when use the aluminum. The results of this glass box shaped beam like the pictures below:



Figure 1. Glass Box

#### THE PRODUCING OF LASER BOX

The producing of the laser box as a light beams that will be used to prove the Snell's law of light reflection in a mirror. The producing of the laser used a beam-shaped plastic box with measurement amount 6 cm in width, length 12 cm, height 5 cm, 3 pieces of lasers , 3 pieces of scalars, and 2 meter cable. As for the laser box producing process, such as:

No	Process	Description	Picture
1	The process of making laser lights	The process of making this laser light was require 3 pieces of lasers, then the laser could open and take the laser lights, then assembled in a series of parallel use the soldering tool.	
2	The process of making laser foundation	In the process of making the laser foundation is first of all create a scheme shaped line in a plastic box, then makes three points where the distance between the point of each other approximately 2.5 cm	
3	The depletion process	The process of depletion is a process that held in deplete the plastic box by use the soldering tool.	
4	Making the Scalar	The making of a scalar is used by 3 pieces of black color scalar as scalar set in every lasers, each assembled series of parallel shape so that the laser can turn on one by one.	
5	Assembling the laser box	Assembled this laser box is consolidating between the boxes with laser and then consolidate the laser with a scalar and the negative and positive connection cables.	

**THE PRODUCING OF SMOKE MEDIUM**

The producing of smoke media used aluminum cans that scissored in variation to be easy to use and give the coir and equipped by spiritus as shown in the following picture:



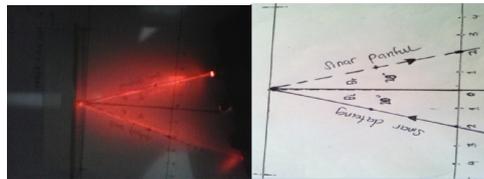
*Figure 8 : The result of smoke media*

**3.2 THE TEST OF LIGHT REFLECTION PROPS**

**3.2.1 INDEPENDENT TEST**

The aim of props light reflection test itself is to find out the results of a product that has been made whether it accordance or not with the theory (the law snelius) i.e. the first one in especially for the light reflection to flat mirror that proved the theory of coming angle size is equal with the angle of reflection ( $\theta_i = \theta_r$ ), second, determine the focal distance of concave mirror, determine the exceptional beams of concave mirror, and determine the distance of shadow on concave mirror. The third is to determine the foccus distance of curve mirror , determine the exceptional beams on a convex mirror, and determine the distance of the shadow on a convex mirror. Which the test of this light reflection props itself was guided with worksheets that have been prepared. Further it can be seen the trial results on the picture below, namely:

**a. The Trial results of light reflection props on the on flat mirror determine ( $\theta_i = \theta_r$ )**



*Figure 9. The practical results of coming angle and reflection angle on flat mirror*

*Tabel IV.2. The calculation of observation result in light reflection test on a flat mirror*

No	Experiment	Distance of objects to the normal line (cm)	Size of coming Angle ( $\theta_i$ )	Size of reflect Angle ( $\theta_r$ )	Difference ( $\Delta$ )
1	Experiment 1	2 cm	$20^0$	$20^0$	$0^0$
		2 cm	$20^0$	$20^0$	$0^0$
2	Experiment 2	4 cm	$23^0$	$23^0$	$0^0$
		4 cm	$23^0$	$23^0$	$0^0$
3	Experiment 3	5 cm	$32^0$	$32^0$	$0^0$
		5 cm	$32^0$	$32^0$	$0^0$

b. The trial results of light reflection props on concave mirror to determining the focus distance on concave mirror.

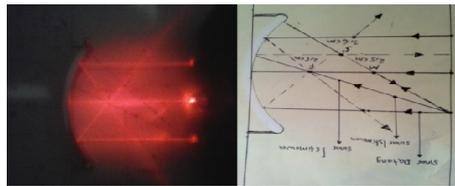


Figure 10. the practical results of focussing point on a concave mirror

The trial results of three exceptional rays on concave mirror are:

c. coming Rays that aligned with the main axle will reflect through the focuss point

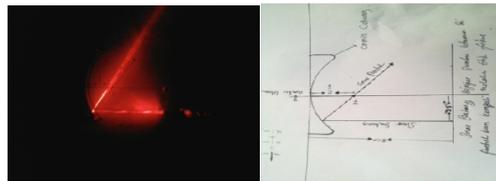


Figure 11. the practical results of first exceptional ray on a concave mirror

d. The coming rays through the focuss point of the mirror will aligned reflect to the main axle of the mirror

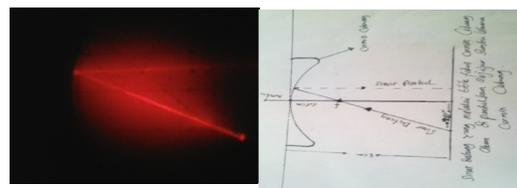


Figure 12. the practical results of second exceptional ray into a concave mirror

e. the coming ray through a curvature central point of the mirror will be re-reflect through the same point.

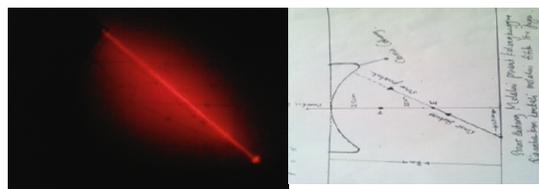


Figure 13. the trial results of the third exceptional ray into a concave mirror

Table IV. The calculation of observation result in light reflection test on a concave mirror

Eksperiment	The distance the laser into a concave mirror (s)	The Experiment Result	The Experiment Result	The Theory Result	Distance ( $\Delta$ )
Eksperiment 1	8 cm	2,5 cm	3,6 cm	3,6 cm	0
	8 cm	2,5 cm	3,5 cm	3,6 cm	0
Eksperiment 2	10 cm	2,5 cm	3,1 cm	3,3 cm	0
	10 cm	2,5 cm	3,3 cm	3,3 cm	0
Eksperiment 3	12 cm	2,5 cm	3,1 cm	3,1 cm	0
	12 cm	2,5 cm	3,1 cm	3,1 cm	0

f. The trial results result of light reflection props on convex mirror in determining the focal length of a convex mirror

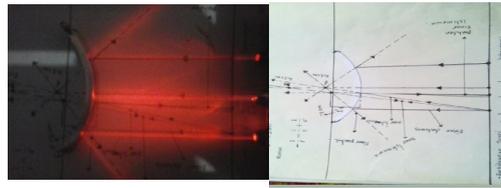


Figure 14. the Practical results of focal point on a convex mirror

The Trial results of three exceptional rays on a convex mirror :

g. coming Rays that aligned with the main axle of the mirror will be reflect as tough from the focal point.

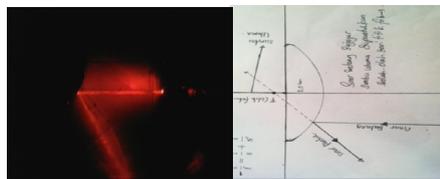


Figure 15. the practical Results of first exceptional ray to on a convex mirror

h. the coming ray that strive to the transparent foccuss point will be aligned reflect on the main axle.

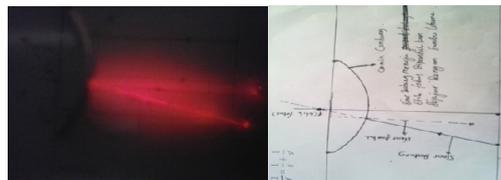


Figure 16. the results of the second exceptional ray on a convex mirror

i. the coming ray through a curvature central point of the mirror will be re-reflected as tough from the same point.

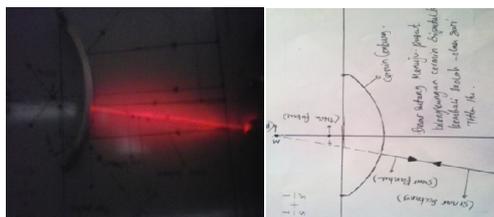


Figure 17. The practical result of third exceptional ray on a convex mirror

Table IV. 4 the calculation of observation result in light reflection test on a convex mirror.

Eksperiment	The distance the laser into a concave mirror (s)	The Experiment Result	The Experiment Result	The Theory Result	Distance ( $\Delta$ )
Ekseperiment 1	8 cm	2,5 cm	- 1,9 cm	- 1,9 cm	0
	8 cm	2,5 cm	- 1,9 cm	- 1,9 cm	0
Ekseperiment 2	10 cm	2,5 cm	- 2 cm	- 2 cm	0
	10 cm	2,5 cm	- 2 cm	- 2 cm	0
Ekseperiment 3	12 cm	2,5 cm	- 2 cm	- 2,06 cm	0,06
	12 cm	2,5 cm	- 2 cm	- 2,06 cm	0,06

Based on the datas generated from the practical itself got the conclusion, that the light reflection props is in accordance with the Snell's law concept of light reflection in a mirror.

### 3.2.2 EXPERT VALIDATION TEST

After the developing finished, the next step is the validation. The Product validation process carried out by way of filing a test expert of light reflection props as a media of learning physics to physics lecturer in IAIN STS Jambi that has expertise in the manufacture of laboratory tools and expert of teaching basic physics as much as 4 people. The test results of manufacturing the light reflection tool as a meda of learning physics to expert lecture maintained on 21-23 April 2014 in physics laboratory of IAIN STS Jambi. As for the results of fourth experts validation were shown as in the following diagram:

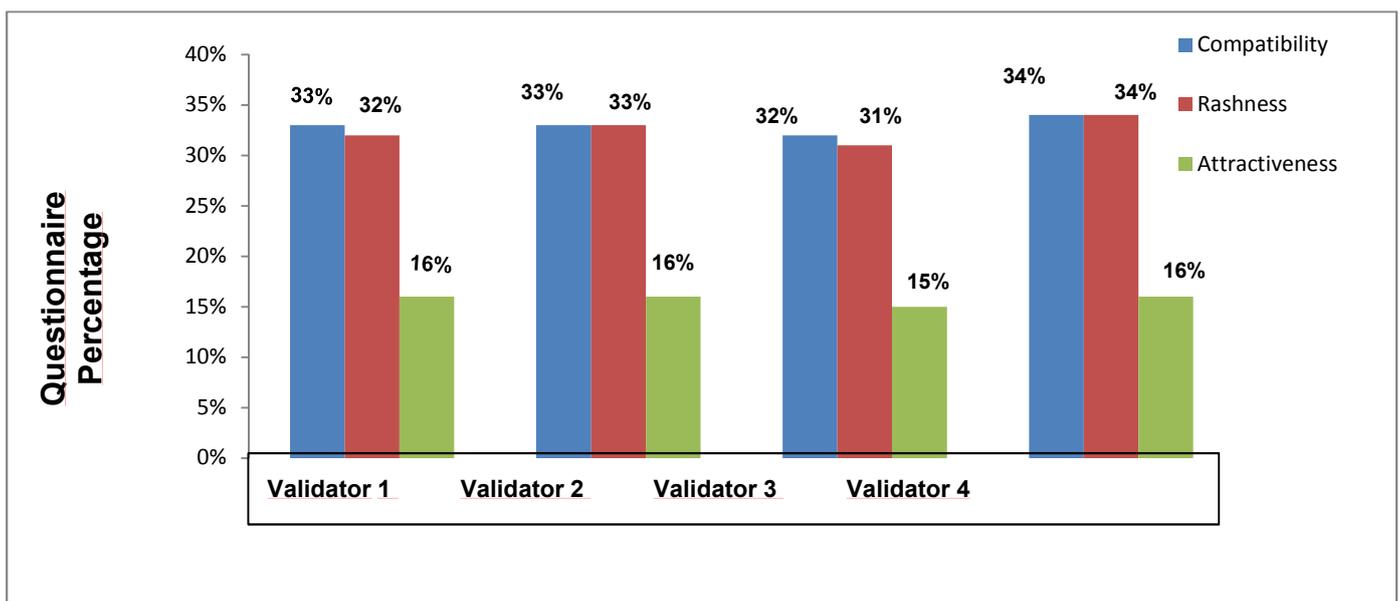


Figure 18. The percentage of steam diagram of the expert validity toward the light reflection props as instructional media

Based on the diagram above, the result perception overall get the score percentage 81,25%, so the light reflection props including the very well criteria for use as a learning media.

### 3.2.3 FIELD VALIDATION TEST

After this light reflection props on a mirror as physics instructional media was validate test by experts, then the next step is carried out the validation field. Field validation test was conduct by using that props on the teaching and learning process. The Field validation test conducted at vocational highschools number 6 tanjab timur at XI A class was on Monday April 28th 2014.

In the implementation of this light reflection props just wanted to see how great the students perception against to light reflection props on the mirror, for easier in measuring the score of students perceptions used a scale questionnaire with the strongly disagree criteria, Disagree, neutral, agree, and Strongly agree. From the Student perceptions obtained, the authors describe the conclusions of three aspects, namely aspect of suitability, convenience, and aspects of the attraction.

No	Aspects	Presentation Students' Answers (Percent)				
		Strong Agree	Agree	Neutral	Disagree	Strong disagree
1	Compatibility	75,9	14,1	2,6	7,4	-
2	Rashness	69,7	16,2	12,5	1,6	-
3	Attractiveness	78,3	18,5	-	3,2	

Based on the table above, seen at the aspects of compliance tools, students who stated that the props have high compliance (strongly agree) as 75.9%. While who stating the level of conformity is average (agree) as much as 14.1%. It shows that the props that been created had a high compliance level against to the curriculum (subject matter), in accordance with the circumstances and in accordance with school age level users (students). As for the students who gave a neutral response as much as 2.6%, it means that students do not have sufficient knowledge toward props, curriculum (subject matter) and so on. As for students who stated disagree as much as 7.4%, which means that according to the students that the props do not have any compatibility with curriculum, school condition and the age of the users (students). Thus in general it can be concluded that the props that been developed had any conformity, i.e. Accordance to the curriculum (subject matter), the schools condition and the age of the users (students).

From the viewpoint of "rashness" on the second aspect, the student's answer were dominate by a positive Outlook by giving an answer of "strongly agree" and "agree". The second aspect in the total declared by 85,9% (69,7% + 16.7 percent). It showed that the props have a high level of convenience, which means that most students stated that the tool were easy to use. While students who have difficulty in using the tools just as much as 1.6%. Thus it can be concluded that in general if this tool have developed have high rashness, so it can be used by students, particularly students of SMK number 6 Tanjung Jabung Timur.

The third aspect that assessed by students is associated with the "attractiveness" of tool. On this aspect the students who had positive perception (strongly agree and agree) in total amount 96.8% (78,3% + 18.5 percent). These Data showed that most of the students stated that the developed tool is very interesting. Because of its very interesting it is possible to use of this tools can improve student learning motivation, which can increase the mastery of physics concepts, especially on the subject of reflection of light. As for students who stated that such instrument were less attractive as much as 3.2%, this is because some students had ever seen a similar tool in elsewhere. This indicate some students are students who come from outside of the region. However, in general it can be concluded that the tool that being developed is capable to attract of most students.

#### **4 CONCLUSION**

Based on the Testing validation and field validation, so the third assessment aspect such as suitability, convenience and attractiveness then it can be affirmed that the light reflection props that have been developed had the level of suitability, convenience and high attractiveness. Thus the tool is fit for use, especially for Physics learning material of SMK and students at the same level in General.

#### **5 SUGGESTION**

- In order to achieve the use of props in this light reflection mirror by well in order to use the worksheet reflection light props that have been specified.
- The weakness of the this light reflection props on the media smoke because the manufacture smoke media is still manual and the smoke trouble the breathing and vision when the measurement takes place, so it suggest to carefully and thoroughly at the time of practical takes place.
- In measurement of the effectiveness level of this light reflection props should be carried out by a number of physics teachers of some from any vocational high school or so on that are different.

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