DOI: 10.14421/impulse.2023.32-01

IMPULSE: Journal of Research and Innovation in Physics Education
Volume 3, Issue 2, 64 – 76

© ISSN (p): 2798–1762; ISSN (e): 2798-1754
http://ejournal.uin-suka.ac.id/tarbiyah/impulse

The Validation of a Video-based Learning Instrument (Tracker) on the Material of Free-Falling Motion with the PBL Model

Bagus Pratama[1*], Tsania Nur Diyana[1]

[1] Department of Physics Education, Universitas Negeri Yogyakarta, Indonesia
*Corresponding author: bagus0026fmipa.2020@student.uny.ac.id

ABSTRACT

This study aims to describe the validity of the VBL learning device (Tracker) on GJB material through the PBL model. This research is research and development, but this article is only at the validity stage. The research instrument used is a validation sheet. The resulting learning tools are validated by one expert. The results of the analysis show that 1) the validity of the device in terms of the validation of the RPP (Learning Implementation Plan) obtains a score of 3.65 in the valid category, the validity of the LKPD (Student Worksheets) obtains a score of 3.81 in the valid category, and the validity of the THB (Learning Outcomes Test) obtains score 4 valid theory. It was concluded that the VBL learning tool (Tracker) on GJB material through the PBL model is in the valid category so that it can be used for the next development stage.

INTISARI

Penelitian ini bertujuan untuk mendeskripsikan validitas perangkat pembelajaran VBL (Tracker) pada materi GJB melalui model PBL. Penelitian ini merupakan penelitian dan pengembangan, namun pada artikel ini hanya pada tahap validitasnya saja. Instrumen penelitian yang digunakan berupa lembar validasi. Perangkat pembelajaran yang dihasilkan divalidasi oleh satu orang pakar. Hasil analisis menujukkan bahwa 1) validitas perangkat ditinjau dari validasi RPP (Rencana Pelaksanaan Pembelajaran) memperoleh skor 3,65 berkategori valid, validitas LKPD (Lembar Kerja Peserta Didik) memperoleh skor 3,81 berkategori valid, dan validitas THB (Tes Hasil Belajar) memperoleh skor 4 berkateori valid. Disimpulkan bahwa perangkat pembelajaran VBL (Tracker) pada materi GJB melalui model PBL berkategori valid, sehingga dapat digunakan untuk tahap pengembangan selanjutnya.

ARTICLE HISTORY
Received: May 23, 2023
Accepted: March 25, 2024

KEYWORDS:
Free fall motion, Instructional media, Problem-based learning

KATA KUNCI:
Gerak jatuh bebas, Media pembelajaran, PBL

* Corresponding author:
Bagus Pratama, Department of Physics Education, Universitas Negeri Yogyakarta, Indonesia
✉ bagus0026fmipa.2020@student.uny.ac.id

A. Introduction

The vast development of electronic fields and science and technology encourage humans to encounter the digital era. In this current 4.0 industry, all matters are sophisticated with shifts of human employment into robotic implementations. Humans must respond the advanced technological development positively. This matter also goes for the teacher candidates to use technology in education. Electronic uses could facilitate learners in understanding various concepts, especially physics concepts.

Physics refers to a science that discusses various concepts, facts, principles, laws, and natural phenomena with the implementation of scientific methods to prove. This matter goes from the real into abstract matters [1]. With the concepts of force, energy, and motion, physics could explain various natural phenomena including mechanics, terma, optical, electrical, magnetic, and various phenomena. With the implementation of scientific and mathematical methods, physics could facilitate humans to understand the basic principles. These principles regulate the universe; open new technological inventions; and advance human civilization.

The process of implementing physics requires accurate media implementation. Suyanto [2] explains that an excellent or effective learning media should cover three important aspects (within certain conditions), such as content material, media design, and effectiveness aspects. The learning media test is useful to ensure the reliability of the developed media based on the learning context. This test includes the evaluation of various aspects such as reliability, technical, information clarity, user accessibility, learning objective relevance, and learning outcome effectiveness with the media implementation. Besides that, the test covers the trial run of the representative users to gain useful feedback for further quality improvement, broad implementation, and effectiveness determination. One of the crucial physics materials is free-fall objects due to the gravitational force without considering the air friction. The implementation of relevant learning media for the material is important because of the complex concept. Thus, relying on verbal lectures is not recommended. Media such as animation or computer simulation could facilitate learners to visualize the free-falling motions. Besides that, the implementations of graphics, data tables, and relevant real cases could facilitate the learners to understand the concepts of time, distance, velocity, and acceleration of the free-falling motion and the entailing physics laws.

Various efforts of school physics learning include the implementation of accurate learning media to facilitate material delivery. The applicable learning media to share the facts and concepts of physics may include photographs, videos, and properties. These media implementations could realize a qualified learning process [3]. The media implementations could facilitate the learners' understanding while the teachers are delivering the materials.

The limited physics properties at schools become a hindrance to the experimental method in delivering the physics concepts [4]. Most properties are expensive so schools cannot afford the properties to facilitate the practices of free-falling objects. Thus, most schools teach the material conventionally. One of the efforts to measure the time of the falling object is with a stopwatch. This measurement technique makes the practice of calculating the free-falling motion not accurate because the falling objects are fast. Thus, merely relying on the human visual capability manually [5]. Measuring the time aspect manually during the practices of free-falling objects is susceptible to measurement mistakes so the obtained data are not accurate. Therefore, accurate media implementation is important to facilitate learners in learning the material. One of the applicable media for learning is the implementation of software-based media. The advancements in technology and computers, including the developed software by IT experts are excellent for example the Tracker software.

Tracker software could analyze and model the phenomena of motion and optics freely. This software is developed by Open Source Physics, OSP, with the Javascript programming language and specific design to learn physics (physlets.org). Tracker software could analyze videos in the form of video-based learning with the design of presenting actual physics phenomena in the forms of quantitative data and graphics simultaneously [6]. The tracker software facilitates learners to analyze an object's motion in a video by tracing the track in the video.

In this research, the researchers found many learners could not design the video-based learning media correctly and autonomously. Many learners did not have any interpretation of the VBL media to analyze with the tracker software. They could not do this action because the software was not familiar to the learners and had to be adjusted to the discussion contexts, such as the real physics event as the principle of the learning concept. Therefore, the capabilities of educators in developing physics learning videos are important to facilitate the understanding of complex and abstract physics concepts. Video implementations could facilitate abstract conceptual understanding because of the capability to show the acceleration, deceleration, and detail of the observed objects by learners [7]. Therefore, the integration of directive and guided learning models for learners is important to encourage the learners to find the learning concepts by designing the VBL media. The applicable learning to facilitate the learners in finding the physics concepts in daily life is - the problem-based learning model.

Arend [8] explains that a learning model with a learner-centered approach and authentic problem encourages learners to arrange personal cognition, develop personal psychomotor, and inquiry, and autonomy capabilities. A PBL model has some features of real-life problems as something to learn. The PBL model could facilitate learners to master various skills instead of the memorized information skill.

The skills may include problem-solving, critical thinking, collaborative performance, interpersonal, communication, and information-finding and management skills. This research describes the validity of the physics learning instrument about free-falling objects based on VBL (tracker) media on the PBL model.

B. Method

This research and development develops a valid VBL-based learning instrument, the Tracker on the PBL model based on the lesson plan, the worksheet, and the learning outcome test. The applied development model is the 4D model. This model consists of defining, designing, developing, and disseminating.

First, is the defining stage. This step collects information about the necessity. The collected information includes the analyses of necessity, the identification, and the cause of the learning problems about the free-falling object material. Second, the designing stage. This step designs the relevant strategy to develop the VBL learning instrument, the Tracker, on the PBL model to overcome the problems experienced by the learners. Third, is the developing stage. This step produces the required learning instrument. The developed learning plan included the lesson plan, worksheet, and learning outcome test arrangements to support the learning. The final step, the dissemination. This step disseminates the evaluation of the product validity based on the validity results and publishes the product in journals.

The product validity requires a validity test by the experts [9]. The applied research instrument was the validity sheet with systematic arrangement. The researchers collected the data with the validation process by two experts, and the supervising lecturers. The collected data from the learning instrument assessment consisted of a lesson plan, worksheet, and learning outcome test. Then, the researchers analyzed the data descriptive qualitatively to determine the validity category of the developed product. The valid category of the instrument is based on the score comparisons based on the validity criteria of the learning instruments [10].

Then, the researchers assessed the media validity based on the given aspect by involving two expert lecturers. After collecting the data, the researchers weighted each response and calculated the mean with the following formula.

$$\bar{x} = \frac{\sum X}{n} \quad (1)$$

Remarks:
$\bar{x}$ = mean
n = the total of the assessors
ΣX = each total score

The researchers categorized the learning media validity based on the following criteria [11].

Table 1. The Criteria for the Media Validity

Score	Category
0-1	Invalid
1-2	Less valid
2-3	Adequately valid
3-4	Valid

C. Result and Discussion

The experts reviewed the developed teaching materials. The results of the development were expected to be applied by the SHS learning within the material of free-falling objects. The developed teaching materials were a lesson plan, worksheet, and learning outcome test.

The Lesson Plan

A lesson plan refers to the arranged procedure to direct the teaching-learning activity in achieving the determined learning objectives. The lesson plan format should refer to the learning achievements, and indicators of competence achievements (cognition, attitude, and psychomotor). The learning objectives then elaborated on the points of the indicators. Then, the learning strategy consisted of the model, method, approach, material, learning source, and learning assessment.

The validation test of the learning instrument development was valid based on the validation sheets by the validators [12]. The validity test of the lesson plan consisted of some assessment aspects, such as school identity, lesson identity, core material, learning objective, core competence achievement indicator, media, tool, learning source, learning activity, assessment, and language. Table 2 shows the calculation of the lesson plan validation test.

Table 2. The Results of the Lesson Plan Validity

The Assessment Aspect	Results	Category
School Identity	4	Valid
Lesson plan identity	4	Valid
Core material	4	Valid
Learning objectives	4	Valid
Worksheet	3	Valid
Media, tools, and learning sources	4	Valid
		Valid
Learning Activity	3.6	Valid
assessment	3.3	Valid
Language	3	Valid

The aspect of the school identity consists of two sub-aspects: the name of the educational unit with complete writing; and the class and the semester with complete writing. The results of the expert lecturer validations obtained a mean of 4 with the category of valid. The aspect of lesson identity consists of two sub-aspects: the lesson identity with complete writing; and the core material identity with complete writing. The results of the expert lecturer validations obtained a mean of 4 with the category of valid. The aspect of core material consists of one sub-aspect, the relevant primary materials based on the applied core and basic competencies. The results of the expert lecturer validations obtained a mean of 4 with the category of valid. The aspect of the learning objective consists of two sub-aspects: the relevance with the applied basic competence; and the relevance between the learning objective formulation and the learning process and achieved results. The results of the expert lecturer validations obtained a mean of 4 with the category of valid. The aspect of the core competence achievement indicator consists of three sub-aspects: the relevance with the basic competence, the relevance with the learning objective, and the relevance between the operational verbs and the measured basic competencies. The results of the expert lecturer validations obtained a mean of 3 with the category of valid. The aspect of media, tools, and learning sources consists of two sub-aspects: the relevance with the learning material and the relevance with the basic competence. The results of the expert lecturer validations obtained a mean of 4 with the category of valid. The aspect of learning activity consists of five sub-aspects: displaying the preliminary activity, core activity, closing activity, the relevance between core competence and basic competence, the relevance between the learning objective and worksheet, the relevance of the learning model syntax, and the relevance of the time allocation. The results of the expert lecturer validations obtained a mean of 3.6 with the category of valid. The aspect of assessment consists of three sub-aspects: the relevance between the assessment procedure and the targeted objective, the question, the answer, the clear and comprehensive written notifications, and the relevance with the worksheet. The results of the expert lecturer validations obtained a mean of 3.3 with the category of valid. The aspect of language consists of two sub-aspects: the standardized Indonesian language and the implementation of non-ambiguous words. The results of the expert lecturer validations obtained a mean of 3 with the category of valid. The validation results with valid categories describe that the developed lesson plan met the standard of excellent lesson plan components.

Worksheet

A worksheet refers to a collection of sheets consisting of tasks as directions for the learners to understand materials and to reach the learning objectives. The directions for filling out the worksheet are useful to guide the learners in carrying out experiments by reading the guidelines. This procedure allows learners to be

independent and not rely on the teachers directly to guide the experiment. The validity test of the worksheet consists of some assessment aspects, such as the experimental activity, the language aspect, the material, and the relevance of the STEM approach. The results of the validity calculation toward the worksheet with the following formula, Table 3.

Table 3. The Results of the Worksheet Validation

The Assessment Aspect	Results	Category
Experimentation	4	Valid
Language	4	Valid
Material	3.5	Valid
The relevance of the STEM approach	3.75	Valid

The aspect of experimentation consists of five sub-aspects: the experimentation based on the systematic and clear worksheet, the easily applied experimentation, the worksheet activity to enrich new learning experiences, the worksheet activity to facilitate learning objective achievement, and the worksheet activity to encourage learners. The results of the expert lecturer validations obtained a mean of 4 with the category of valid. The language aspect consists of five sub-aspects: the easily applied and less ambiguous language, the model and clear sentence implementation, the clear figure implementation in the worksheet, the relevance of the applied font type, and the relevance of the applied font size. The results of the expert lecturer validations obtained a mean of 4 with the category of valid. The aspect of the material consists of two sub-aspects: the relevant material between the core competence and the basic competence; and the relevance of the applied terms. The results of the expert lecturer validations obtained a mean of 3.5 with the category of valid. The results of the worksheet validity are generally valid. The aspect of the relevance with the STEM approach consists of four sub-aspects: the experimentation based on observation, the technology implementation, the science and technology implementation in practical life, and the calculation skills. The results of the expert lecturer validations obtained a mean of 3.75 with the category of valid. The validation results achieved a valid category. This finding describes that the developed worksheet meets the standard of excellent worksheet components.

The Learning Outcome Test

The applied learning outcome test is useful to examine the effectiveness of the promoted learning with the developed learning instruments. The developed learning outcome test is useful to examine the learning effectiveness with multiple choice and essay types to determine the learners' cognitive skills. The validation result of the learning outcome test consists of the aspects of material, construction, and language. Table 4 shows the evaluation results of the learning outcome test.

Table 4. The Results of Learning Outcome Validation

The Assessment Aspect	Results	Category
Content or material	4	Valid
Construction	4	Valid
Language	4	Valid

The aspect of the material consists of two sub-aspects: the relevance of the achieved basic competence, the relevance between the question and the measured indicator, the logical and homogeneous answer option, and the accurate answer selection. The results of the expert lecturer validations obtained a mean of 4 with the category of valid. The construction aspect consists of four sub-aspects: the formulated question core, the non-key answer question, the relatively similar formulation length, and the non-correlated question option with the previous question. The results of the expert lecturer validations obtained a mean of 4 with the category of valid. The language aspect consists of three sub-aspects: using the Indonesian language based on the standard, non-ambiguous answer options, and clear and understandable sentences. The results of the expert lecturer validations obtained a mean of 4 with the category of valid. Table 4 shows the results of the learning outcome validation. All presented items are valid. The question items in the learning outcome test are in line with the learning objectives. The arranged items are based on the scoring guidelines and directions based on the cognitive levels of the questions. The developed test arrangement is based on the correct and standard Indonesian language. The arrangement of the test is based on the criteria of an excellent test, such as practicability and clear assessment [13]. Daryanto & Dwicahyono [14] also explain that the arranged test must apply clear sentences to avoid ambiguity. The validation results of the test receive the category of valid. The results describe that the developed test could provide valid data to measure the learning effectiveness correctly. Table 5 shows the question item rubrics.

Table 5. Rubrics and the Question Examples

No.	The Indicators of the Question Items	Question items	Discussion
1.	Calculating the final velocity of an object	1) From the peak of the Enies Loby building, Chopper drops a cannonball. If the height of the building is 500m, calculate the speed of the	Given h = 500 m g = 10 m/s^2 Solutions $V_t^2 = 2.g.h$ $V_t = \sqrt{2.g.h}$

			cannonball once it touches the ground.	$V_t = \sqrt{2.10.500}$ $V_t = \sqrt{10000}$ $V_t = 100\ m/s$ The speed of the cannonball thrown by Chopper once it touches the ground is 100 m/s.
		2)	Agus drops a durian from a 20-meter-high tower. Calculate the speed of the durian once it touches the ground! a. 20 m/s b. 10 m/s c. 25 m/s d. 40 m/s e. 80 m/s	Given h = 20 m g = 10 m/s^2 Solutions $V_t^2 = 2.g.h$ $V_t = \sqrt{2.g.h}$ $V_t = \sqrt{2.10.20}$ $V_t = \sqrt{400}$ $V_t = 20\ m/s$ Thus, the speed of the thrown durian by Agus is 20 m/s once it touches the ground.
2.	Calculating an object's speed within a certain time	3)	Nathi drops an orange from the branch into the ground with an elapsed time of 5 seconds. Calculate the dropped orange's speed at 2 seconds if the g = 9.8 m/s^2.	Given g = 9,8 m/s^2 t = 2 s Solutions $V_t = V_0 + g.t$ $V_t = 0 + 9{,}8.2$ $V_t = 19{,}6\ m/s$ Thus, the speed of the orang at the 2 seconds after slipping from the branch is 19.6 m/s.
		4)	A coconut falls from the tree into the ground within 5 seconds. Calculate the speed of the fallen orange at 4 seconds if the g = 10 m/s^2. a. 20 m/s b. 10 m/s c. 40 m/s d. 50 m/s e. 25 m/s	Given g = 10 m/s^2 t = 4 s Solutions $V_t = V_0 + g.t$ $V_t = 0 + 10.4$ $V_t = 40\ m/s$ Thus, the speed of the fallen coconut at 4 seconds is 40 m/s.
3.	Calculating the time of the fallen object into the	5)	While chasing the enemy, Zoro unintentionally	Given h = 80 m g = 10 m/s^2

	ground		dropped off his sword. If the sword has fallen from an 80-meter height, calculate the time of the sword to reach the ground!	Solutions $t^2 = \frac{2.h}{g}$ $t = \sqrt{\frac{2.h}{g}}$ $t = \sqrt{\frac{2.80}{10}}$ $t = \sqrt{16}$ t = 4 s Thus, the time for the fallen sword to reach the ground is 4 seconds.
		6)	A bomb falls from 180-meter height, calculate the time to reach the ground! a. 9 s b. 18 s c. 3 s d. 6 s e. 2 s	Given h = 180 m g = 10 m/s^2 Solutions $t^2 = \frac{2.h}{g}$ $t = \sqrt{\frac{2.h}{g}}$ $t = \sqrt{\frac{2.180}{10}}$ $t = \sqrt{36}$ t = 6 s Thus, the time for the bomb to reach the ground is 6 seconds.
4.	Calculating the object height within a certain time	7)	Trafalgar Law drops a block of ice from a 50-meter height. Calculate the position of the iceberg after three seconds!	Given $h_0 = 50\ m$ t = 3 s Solutions $h = h_0 - \frac{1}{2} g.t^2$ $h = 50 - \frac{1}{2} 10.3^2$ h = 50 – 5.9 h = 50 – 45 h = 5 m Thus the position of the fallen rock after three seconds is at 5 meter height

			from the ground.
		8) Albert unintentionally drops a box from 100-meter height. Calculate the position of the box after 4 seconds! a. 20 m b. 40 m c. 10 m d. 25 m e. 5 m	Given $h_0 = 100\ m$ t = 4 s Solutions $h = h_0 - \frac{1}{2} g.t^2$ $h = 100 - \frac{1}{2} 10.4^2$ h = 100 – 5.16 h = 100 – 80 h = 20 m Thus, the position of the box after 4 seconds is 20 meters above the ground.
5.	Calculating the time of a fallen object from a certain height	9) A basketball falls from h meter above the ground. The speed of the ball once it hits the ground is 30 ms^{-1}. The required time to reach the 1/2 h above the ground (g = 10 ms^{-2}) is	Given g = 10 m/s^2 V_0 = 0 m/s V_t = 30 m/s Solutions $vt^2 = 2\ g\ h$ $30^2 = 2\ 10\ h$ h = 900/20 h = 45 m h = ½ g t^2 45 = ½ 10 t^2 t^2 = 45/5 t = 3 s Thus, the required time to reach 1/2 h above the ground is 3 seconds.
		10) A cannon ball falls from h height above the ground. The speed of the ball once it hits the ground is 20 ms^{-1}. The required time to reach the 1/2 h above the ground (g = 10 ms^{-2}) is . . . . a. 2 s b. 10 s c. 5 s d. 20 s e. 4 s	Given g = 10 m/s^2 V_0 = 0 m/s V_t = 20 m/s Solutions $vt^2 = 2\ g\ h$ $20^2 = 2\ 10\ h$ h = 400/20 h = 20 m h = ½ g t^2 20 = ½ 10 t^2 t^2 = 20/5 t = 4 s Thus, the required time to

			reach 1/2 h above the ground is 4 seconds.
6.	Calculating the height of a falling object	11) An apple falls from a tree with h height. If the required time to reach the ground is 5 seconds, calculate the height of the apple tree! (g = 10 m/s2)	Given g = 10 m/s^2 V_0 = 0 m/s s = 5 detik Solutions h = ½ g t^2 h = ½ 10.5^2 h = 5.25 h = 125 meter Thus, the height of the apple tree is 125 meters.
		12) A *keris* falls from a tower with h height. If the required time to reach the ground is 6 seconds, calculate the height of the tower! (g = 10 m/s2) a. 180 m b. 60 m c. 30 m d. 120 m e. 40 m	Given g = 10 m/s^2 V_0 = 0 m/s s = 6 detik Solutions h = ½ g t^2 h = ½ 10.6^2 h = 5.36 h = 180 meter Thus, the height of the tower is 180 meters.

D. Conclusion

Based on the assessment of the VBL-based learning instrument, the Tracker, with the PBL model, the validation result of the lesson plan is 3.65, the validation result of the worksheet with 381, and the learning outcome test validation with a score of 4. The whole validation results indicate a valid category. Based on the learning instrument validation result, the developed product, the physics learning instrument about the free-falling motion could be applied in the next development stage.

Acknowledgments

Thanks to all respondents and participating parties for to success of this research.

References

[1] S. Maiyena, M. Imamora, and F. Ningsih, "Pengembangan Alat Praktikum Gerak Jatuh Bebas Menggunakan Sensor Phototransistor untuk Pembelajaran Fisika pada Materi Gerak Jatuh Bebas," *Sainstek J. Sains dan Teknol.*, vol. 9,

no. 1, 2018, doi: 10.31958/js.v9i1.750.
[2] E. Suyanto, *Penguasaan Teori dan Praktik Membuat Skenario Pembelajaran Mikro*. Bandar Lampung: Universitas Lampung, 2006.
[3] Sudjana, *Dasar-Dasar Proses Belajar Mengajar*. Bandung: Sinar Baru Algensindo, 2011.
[4] N. Qomariyah, R. Wirawan, S. Minardi, S. Alaa', and I. G. N. Yudi Handayana, "Pendalaman Konsep Fisika Menggunakan Alat Peraga Berbasis Mikrokontroler pada Siswa SMA," *Selaparang: J. Pengabdi. Masy. Berkemajuan*, vol. 4, no. 1, 2020, doi: 10.31764/jpmb.v4i1.3225.
[5] M. K. Hamdani and S. Supardiyono, "Rancang Bangun Alat Praktikum Gerak Jatuh Bebas Digital Berbasis Sensor Inframerah," *IPF Inov. Pendidik. Fis.*, vol. 9, no. 3, 2020, doi: 10.26740/ipf.v9n3.p410-416.
[6] M. Subhan, F. Fat, and N. Almaidah, "Pemanfaatan Media Pembelajaran LoggerPro Terhadap Pemahaman Konsep Fisika Pokok Bahasan Osilasi Sederhana pada Siswa Kelas XI," *Gravity Edu (Jurnal Pendidik. Fis.*, vol. 2, no. 2, 2019, doi: 10.33627/ge.v2i2.239.
[7] S. Hafizah, "Penggunaan dan Pengembangan Video dalam Pembelajaran Fisika," *J. Pendidik. Fis.*, vol. 8, no. 2, pp. 225–240, 2020, doi: 10.24127/jpf.v8i2.2656.
[8] R. I. Arends, *Belajar untuk Mengajar*. Yogyakarta: Pustaka Pelajar, 2008.
[9] S. Akbar, *Instrumen Perangkat Pembelajaran*. Bandung: Remaja Rosdakarya, 2016.
[10] S. E. P. Widoyoko, *Hasil Pembelajaran di Sekolah*. Yogyakarta: Pustaka Pelajar, 2016.
[11] I. Ernawati, "Uji Kelayakan Media Pembelajaran Interaktif pada Mata Pelajaran Administrasi Server," *Elinvo (Electronics, Informatics, Vocat. Educ.*, vol. 2, no. 2, 2017, doi: 10.21831/elinvo.v2i2.17315.
[12] M. Wati, M. Misbah, and P. A. Lestari, "The Validity of Physics Module Class X Accompanied Peer Assessment Peer in a Topic Circular Motion," in *The 4th International Conference On Educational Research and Innovation*, Yogyakarta: Universitas Negeri Yogyakarta, 2016.
[13] K. Kusaeri and S. Suprananto, *Pengukuran dan Penilaian Pendidikan*. Yogyakarta: Graha Ilmu, 2012.
[14] Daryanto and A. Dwicahyono, *Pengembangan Perangkat Pembelajaran (Silabus, RPP, PHB, Bahan Ajar)*. Yogyakarta: Gava Media, 2014.