P-ISSN: 2580-5525 | E-ISSN: 2580-5533
https://journal.uny.ac.id/index.php/jk/

Website-based formative feedback needs analysis in physics learning

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Abstract: The limitations of time and facilities, and the difficulty of conducting formative evaluation cause teachers to skip the assessment stage. This causes the learning process to run less optimally because students do not get instructions or guidance properly. This research aimed on analyzing the need for website-based formative feedback in physics learning by applying ADDIE research design. The test subjects in this research were 485 students in 12th grade from the Mathematics and Science Program and 13 physics teachers from 13 districts in South Kalimantan. Data collection techniques were obtained through questionnaires and interviews. The results of this research show that website-based formative feedback are needed, which allows: feedback to be delivered both verbally and non-verbally, delivery accuracy addressed to each student or as a group, and focus not only on students' ability but also on their lack of concepts. The results of this research are expected to be one of the alternative solutions to formulating the development of website-based formative feedback assessments, especially in physics learning.

Keywords: *formative feedback, website, physics learning*

How to cite (APA 7th Style): Sasmita, F. D., Kusairi, S., & Khusaini. (2022). Website-based formative feedback needs analysis in physics learning. *Jurnal Kependidikan*, *7*(1), 105- 116. https://doi.org/ 10.21831/jk.v7i1.58102

INTRODUCTION

The development of science and technology has become an integral part of the current education sector. In line with this the knowledge transfer system must be able to keep pace with science and technology developments by integrating ICT or Information and Communication Technology in the learning process (Fauzi, Wahyuningsih, Kurniawan, & Setiono, 2016; Permatasari, Ellianawati, & Hardyanto, 2019)demanding innovation in the delivery of learning. So that this study has the aim of developing, knowing the feasibility of online web-based learning and assessment tool in physics, as well as knowing students' learning results in the ICT media. This study research & development (R&D. ICT plays an important role in developing the education system, so that all subjects will ultimately depend on ICT (Rodríguez, 2015; Habibi & Habibi, 2014).

In this regard, many studies reveal the role of technology in education, as stated by Drigas and Kontopoulou (2016), that the use of computers has become an integral part of learning, especially in physics lessons. Learning connected to ICT, such as certain websites or pages, is stated to positively impact the achievement of physics learning outcomes (Chandra & Watters, 2012) and physics study motivation (Afrilia, Rusli, Tanti, Mutamasikin, & Yusuf, 2021). One of the ICT breakthroughs in physics is the presence of Computer Assisted Assessment (CAA). CAA refers to the use of computer equipment to assess the progress of students' grades or learning achievements (Chalmers & McCausland, 2002).

Issues regarding assessment or assessment are one of the important factors in monitoring the development of physics learning outcomes. One of the assessments that are used as the first priority in learning practice is the assessment for Learning (AFL) with a strategy in the form of a formative feedback (Flórez & Sammons, 2013). This is as stated by (Stăncescu & Drăghicescu, 2017) that assessment in a formative strategy is seen as a form of assistance so the teacher has the responsibility of providing feedback that helps students to identify learning strengths and weaknesses, as well as giving suggestions about what should be learned or improved. Therefore a positive combination is needed between the active involvement of students and continuous, diverse, and appropriate feedback from the teacher (Owen, 2016)the instructor introduced a number of increasingly complex low-stakes assignments for students to complete prior to submitting their final project. Concrete, constructive feedback from either the instructor or peers or both was offered at each stage of the project so that students could have the opportunity to review their work and improve particular aspects prior to moving on to the next assignment. Student performance on each subsequent submission was assessed through the use of a scoring rubric. Although there was significant improvement from one draft of a given assignment (T1.

However, it is not uncommon for teachers to face obstacles or difficulties when giving feedback to students. The obstacle that is generally faced by teachers when providing feedback is the large number of students in the class so that it is difficult for the teacher to interact individually with each student (Suryadi & Kusairi, 2021). This is related to the characteristics of feedback which must pay attention to the content (substance) and delivery methods according to the needs of students. As stated by Hatziapostolou and Paraskakis (2010) that the components in feedback include the content of the feedback and the methods used to deliver the feedback. Meanwhile, efforts to support the physics learning process through formative feedback are still very rarely done. This is based on several constraints, such as too many students in one class (Quyen & Khairani, 2017)meso- and macro- level. Yusoff (2013) also describes the two main factors that hinder the implementation of feedback during the learning process, namely the teacher's limited time to make or provide feedback and the lack of training programs obtained by teachers related to how to optimize the role of feedback in the learning process.

Formative assessment and feedback are fundamental aspects that must be provided substantially in the design and learning process (Morris, Perry, & Wardle, 2021). Therefore the components in feedback, such as functions and objectives, content or substance, and method of presenting feedback must be considered separately and interactively with the characteristics of the learner (Flórez & Sammons, 2013). Meanwhile, Stăncescu and Drăghicescu (2017) states that each student; both with high and low academic achievement must receive feedback. The main benefit of having feedback according to Morris *et al*. (2021) is to support the development of students' understanding so as to improve the achievement of learning outcomes. This, of course, can make it easier for teachers/ instructors to carry out the assessment process so that learning can run more effectively and efficiently, as well as help the evaluation process more thoroughly for teachers in schools.

So far, one of the efforts to overcome this is through formative assessment. Formative assessment contains continuous feedback or feedback in the learning process which allows students or teachers to know the progress of the learning process (Andrade & Heritage, 2017; Molin, Haelermans, Cabus, & Groot, 2021), promote learning and improve learning

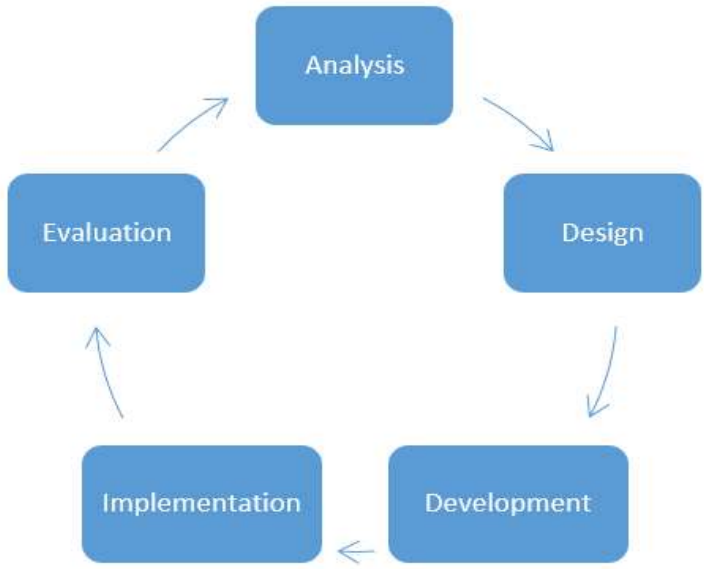
outcomes (Menéndez, Napa, Moreira, & Zambrano, 2019), have significant impact on learning motivation and student learning outcomes, improving teacher performance during learning (Jeffs & Piera, 2016; Ozan & Kıncal, 2018), help students understand cocepts (Suryadi & Kusairi, 2021), and improve understanding of concepts (Pratama, Wartono, & Kusairi, 2019) as well as encourage increased problem-solving skills (Irvani, Warliani, & Fauziyyah, 2020).

Based on this description, this study aims to anlyze the need for website-based formative feedback in physics learning as a solution for teachers and students, at the upper secondary level (SMA/MA) and equvalent, especially for schools in South Kalimantan Province.

METHOD

This research was part of research and development (Research and Development) with the ADDIE research design (analysis, design, development, implementation, and evaluation), as shown in Figure 1. This article focused on the stages of analysis as part of the preliminary study. This research was conducted in July 2022. The test subjects in this study were 485 students in class XI of the MIPA program and 13 physics teachers spread across 13 districts/ cities in South Kalimantan Province.

Figure 1. ADDIE framework



Source: Molenda (2003) cited in Allen (2017)

Data collection was obtained through questionnaires and interviews. The questionnaire is in the form of a need questionnaire in physics learning. The questionnaire distributed online and consisted of 15 statement items adapted from Kyaruzi, Strijbos, Ufer, and Brown (2019) and arranged with a Likert scale of 1-4, as well as 3 open-ended questions adapted from Al-Shehri (2008). The questionnaire for teachers consists of 3 open-ended questions adapted from (Al-Shehri, 2008). The interview instrument for students consists of 2 questions adapted from (Walker *et al*., 2020), and for teachers, it also consists of 2 questions adapted from (Clemons,

2018). The data obtained were then analyzed by calculating the percentage of the response questionnaire from teachers and students. The interview data were analyzed descriptively.

FINDINGS AND DISCUSSION

This research is an early stage of research and development which aims to obtain an overview of the need for website-based formative feedback to improve students' understanding of concepts in physics lessons. The research results related to needs analysis on websites designed by researchers are presented in Figure 2, 3, and 4. The results of the research based on student response questionnaire scores are presented in Table 1.

Based on Table 1, for the indicators of perceived scaffolding, it is known that more than 88% of students agree that during physics learning, whether it's doing assignments or

Figure 2. Fortion display on laptop screen when logging in

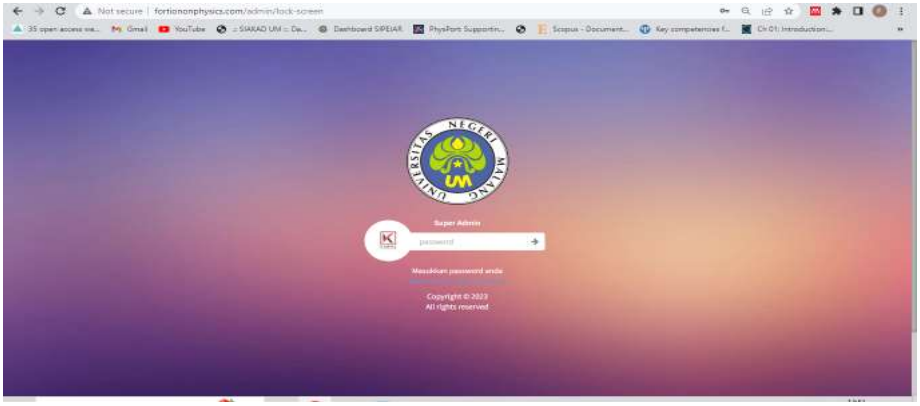


Figure 3. Fortion display on smartphone screen when login

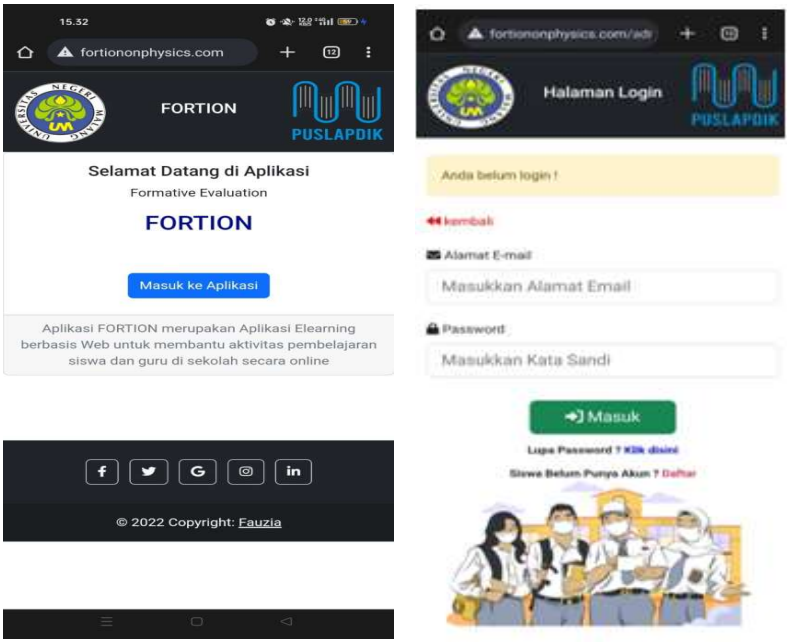
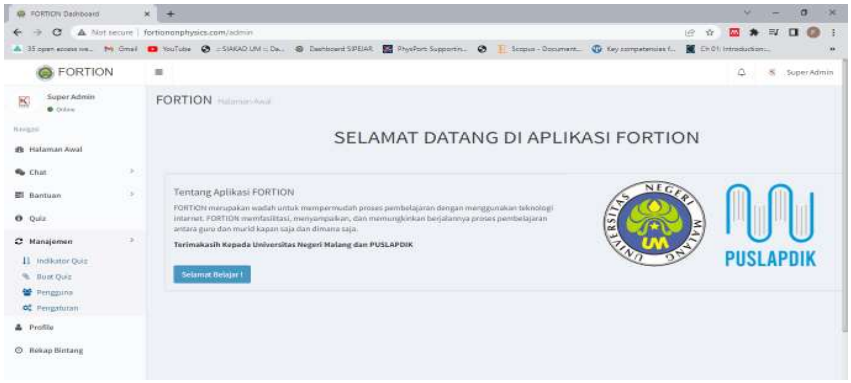


Figure 4. Initial display for user admin



Tabel 1
Student response questionnaire scores

No	Indikator	SA (%)	A (%)	LA (%)	D (%)
1	Perceived Scaffolding	28.61	60.27	10.00	1.49
2	Perceived Monitoring	19.79	51.27	20.36	6.19
3	Feedback Delivery	19.33	60.07	17.63	2.68
4	Feedback Use	23.92	62.27	9.76	1.65

Note:
SA : Strogly agree A : Agree LA : Less Agree D : Disagree

exercises, they get help and work instructions as well as opportunities to ask questions. Thus, students can measure the extent of their abilities and they can identify their weaknesses in sub-materials that they have not mastered. This is as stated Mamoon-Al-Bashir, Kabir, & Rahman (2016) that feedback plays an important role in improving the learning experience for students because it encourages improvement in self-assessment or reflection. Obilor (2019) also suggests that feedback allows students to identify learning weaknesses so that they can become independent evaluations for students.

As for the perceived monitoring indicators, it is known that more than 70% of students agree that during physics learning, they obtain control and guidance from their physics teacher. More than 70% of students also agreed that their teacher discussed the results of the assignments and exercises they collected so that according to them their physics teacher knew their weaknesses in learning physics. The role of the teacher in controlling student achievement also plays an important role in the learning process. Mamoon-Al-Bashir *et al*. (2016) states that teachers are usually more effective in detecting and identifying errors in students' assignments or work. Therefore, the information provided by the teacher is very important to ensure the achievement and learning process of students. The same thing was also stated Caballé, Daradoumis, Xhafa, and Juan (2011) that monitoring in feedback related to student performance is important so that students can achieve learning goals effectively.

The feedback delivery indicator shows that more than 79% of students agree that feedback plays an important role in increasing their learning motivation. Students also agreed that

the feedback they received from their physics teacher was objective and well understood. Meanwhile, for the feedback use indicator, 85% of students agree that feedback is a benchmark for them to evaluate their learning method. 85% of students also agreed that notes given by the teacher on assignments or physics exercises could help them to work on other practice questions, as well as encourage them to improve understanding and learning methods. This is as stated by Facullo (2022) and Wahyuni (2017) that indirect feedback or indirect correctional feedback delivered through notes or written notes on assignments collected by students, can guide students to improve their writing skills and problem-solving abilities. students, so according to Djudin (2020) it can have a positive impact on student learning outcomes.

These four indicators show that the teacher's role has been able to assist the physics learning process, especially with feedback; such as through teacher notes on assignments or exercises collected by students. As for comments related to feedback that students have obtained during physics learning, answers are obtained with substance as shown in Table 2.

Table 2 shows that the feedback obtained by students during the learning process was classified as positive and some was classified as negative. This is related to the responses

Table 2
Summary of student interview results

No	How do you feel about the feedback you received?
1	My teacher gave a plus point when I managed to answer his questions.
2	Feel proud of myself and increase my learning enthusiasm for the feedback the teacher gives, such as saying directly with the phrase "good, smart, good".
3	I think that while studying physics, there is rarely memorable feedback that can change me, because I think the feedback my physics teacher gave was feedback as a group, not individually, so I paid less attention to this feedback.
4	I want to get feedback with sound and in a good way, not by being scolded.
	What type of feedback did you receive from your teacher?
5	The feedback given was good in my opinion, but you don't recognize your students because you only met a few times yesterday, so you don't recognize your students where their weaknesses lie.
6	When studying with older siblings and friends, learning physics is more fun than studying formally with a schoolteacher.
7	It seems I rarely receive feedback from my physics teacher, so I'm not too sure about this.
8	There is good and bad feedback, please if you want to give bad feedback not in front of all class students, please give it in person.
9	No feedback has ever been given.
10	Feedback is rarely given.
11	In my opinion the teacher must explain using the correct technique and in accordance with the times and the level of understanding of his students.
12	The feedback is not bad, but sometimes the teacher doesn't show enough appreciation.
13	When giving material at school it is more difficult to understand than during tutoring, in tutoring places it is easier to understand and there is no pressure.
14	The comments given may be good but have anger and words that are less heartful which can reduce interest in learning, learning mood and understanding of the material.

of students who think that their teacher gives comments in language that is less subtle and less communicative. This acceptance affects students' responses to interests and ways of learning physics while in class. As stated by Ullah, Badshah, and Qamar (2018), the method of delivering the teacher in the learning process has a significant impact on academic achievement and the achievement of student learning outcomes. Tang and Hu (2022) also shows that the teacher's discouraging attitude is a factor that leads to student demotivation. Demotivation causes students to start to feel a loss of enthusiasm for learning, it has bad consequences because it reduces their interest in physics lessons.

Even so, there were also students who showed a positive response to the feedback they received during the physics learning process. Their teachers give appreciation in the form of values and also positive expressions that increase the enthusiasm and motivation of students' learning. Appreciation is intended to stimulate the potential of students and build a positive learning environment. As for finding out more about the mechanism for receiving feedback obtained by students and given by teachers, Table 3 and 4 are presented.

As the results of the interviews shown in Table 2, there are not a few students who feel that they have not been optimally facilitated during the physics learning process. Table 3 shows that students want to get direct/oral feedback (88.90%), which is directed at themselves personally (55.30%) and focuses on their abilities and weaknesses (58.10%). Meanwhile,

Table 3
Percentage of student response questionnaire scores: Acceptance of feedback

Statement	Oral (%)	Written (%)	
Student Response Questionnaire Scores: Acceptance of Feedback	70.10	29.90	
Statement	**Individual (%)**	**Group (%)**	
I would like to receive feedback by:	55.30%	44.70	
Statement	**Weaknesses (%)**	**My ability (%)**	**Both combination (%)**
I'd like to get feedback that focuses on:	22.70	19.20	58.10

Table 4
Percentage of teacher response questionnaire scores: Providing feedback

Statement	Oral (%)	Written (%)	
Feedback is always given in the form of:	88.90	11.10	
Statement	**Personal (%)**	**Group (%)**	
Learners get feedback by:	33.30	66.70	
Statement	**Weaknesses (%)**	**Ability (%)**	**Both combination (%)**
The feedback provided focuses on:	77.80	11.10	11.10

based on Table 4, it is known that the teacher is more dominant in providing direct/oral feedback (88.9%) which is focused as a whole (66.70%) and focuses on students' weaknesses (77.80%). These results indicate that there is still a gap between the needs of students and what has been provided by their teachers in physics lessons. To find out more about the feedback given by the teacher during the physics learning process, it is presented in Table 5.

Table 5 shows that the feedback given by the teacher during the physics learning process was in the form of repeating the material being taught, asking questions, explaining examples that are easy to find in everyday life, and building discussion spaces between students through peer feedback (feedback provided by students). to other students / feedback from colleagues). delivered by the teacher orally or in writing to any student. Delivery of feedback orally and in writing, according to the teacher, depends on the duration of the remaining time in learning. As the results of the teacher's narrative, the feedback given during the learning process

Table 5
Summary of teachers' interview results

No	How Feedback Given to the Students
1	After the students answered the questions, I gave feedback by directly explaining the parts that were missing or wrong or by asking again
2	Delivering answers/feedback directly, can also be through writing after giving grades in the exercise book
3	If time permits, written feedback. If time is running out, then only orally, and by random sampling.
4	Ask questions about the material being explained.
5	By giving a few short questions, at the end of the lesson
6	Providing a phenomenon related to everyday life that is familiar to students.
7	a. Provide positive comments on student answers. b. When there are questions from students, they are not immediately answered but can be thrown first to other students. c. When the discussion takes place, the teacher is involved so that he can find out the thinking processes of students in understanding the concept. d. Give praise to students who do the job well.
8	I give positive feedback that is objective and not emotional
	The advantages and disadvantages of formative feedback
9	Strengths: students immediately know which part is wrong or needs improvement. Disadvantages: it takes a lot of time
10	Pros: can provide improvements and suggestions to students in accordance with the learning material that has been taught in each chapter Disadvantages: have to prepare some feedback at each meeting
11	The advantage is being able to find out students' understanding in more detail than a summative test
12	The advantage is that we can find out how much students understand the material presented.
13	Can awaken students' memory of the material that has been studied
14	Formative feedback triggers students to be able to find out their own strengths and weaknesses but on the contrary this formative feedback requires an analysis of students' conditions appropriately.
15	The advantage is that students can find errors and can make improvements. The downside is that it will obviously take more time to analyze
16	The advantage of formative feedback is that students can correct their deficiencies so that they can be even better in the next lesson.

(formative feedback) does have advantages, such as being an independent evaluation material for students. The teacher can also find out which part of the material is still not understood by students, so the teacher can prepare the learning process at the next meeting.

However, the shortcomings of the process of providing formative feedback according to teachers are based on several reasons, such as the limited time for physics lessons, while giving feedback to each individual or student certainly requires a lot of time. The teacher must also be able to analyze the conditions or achievements of students appropriately so that the teacher can provide feedback according to the needs of students. This is in line with the research (Higgins, Grant, & Thompson, 2010) which states that formative feedback requires a lot of time, and if the analysis provided is not appropriate/incorrect, it actually results in a decrease in students' learning motivation. As stated (EEF (Education Endowmnet Foundation), 2021) that formative feedback should focus on the content, methods, and goals of individual feedback. Based on these guidelines, time and appropriate feedback preparation strategies are needed. In addition, the teacher must also prepare various types of feedback because each student has a different ability to absorb information, two of which are typical students with visual learning styles and audio-visual learning styles (Sulisawati, Lutfiyah, Murtinasari, & Sukma, 2019). Where these two learning styles are the most dominant learning styles, so feedback is needed that is able to facilitate students with these learning styles.

Based on these findings and analysis, a solution is needed in the form of learning tools that are able to play the role of the teacher in providing formative feedback to students. The reference put forward by the Education Endowmnet Foundation (2021) regarding three main things in providing feedback, which includes principles (effectiveness, focus on learning progress, and planning), methods (oral or written), and implementation (implementation). With reference to what students need and the constraints faced by teachers in the learning process in class, as well as the guidelines provided by the Education Endowment Foundation, the authors suggest tools in the form of technology-based formative feedback. Utilization of technology in formative feedback design according to Elmahdi, Al-Hattami, and Fawzi (2018) can improve the learning process in the classroom, increase the active participation of students, save study time, guarantee opportunities for equal participation, and create a fun learning environment. Technology provides solutions that allow to overcome some of the obstacles when implementing formative assessment, such as providing timely individual feedback on learning in a way that engages students so that the implementation of formative assessment can run more effectively (Heitink, Voogt, Fisser, Verplanken, & van Braak, 2016).

Thus, to facilitate the process of accessing technology-based formative feedback, the author specifically proposes a website-based formative feedback. The website is one of the options proposed because it allows access for all digital devices (Android, iPhone, Tablet, Windows, and so on). The website also does not use as much RAM (Random Access Memory) or storage space on digital devices as the website uses, so the use of the website is certainly more efficient than the application because it does not cause problems such as bugs.

CONCLUSION

Based on the data analysis results, it can be concluded that website-based formative feedback is needed which can facilitate students and make it easier for teachers to provide various types of feedback based on students' learning styles. The website-based formative feedback in question allows feedback to be delivered both orally and in writing, addressed

to each student or as a group, and focuses not only on the abilities of students, but also on the weaknesses they have.

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