



# Systematic Literature Review: Analysis of the Use of Website-Based Physics Learning Devices to Support Students' Abilities in Learning Physics in High Schools

Simon Karuku<sup>1</sup>

<sup>1</sup>Faculty of Education and Social Science, University of Embu, Embu, Kenya

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## ABSTRACT

**Purpose of the study:** This study aims to determine students' abilities with the use of web-based physics teaching materials at the high school level.

**Methodology:** This research is a qualitative research with a systematic literature review research method. The population in this study were 55 articles obtained from Google Scholar with publications ranging from 2017 to 2022. Meanwhile, the sample in this study were 10 articles related to the title of this study.

**Main Findings:** Through the analysis and review of the articles carried out, it can be seen that website-based physics teaching materials are a form of innovation that teachers can use to support physics learning. The use of website-based physics teaching materials can support the ability to think creatively, independent learning, scientific literacy skills, learning outcomes, and competency achievement.

**Novelty/Originality of this study:** The novelty of this research is the discovery of an innovation for educators in achieving learning objectives and supporting students' abilities, namely through the use of website-based physics teaching materials in high school physics learning which is a good innovation used to help teachers achieve learning goals and support students' abilities.

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### Corresponding Author:

Simon Karuku,

Faculty of Education and Social Science, University of Embu, Embu, Kenya

Meru - Nairobi Hwy/B6, Embu, Kenya, 60100

Email: [simonkaruku386@gmail.com](mailto:simonkaruku386@gmail.com)

## 1. INTRODUCTION

Education is a means to advance all areas of human life [1]–[3]. Along with the development of science and technology, education faces particular challenges in the 21st century. The challenge of education in the 21st century is to prepare human resources who have the ability to face the times [4], [5]. Human ability can be continuously improved through education. What's more, in this digital era, the development of human capabilities is carried out through education that is integrated with technology. Technology is a supporting tool used in education to make it easier for teachers to teach students so that learning objectives can be achieved properly [6]. Technology integration in education can be carried out in all subjects, one of which is physics.

Physics is a science that studies the occurrence of a natural phenomenon which includes material components and their interactions [7], [8]. Physics is solved using formulas to prove a natural event [9]. Physics is one of the main elements for the development and realization of science and technology [10]. However, the current challenge is that many high school students think that physics is a subject that is difficult, boring, and less interesting to study [11], [12]. Therefore, these things must be addressed immediately in order to achieve the learning objectives. One way to achieve these learning objectives is to use web-based teaching materials.

Research conducted by Fitriana et al. states that it is necessary to develop website-based teaching materials because students like learning physics that is integrated with technology [13]. This is supported by Fernando et al. which states that website-based digital teaching material products are very practical to use in the learning process [14]. In line with Nalasari et al. which states that web-based teaching materials are classified as practical for use in learning by teachers and students as learning supplements [15].

Website-based teaching materials are teaching materials that are developed by utilizing technology in them. The website is a medium that can be integrated into teaching materials. A website is a collection of web pages and their supporting files, such as image files, videos and other digital files stored on a web server which can generally be accessed via the internet [16]–[19]. Making website-based teaching materials has the advantage that it can be accessed from anywhere and at any time with devices connected to the internet [20]. The existence of website-based physics teaching materials is an innovation that teachers can use in learning physics so that students become more interested in learning physics. The use of website-based physics teaching materials is expected to be a solution to improve students' abilities.

Research on web-based teaching materials has been carried out by previous researchers. argued that the effectiveness of using web-based teaching materials on learning outcomes was evidenced by the acceptance of the alternative hypothesis [21]. Then, Eliyarti et al. stated that the application of physics teaching materials with various forms of web-based assignments had an effect in the form of increasing the average score on learning outcomes [22]. In line with Pramestika & Wahyudi stated that website-based teaching materials are said to be practical to use and able to improve students' independent learning processes [23].

Based on this study, it was found that web-based teaching materials are a support in learning physics. However, no research has been found that examines the use of web-based physics teaching materials to improve high school students' abilities. So it is important to conduct this research to find out what abilities students have with the use of physics-based teaching materials at the high school level? Thus, this study aims to provide information and describe students' abilities with the use of physics-based teaching materials at the high school level.

## 2. RESEARCH METHOD

This study aims to determine students' abilities with the use of website-based physics learning tools at the high school level. This research is a qualitative research with the chosen research method is a systematic literature review. A systematic literature review is a type of literature review that uses systematic methods to collect secondary data, conduct research studies, and collect findings[24]. The secondary data in this study are research results documents related to students' abilities with the use of website-based physics learning tools at the high school level.

The population in this study came from research documents (articles) obtained from the Google Scholar website. There are article criteria that can be used further, namely articles related to the keywords of this research. So that the population in this study totaled 55 articles written in Indonesian and English obtained from Google Scholar with publications ranging from 2017 to 2022. Furthermore, the study population was analyzed to obtain a research sample of 10 articles related to the title of this study. This sample was taken using purposive sampling, namely the sample was taken based on the criteria required by the researcher.

This research was conducted with the following procedures: 1) Determine the keywords that will be used to search literature; 2) Searching for literature on Google Scholar with the keyword “Website-Based Physics Teaching Materials” with publications ranging from 2017 to 2022; 3) The articles that have been obtained are selected and filtered by reading the title and abstract of the research according to the criteria that the research in the article is carried out on learning physics in high school students; 4) Carry out a review process for articles that are in accordance with the research objectives by reading the entire article. The chart of this research procedure can be observed in the image on figure 1.

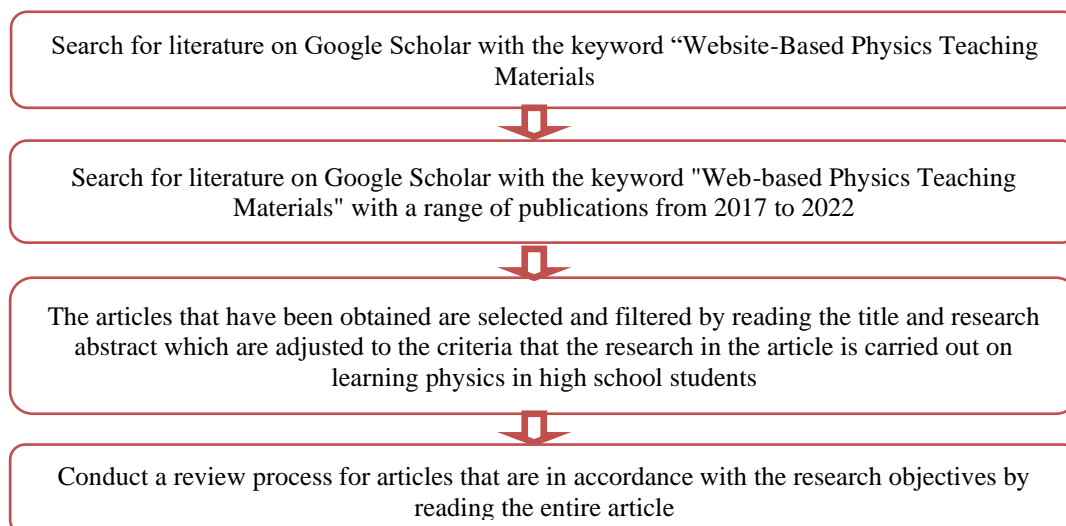


Figure 1. Research procedures flowchart

### 3. RESULTS AND DISCUSSION

This study aims to determine students' abilities with the use of website-based physics learning tools at the high school level. By carrying out the research procedure, a total of 10 articles were obtained that met the objectives of this study. The articles that have been obtained can be grouped into several criteria, namely based on the year of publication and based on the goals or objectives to be achieved. The results of grouping articles based on the year of publication can be observed in the table below.

Table 1. Grouping of Articles by Year of Publication

Year	Frequency	Percentage
2017	4	40%
2018	1	10%
2019	2	20%
2020	0	0%
2021	3	30%
2022	0	0%
Amount	10	100%

Table 1 shows that the website-based physics teaching material articles published in 2017 had the largest percentage, namely 40% with a total of 4 articles. A total of 3 website-based physics teaching material articles (30%) were published in 2021. 2 website-based physics teaching material articles (20%) were published in 2019. Finally, 1 website-based physics teaching material article (10%) published in 2018. Furthermore, the grouping of articles based on the goals or objectives to be achieved can be observed in the table below.

Table 3. Grouping of Articles based on Achieved Capability Targets

Target E-module	Frequency	Author(s)
Creative thinking ability	1	(Ahmad & Arkiang, 2021)
Learning independence	2	(Ismawati et al., 2021; Sari, Suseno, & Riswanto, 2019)
Scientific literacy skills	1	(Setiyanti, Pratiwi, & Ashari, 2021)
Learning outcomes	4	(Kurniawan, 2017; Nur, 2017; Yani, 2017; Permatasari, Ellianawati, & Hardyanto, 2019)
Competency achievement	2	(Zainal, Djamas, & Yohandri, 2017; Solihudin, 2018)

The ten articles obtained will be analyzed. However, before this is done, the following details the articles analyzed in this study, which are shown in the table below.

Table 4. List of Articles Analyzed

Journal Name	Author (Year)	Title	Findings
Journal of Nusantara Education	Ahmad & Arkiang, (2021)	Pengaruh Penggunaan Web Module Fisika Berbasis NTT's Local Wisdom terhadap Kemampuan Berpikir Kreatif [The Effect of Using NTT's Local Wisdom Physics Web Module on Creative Thinking Ability]	The results showed that the web module based on local wisdom in East Nusa Tenggara was effective as a means of increasing creative thinking skills. The effectiveness of using the web module can be seen from the N gain analysis of creative thinking ability which shows a value of 0.62 for the experimental class and 0.39 for the control class. While the effect size value shows the value of $f = 0.40$ . Therefore, it can be said that the development of physics learning through local wisdom-based web modules is very important to develop because it can improve creative thinking skills.
Schrodinger Jurnal Ilmiah Mahasiswa Pendidikan Fisika	Ismawati et al., (2021)	Pengembangan Media Pembelajaran Fisika Berbasis Web Menggunakan Google Sites pada Materi Gelombang Bunyi [Development of Web-Based Physics Learning Media Using Google Sites on Sound Wave Material]	The results of the study show that the Website-based learning media developed using Google Sites on the subject of sound waves is feasible to use. Thus helping students to learn easily and independently during learning.
Scientiae Educatia: Jurnal Pendidikan Sains	Kurniawan, (2017)	Pengaruh Pembelajaran Berbasis Web terhadap Motivasi dan Hasil Belajar Siswa Kelas X SMA Negeri Paguyangan pada Mata Pelajaran Fisika Pokok Bahasan Suhu Dan Kalor [The Effect of Web-Based Learning on the Motivation and Learning Outcomes of Class X Students of Paguyangan State Senior High School in the Subject of Physics Subject of Temperature and Heat]	The results of the t test showed an increase in learning outcomes in the experimental class of 26.66, which was higher than that of the control class, which was only 20.10. Based on the findings of the research results, it can be concluded that web-based learning can increase student motivation and learning outcomes on the subject of temperature and heat.
Edcomtech: Jurnal Kajian Teknologi Pendidikan	Nur, (2017)	Pengaruh Strategi Pembelajaran Fisika Berbasis Website terhadap Hasil Belajar pada Siswa yang Memiliki Self-Regulated Learning (SRL) yang Berbeda [The Effect of Website-Based Physics Learning Strategies on Learning Outcomes in Students with Different Self-Regulated Learning (SRL)]	The test results show that the learning outcomes between groups of students with high self-regulated learning have a value of 19.53% higher than low self-regulated learning. So it is stated that there is an interaction between website-based physics learning and self-regulated learning on learning outcomes.

Journal Name	Author (Year)	Title	Findings
JPPPF (Jurnal Penelitian dan Pengembangan Pendidikan Fisika)	Permatasari, Ellianawati, & Hardyanto, (2019)	Online Web-Based Learning and Assessment Tool in Vocational High School for Physics [Online Web-Based Learning and Assessment Tool in Vocational High School for Physics]	The results of validation by material experts on web-based online learning and assessment tools get an average percentage score of 82%, and the material gets a percentage of 81.33% very feasible criteria. Online web learning resources have a valuable addition for students to get better test results on each student with different learning styles.
JIPFRI (Jurnal Inovasi Pendidikan Fisika dan Riset Ilmiah)	Sari, Suseno, & Riswanto, (2019)	Pengembangan Modul Fisika Online Berbasis Web pada Materi Usaha dan Energi [Development of a Web-Based Online Physics Module on Business and Energy]	The results showed that the level of eligibility according to experts and student responses were in the appropriate criteria with a respective percentage of 85% and 72.5%. Web-based online physics modules can be used as independent learning resources that can train student learning independence.
Jurnal Inovasi Pendidikan Sains (JIPS)	Setiyanti, Pratiwi, & Ashari, (2021)	Pengembangan Media Pembelajaran Menggunakan Web Appgeyser Berbasis Sparkol Videoscribe untuk Peningkatan Kemampuan Literasi Sains [Development of Learning Media Using Web Appgeyser Based on Sparkol Videoscribe to Improve Scientific Literacy]	The results of this study indicate that the feasibility of the Sparkol Videoscribe-based Appgeyser Web learning media developed in this study is categorized as good and suitable for use as an alternative physics learning media and can improve students' scientific literacy skills.
Jurnal Wahana Pendidikan Fisika	Solihudin, (2018)	Pengembangan E-Modul Berbasis Web untuk Meningkatkan Pencapaian Kompetensi Pengetahuan Fisika pada Materi Listrik Statis dan Dinamis SMA [Development of Web-Based E-Modules to Increase the Achievement of Physics Knowledge Competency in High School Static and Dynamic Electricity Materials]	The results showed that there was an increase in the achievement of knowledge competence as indicated by the N-Gain value of 0.84 in static electricity material and 0.87 in dynamic electricity material. Based on the data above, this study shows that the development of web-based e-modules on static electricity and dynamic electricity material can be used as learning multimedia and can increase students' knowledge competency achievement.
Jurnal Sains dan Pendidikan Fisika (JSPF)	Yani, (2017)	Pengaruh Media Model Hybrid Berbasis Web Whanced Course terhadap Hasil Belajar Fisika [The Influence of the Whanced Course Web-Based Hybrid Media Model on Physics Learning Outcomes]	The results of inferential research found that the value of t-count = 3.68 and t-table = 1.99 or in other words there is a convincing difference between the experimental class and the control class. Where physics learning using hybrid media based on the web enhanced course is higher than physics learning using conventional media.
Pillar of Physics Education	Zainal, Djamas, & Yohandri, (2017)	Pengaruh Bahan Ajar Mobile Web dalam Pembelajaran Discovery terhadap Pencapaian Kompetensi Peserta Didik Kelas XI SMAN 4 Padang pada Materi Hukum Newton tentang Gravitasi, Usaha, dan Energi [The Effect of Mobile Web Teaching Materials in	The results of this study are that mobile web teaching materials have an effect on students' achievement of knowledge competence for a significant level of 0.05 on Newton's law material on gravity, work, and energy at SMA Negeri 4 Padang.

Journal Name	Author (Year)	Title	Findings
		Discovery Learning on Competency Achievement of Class XI Students of SMAN 4 Padang on Newton's Laws of Gravity, Work, and Energy]	

Based on Tables 3 and 4 it can be seen that website-based physics teaching materials used in physics learning can help support creative thinking abilities, independent learning, scientific literacy skills, learning outcomes, and achievement of competencies. Thus, the use of website-based physics teaching materials is an innovation for teachers in carrying out learning. In addition, the use of web-based physics teaching materials helps students develop the skills needed in learning.

Teaching materials are materials or subject matter that are arranged systematically which are used by teachers and students in the learning process [25], [26]. A teaching material must be designed and written with instructional principles because it will be used by the teacher to assist and support the learning process. The role of a teacher in designing or compiling teaching materials greatly determines the success of the learning process and learning through a teaching material. Teaching materials can also be interpreted as any form of material that is arranged systematically which allows students to learn independently and is designed according to the applicable curriculum [27].

This research, which was conducted using a systematic literature review, shows that teaching materials can be developed on a web-based basis. The developed website-based teaching materials are used in physics learning. Web-based teaching materials have several advantages, namely web-based teaching materials which are of course supported by computer and internet technology, which make it easy for students to re-access teaching materials after learning in class and the ability to penetrate time limits and places of use[28], [29]. Furthermore, Purmadi & Surjono, (2016)stated several other advantages of web-based teaching materials, namely: 1) Can be accessed anytime and anywhere; 2) The material presented is adapted to the student's learning style so that it will be easier to understand the material; 3) Communication between teachers and students does not only occur in schools; 4) Update data easier; 5) A more practical and transparent assessment system; 6) Students can study independently; 7) With the existence of web-based teaching materials students are no longer dependent on printed teaching materials such as textbooks; 8) The material presented in web-based teaching materials is also more varied so that it is easy to understand [30].

The use of website-based physics teaching materials can support and improve students' abilities. The use of website-based teaching materials in physics learning can improve creative thinking skills [31], independent learning [32], [33], scientific literacy skills[34], learning outcomes[35]–[38], competency achievement [39], [40].

The use of website-based physics teaching materials can help improve students' creative thinking abilities. The ability to think creatively is an ability that is categorized as high order thinking skills or High Order Thinking Skills (HOTS). The ability to think creatively can produce or develop something new [41]. Through the ability to think creatively, students are required to be able to understand, master and solve the problems they are facing [42]. Creative thinking requires teachers to be able to motivate and bring out students' creativity during learning by using a variety of methods and strategies [43]. One strategy that can be carried out is to package teaching materials with a touch of technology which in this case is website-based.

The use of website-based physics teaching materials can help improve students' scientific literacy skills. Teaching materials with web media have a positive effect on science literacy compared to traditional media [44]. The use of website-based physics teaching materials will improve students' creative thinking skills and literacy skills which will have an impact on increasing learning outcomes and achieving student competence. In addition, the use of website-based physics teaching materials will enable students to learn independently thereby increasing student learning independence.

This research has implications for the field of education in particular, which provides information to teachers, students, researchers, or other parties regarding students' abilities which can be improved through the use of website-based physics teaching materials. The novelty in this study is to provide an overview of the abilities students can acquire after using website-based physics teaching materials so that it becomes a guide for teachers to develop website-based teaching materials that can improve students' abilities. The implication of this research is that it can provide up-to-date information for researchers who want to examine student abilities that can be improved by using e-modules. The researcher hopes that future researchers will be able to systematically analyze relevant articles so that they can provide benefits for the development of science.

#### 4. CONCLUSION

Website-based physics teaching materials are technology-based teaching materials. This teaching material can be used anywhere and anytime because it has many advantages. Website-based physics teaching materials are an innovation that teachers can use to create innovative and interesting physics learning. Not only as an innovation in learning, website-based physics teaching materials can support and improve creative thinking skills, independent learning, scientific literacy skills, learning outcomes, and competency achievement. Thus, it can be stated that the use of website-based physics teaching materials developed is good and effective for use in physics learning. Recommendations for further research are that future researchers can develop teaching materials that can improve students' HOTS and also students' skills

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