



Development of Web-Based Media Integrated with 3D Models for Training Information Literacy

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ABSTRACT

One aspect that also influences learning is information literacy, which is one of the knowledge and skills of the 21st century. Based on the results of the needs analysis of XI MIPA students at Senior High School, the average score for information literacy skills only reached 33.74%. Apart from that, the implementation of information literacy is only limited to finding and using information obtained on the internet to complete assignments given by the teacher. This research aims to develop a web-based learning media integrated 3D models to train the information literacy skills called Biology Insight. The type of research used is Research and Development (R&D), through the ADDIE development model. The data analysis technique used is descriptive analysis. The research results show that the Biology Insight web is declared very valid and suitable for use in the learning process of class XI MIPA students. This is proven by the validation results of media experts (88%) and material experts (97.5%), readability vi tests through Biology teacher responses (98.8%) and student responses on a small scale (87%).

Pengembangan Media Berbasis Web Terintegrasi dengan Model 3D untuk Melatih Literasi Informasi

ABSTRAK: Salah satu aspek yang turut memengaruhi pembelajaran yaitu literasi informasi yang merupakan salah satu pengetahuan dan keterampilan abad ke-21. Berdasarkan hasil analisis kebutuhan terhadap siswa XI MIPA Sekolah Menengah Atas, nilai rata-rata keterampilan literasi informasi hanya mencapai 33,74%. Selain itu, implementasi literasi informasi hanya sebatas menemukan dan menggunakan informasi yang didapatkan diinternet. Penelitian ini bertujuan untuk mengembangkan media pembelajaran berbasis web terintegrasi model 3D untuk melatih kemampuan literasi informasi yang dinamakan Biology Insight. Jenis penelitian yang digunakan yaitu Research and Development (R&D), melalui model pengembangan ADDIE. Teknik analisis data yang digunakan yaitu analisis deskriptif. Hasil penelitian menunjukkan bahwa web Biology Insight dinyatakan sangat valid dan layak untuk digunakan dalam proses pembelajaran siswa kelas XI MIPA. Hal ini dibuktikan dari hasil validasi ahli media (88%) dan ahli materi (97,5%), uji vi keterbacaan melalui respon guru Biologi (98,8%) dan respon siswa dalam skala kecil (87%).

INTRODUCTION

One aspect that also influences student learning outcomes is information literacy, which is one of the knowledge and skills of the 21st century, namely information media and technology skills, learning and innovation skills, as well as life and career skills (Nurtanto et al., 2020), where information literacy is included in information media and technology skills (Oluwagbohunmi & Alonge, 2023);(Fadhilawati et al., 2023). Pratama et al. (2020) and Winarni et al. (2020) argue, this is important to consider considering that information literacy skills along with media and technology literacy need to be improved in the era of technological and information development.

The quality of the information obtained is determined by the ability to access information (Rotemberg et al., 2021). Accuracy of information is obtained through balanced skills in processing information (Mayuga, 2022). The rapid development of the world of technology means that students can obtain unlimited information, but the information available, especially the internet, is not always completely correct, so there is a big chance of getting incorrect information by irresponsible parties (Darwati et al., 2024);(Piatnychuk & Pyatnychuk, 2021).

Saragih & Tanjung (2023) argue, information literacy provides space for students to select and utilize information to solve problems and achieve learning success. Therefore, students are required to have the ability to process information obtained from the internet (Syara et al., 2020). However, based on the results of a needs analysis of XI MIPA students at Senior High School (August, 2023), the average score for information literacy skills only reached 33.74%. Apart from that, the implementation of information literacy is limited to finding and using information obtained on the internet to complete assignments given by the teacher (Darwati et al., 2024). This is following research

conducted by Haka et al. (2024), that some students experience difficulty in processing information from various sources and many students only rewrite information from the teacher or the internet. In addition, Kamil et al. (2020) and López-Escribano et al. (2021) in their research also stated that students' information literacy levels were still low based on the results of formative tests which was caused by less than optimal implementation of information literacy.

Supporting this statement Dolničar et al. (2020) and Encheva et al. (2020), stated that high school students' information literacy skills are inadequate due to not mastering information literacy techniques. Additionally, Head et al. (2020) stated that students' low information literacy skills could be caused by the absence of questions to train or facilitate students in improving information literacy. Widodo et al. (2023) stated that the development of information literacy in most schools has not been integrated with certain subjects, especially biology. Therefore, it is necessary to improve and increase information literacy to welcome 21st century learning (Puspita et al., 2023).

In response to this, there is a need to increase information literacy for students. Risniawati et al. (2020) and Fedorov & Mikhaleva (2020) argue, to support the achievement of information literacy skills, learning media is needed to convey information to recipients. Therefore, educators are expected to have knowledge and understanding of learning media. The level of message delivery or teaching activity material is influenced by the use of the media used, so choosing quality media is very important (Handoko et al., 2024). The presence of web-based learning media which is designed, developed and used as learning media, provides unlimited space for students to participate in learning (Mulder et al., 2023). Apart from that, the information packaged on the learning website is more interesting, the material is combined with images, motion, animation

and sound, thus making the information presented interesting (Tsai et al., 2020);(Kustyarini et al., 2020). Therefore, web-based learning media can be a solution to general problems related to the learning process in schools (Astuti et al., 2020).

Google sites is a website development platform that is relatively easy to use so it can be used as a learning medium (Novaliendry et al., 2021);(Fatahillah et al., 2020). This convenience factor is one of the basics for developing website-based learning media. Google sites can be developed without going through a coding process (programming language) so that website development via Google Sites can be done easily by educational staff, which is also a differentiator between Google Sites and other developer media (Ramadannisa & Hartina, 2021). Ease of access is also an advantage of Google Sites because it can be accessed either via desktop or smartphone as long as connected to internet network. Apart from that, Google Sites also has the ability to be integrated with other learning media provider platforms, one of which is Assemblr Edu. Syakur et al. (2020), stated that Assemblr Edu is a platform for developing 3D (three-dimensional) objects or models and AR (Augmented Reality) which can provide variations in the web media that will be developed while also playing a role in helping interactive learning styles.

Based on the problems that have been explained, it is necessary to carry out innovative research and development in the form of integrated web-based media with a three-dimensional model as an alternative that is oriented towards cell material and membrane transport, where based on an analysis of the needs of class XI MIPA students at Senior High School, this material is considered difficult to understand and considered less attractive with percentages of 62.5% and 59.4% respectively. This is because this material is a very complex and abstract material so it requires students' complete knowledge (Ridha et al., 2020).

METHOD

This development uses research and development (R&D) method through models development of ADDIE (Analysis, Design, Development, Implementation, and Evaluation). The development process begins by identifying solutions to problems in the learning process at the analysis stage. The design stage of designing a product is like designing the basic appearance of the web and its main elements. This development stage continues, containing realization activities from the previous stage, and the products that have been produced are assessed by validators and tested on research samples. The implementation stage in developing the Biology Insight web will be skipped, because this research only reached the small-scale trial stage (Branch, 2009). Evaluation phase depends on input or suggestions from the validation questionnaire findings, researchers will make changes to the resulting product (Brouwers et al., 2020).

This research was conducted at Senior High School which was carried out in the odd semester of the 2022/2023 academic year in September. The research subjects used for testing and analyzing product needs were XI MIPA students and Biology subject teachers at Senior High School, while the expert validators were lecturers from the Biology study program at UIN Walisongo as media and material experts.

This development needs analysis consisted of 123 students of XI MIPA Senior High School. Furthermore, the product was validated by media experts and material experts as well as readability tests by biology teachers and small-scale students (10 students). Needs analysis data was obtained from the results of questionnaires and interviews, while testing the validity and feasibility of learning media was obtained through questionnaires.

Validity testing and feasibility testing are some of the data analysis methods used. Assessing the validity and feasibility of the products produced, several questionnaires

distributed in this research include a needs analysis questionnaire given to students, a validation questionnaire by media experts, material experts, and questionnaire respondents including Biology teachers and students (Novia et al., 2023). Table 1 and 2 shows the grouping of validity and feasibility categories which is used as a representation of percentage results.

Tabel 1. Likert Scale Validity Test

Achievement (%)	Categories
81 - 100	Very Valid
61 - 80	Valid
41 - 60	Moderately Valid
21 - 40	Not Valid
0 - 20	Very Invalid

Source: (Riduwan, 2015)

Tabel 2. Likert Scale Feasibility Test

Achievement (%)	Categories
81 - 100	Very Good
61 - 80	Good
41 - 60	Moderately Good
21 - 40	Not Good
0 - 20	Very Not Good

Source: (Riduwan, 2015)

RESULTS AND DISCUSSION

This research began with a needs analysis consisting of interviews with Biology teachers and distributing questionnaires to class XI MIPA students at Senior High School. Based on the results obtained, the use of information technology-based media has been carried out, namely only through Microsoft Teams and also Microsoft Power Point. Use of the web is only carried out when there are certain assignments regarding material. This leads to a lack of control over students in the classroom. Apart from that, it is felt that the implementation of information literacy is not optimal, because it is only carried out by searching for and using information when an assignment is given.

Based on the results of the student needs questionnaire analysis, it was found that the material that was considered difficult and less interesting was KD 2.1 and 3.1 cells and membrane transport. In

addition, students' information literacy skills with an average score of only 33.74%, thus becoming one of the considerations in developing media to train information literacy.

The initial product design was prepared through a storyboard using Microsoft PowerPoint, named Biology Insight which contains five main menus, including the home menu, guide, competencies & objectives, materials, and about us. 1) Home, contains the initial web display on the first page when facing the user. 2) Guide, contains instructions for using the Biology Insight web. 3) Competencies, containing analysis of core competencies, basic competencies, and learning objectives to be achieved by students. 4) Material, containing the main content of Biology Insight, namely material, learning support videos, and evaluation, according to KD 3.1 and 3.2 material. 5) Evaluation, contains practice questions and worksheets. 6) References, contains additional information related to biology learning resources. 7) About us, contains the identity of the Biology Insight web along with the developer's personal identity. An illustration of the design or systematics of the Biology Insight web can be seen in Figure 1 and Figure 2.



Figure 1. Web storyboard of main pages

Biology Insight was developed with several main platforms, namely, Google Sites as a website and Assembler EDU as a provider of three-dimensional content.

Apart from that, Biology Insight is designed using other supporting platforms, namely: 1) Google forms, for creating evaluation tests and student information literacy worksheets. 2) YouTube, a source of videos supporting learning materials. 3) Canva, Biology Insight's premier web banner design platform. 4) Freepik, Biology Insight's premier web design minor platform.



Figure 2. Web storyboard of materials page

The preparation of the material was carried out through several accurate and relevant references to high school class XI Biology material such as Campbell Biology, Biology XI textbooks, and also web providers of Biology material such as Biology Openstax. This stage also developed an evaluation in the form of practice questions on the learning material (Kurdi et al., 2020);(Hardiansyah & Mulyadi, 2022). Apart from that, information literacy material was also developed based on TRAILS standards that were relevant to the material along with information literacy worksheets.

Evaluation at the development stage consists of input and suggestions from supervisors and Biology teachers at the analysis and design stage, as well as the results of expert reviews, teacher and student responses on a small scale at the development stage. There is a media expert and a material expert to evaluate the validity of the Biology Insight web being developed.

The percentage of Biology Insight media validation results in Table 3 obtained

an average score of 88%, including the very suitable category for use in the learning process without revision.

Table 3. Media Expert Validation Results

Aspect	Validation score	Percentage (%)
Operation	26	86,6
Media Display	72	90
Product Quality	8	80
Product Efficiency	5	100
Product Effectiveness	21	84
Total Score/Percentage	132	88

The percentage of Biology Insight media content validation results in Table 4, obtained an average score of 97.5% which is included in the very suitable category for use in the learning process without revision. After the Biology Insight media is suitable for use in the learning process, the media is then assessed by the Biology teacher before being tested on a small scale with students.

Table 4. Media Expert Validation Results

Aspect	Validation score	Percentage (%)
Learning Design	30	100
Material Contents	35	100
Use of Language & Communication	30	100
Aspects of Information Literacy	22	88
Total Score/Percentage	117	97,5

The percentage of Biology teacher response results in Table 5 obtained an average score of 98.8%, included in the category of very suitable for use in the learning process without revision. Positive comments were also given regarding the Biology Insight website, namely that the media was felt to be able to stimulate learning to be more interesting and interactive and easier to access.

Table 5. Biology Teacher Response Results

Aspect	Validation score	Percentage (%)
Product Suitability	10	100
Clarity of Presentation	10	100
Convience and Access	15	100

Aspect	Validation score	Percentage (%)
Affordability	5	100
Serving Components	9	90
Layouts	10	100
Language Use	25	100
Total	85	98,8
Score/Percentage		

Table 6 shows the response results from 10 students of XI MIPA Senior High School, with an average score of 87% so that it is included in the very suitable category for use in the learning process without revision. Positive comments were also given by students in the form of a well-arranged presentation of the material, so that the product developed was very interesting and the material provided was complete. Apart from that, the presentation of images also received a positive response from students.

Table 5. Student Response Results (Small Scale)

Aspect	Validation score	Percentage (%)
Media Design	42,4	85
Contents of the Material	43,3	87
Product Efficiency	44,5	89
Product Effectiveness	43,14	86
Total	117	97,5
Score/Percentage		

Web Biology Insight was developed to facilitate students following the demands of developments in information and communication technology in the world of education as well as to provide a variety of teaching media used in the learning process (Scott et al., 2020);(Zulyusri et al., 2022). This statement is proven by media expert validation results which show the scale is very suitable for use in the learning process (88%). Assemblr edu, which is a platform for developing 3D models of related material, is also one of the main characteristics in the development of the Biology Insight web. Based on validation assessments by media experts regarding 'suitability and quality of three-dimensional content', each received a very good score (100%).

Through the use of the web, facilitated 3D interaction allows students to learn in an

interactive and interesting environment so that they understand the lessons being taught much more quickly. In addition, the use of 3D technology can improve students' understanding of complex biological concepts and result in higher test scores (Reinke et al., 2021). This can be a solution to the problem of students' understanding of complex and abstract material, namely cells and membrane transport.

The Web Biology Insight that was developed has been integrated with information literacy indicators based on TRAILS (Tools for Real-Time Assessment of Information Literacy Skills) standards, where there are five indicators, namely; 1) identify information needs; 2) identify potential sources; 3) develop, use, and revise search strategies; 4) evaluate information and its sources; and 5) use information responsibly, ethically, and legally (Öncül, 2020);(Zimmerman, 2020). The implementation of each indicator is presented on the "Ayo Berliterasi!" page, and a worksheet for training students' information literacy is presented on the "Evaluasi" page. According to Brodsky et al. (2021), direct independent practice can strengthen students' information literacy. The integration of information literacy on the Biology Insight website received an average score of very good by material validators (88%) regarding the information literacy aspect with all indicators categorized as very good, where indicator 1 (100%), indicators 2 to 4 (80%), and indicator 5 (100%).

Web Biology Insight structuredly provides insight into information literacy based on TRAILS standards through instructions and examples of implementation. In accordance with the statement by Avcı & Ergün (2022), that providing instruction such as online tutorials can encourage the development of information literacy skills and can be applied to other academic fields. Guo & Huang (2021) stated, that there is potential in using web learning to develop

information literacy. Additionally, web-based learning helps students learn how to find and assess relevant information. This is proven by Jang et al. (2021) and Lee et al. (2020), that there is a significant positive correlation between information literacy skills and the use of web technology.

Using the web as a learning medium can improve student learning outcomes which can be determined through learning effectiveness. Learning is said to be effective if it can meet learning objectives (Fitakurahmah et al., 2020). Based on the results of validation and teacher response tests, shows that the Biology Insight web has been presented in accordance with the indicators and learning objectives. This is proven through the results of expert validation regarding aspects of learning design in the assessment of 'relevance between learning aspects (goals, materials, use of media)' and Biology teachers' responses regarding aspects of product suitability in the assessment of 'products in achieving learning objectives', each amounting to 100 % in the very good category.

The development of the Biology Insight web is accompanied by the hope that students will gain insight, skills, or changes in behavior that are observed due to their learning results (Widya & Isnaeni, 2023). This statement is proven through the results of small-scale student feasibility tests in terms of material content (87%), product effectiveness (86%), and product efficiency which received the highest score (89%). In accordance with student responses to comments and suggestions, it shows that the Biology Insight website is good and interesting, and the material provided is complete and clear. In line with the statement of Stepanyuk et al. (2022) and Burley et al. (2021) that the product produced should be able to attract students' interest and motivation during the learning process.

CONCLUSIONS AND SUGGESTIONS

The Biology Insight web biology learning media was developed using the ADDIE development model. Biology Insight was created through the Google Sites and Assembler EDU platforms. Web Biology Insight can be accessed online for free via the following page: <https://sites.google.com/student.walisongo.ac.id/biology-insight/>. Web Biology Insight was declared very valid and suitable for use in the learning process of class XI MIPA students, as evidenced by the validation results from media experts (88%) and material experts (97.5%). Apart from that, the Biology Insight web was declared very suitable for use in the learning process of XI MIPA students, as proven by the readability test through teacher responses of 98.8% (very feasible) and small-scale student responses of 87% (very feasible). The development of the Biology Insight web is of course still not perfect, so further development or research is needed, in order to make it easier for teachers and students in the teaching and learning process, especially in Biology subjects.

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