

***A Single Center Experience: Meningkatkan Keterampilan Identifikasi Bakteri Melalui Pengembangan Kegiatan Laboratorium Berbasis Web pada Program Pendidikan Sarjana***

***A Single Center Experience: Enhancing Bacterial Identification Skills in Undergraduate Programs Through the Development of a Web-Based Laboratory Activity***

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<i>Article Info</i>	<i>Abstract</i>
<i>Article History</i> <b>Submitted</b> 10 Januari 2021  <b>Accepted</b> 11 Februari 2021  <b>Published</b> 25 Juni 2022	Microbiology is considered to be a difficult subject to learn due to the dense content and frequent use of difficult-to-understand Latin terms in sentences. Developing the web-based modul of this subject will stimulate the student and be more innovative. The research aims to (1) develop web-based learning media for microbiology laboratory activity, and (2) determine the feasibility of the media for learning. This study employed Research and Development (R&D) design and is an adaptation of Borg and Gall's model. This process consists of ten steps: research and information gathering, planning, developing preliminary product form, main product revision, main field testing, operational product revision, operational field testing, and final product testing. The two media validation results above, then summed up and produced an average percentage value of 80.38% with a decent category. Thus, this web-based learning media from the aspect of studying the feasibility of learning media by experts is declared worthy of use in learning activities. This web-based learning media from the aspect of studying the feasibility of the content / learning materials by experts is declared very suitable for use in learning activities (87.74%). Web-based learning media for identification of bacteria in microbiology laboratory activities has been shown to be innovative and capable of supporting learning activities.

*Keywords*

Bacterial identification, learning media, microbiology, web-based

Mikrobiologi dianggap sebagai mata pelajaran yang sulit untuk dipelajari karena konten yang padat dan seringnya penggunaan istilah Latin yang sulit dipahami dalam kalimat. Pengembangan modul berbasis web mata pelajaran ini akan merangsang siswa dan lebih inovatif. Penelitian ini bertujuan untuk (1) mengembangkan media pembelajaran berbasis web untuk kegiatan laboratorium mikrobiologi, dan (2) mengetahui kelayakan media pembelajaran. Penelitian ini menggunakan desain Research and Development (R&D) dan merupakan adaptasi dari model Borg and Gall. Proses ini terdiri dari sepuluh langkah: penelitian dan pengumpulan informasi, perencanaan, pengembangan bentuk produk awal, revisi produk utama, pengujian lapangan utama, revisi produk operasional, pengujian lapangan operasional, dan pengujian produk akhir. Hasil validasi kedua media di atas, kemudian dijumlahkan dan menghasilkan nilai persentase rata-rata 80,38% dengan kategori layak. Dengan demikian media pembelajaran berbasis web ini ditinjau dari aspek kelayakan media pembelajaran oleh para ahli dinyatakan layak digunakan dalam kegiatan pembelajaran. Media pembelajaran berbasis web ini dari aspek kajian kelayakan isi/materi pembelajaran oleh para ahli dinyatakan sangat layak digunakan dalam kegiatan pembelajaran (87,74%). Media pembelajaran berbasis web untuk identifikasi bakteri pada kegiatan laboratorium mikrobiologi terbukti inovatif dan mampu mendukung kegiatan pembelajaran.

*Kata Kunci*

Identifikasi bakteri,  
media pembelajaran,  
mikrobiologi, berbasis  
web

## Introduction

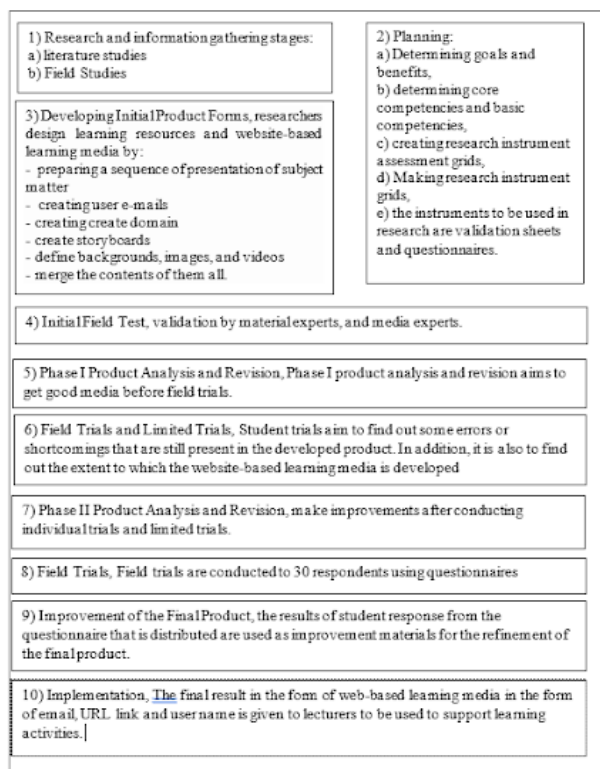
The advancement and role of technology has grown in importance, resulting in the use of teaching aids, educational props, audio, visual, and audio-visual materials. The use of information technology in the learning process does not only apply to students; educators can also use these resources to improve their daily teaching skills. (Sidiq, n.d.) As a result, comprehensive efforts are required to improve learning quality. Humans, media technology, learning strategies, learning environments, learning resources, and learning messages are all components in improving the quality of learning. (Munandar & Surjono, 2017)

Web-based learning media is one of the media that can support online learning and gain more popularity in this recent year. (Satrio & Gafur, 2017) . Web-based learning, also known as e-learning, is the application of technology in the world of learning to an educational process through the use of the internet. Web-based learning has several advantages, including the ability to distribute education to all corners of the country, unlimited capacity because it does not require classrooms, and the learning process is not time-limited.(Chumley-Jones et al., 2002)

According to a study conducted in Indonesia, microbiology is a difficult subject due to the traditional and boring method of instruction (Roviati et al., 2017). Many scientific terms and latin words are used in the material during the laboratory activity in Microbiology course was another reason for the difficulty of the subject. Medical faculty UPN Veteran Jakarta microbiology course had learning objectives as follows: (a) describe the nature of bacteria, (b) identify bacteria, and (c) compare bacterial identification. During the popularity of online learning and website based learning, we conduct a study with the title "Improving Bacterial Identification Skills in students of the Medical Study Program of the Jakarta Veteran National Development University through the Development of a Website-based Microbiology Practicum Module (Web Based Learning)". This study aimed to develop web-based learning that is interactive and is able to be a media that delivers learning outcomes.

## Methods

This study employed the Borg and Gall model (Gall et al., 1996) (2007, which consists of a ten-stage research and development program. The final product went through expert validation and product user trials. Product user validation and trial results were presented in a descriptive manner.



Graph1.Ten stages of research and development (Gall et al., 1996)

Field trials are conducted to find out how much influence the products made on learning activities. If it has passed 10 stages of research, researchers classify it into 5 categories based on the likert scale.

The following are the categories of media eligibility category divisions:

Table 1 Media Eligibilities Categories

Categories	Percentage
Very eligible	81% - 100%
Eligible	61% - 80%
Quite eligible	41% - 60%
Not Eligible	21% - 40%
Very Not Eligible	0% - 20%

## Results

This development research is a web-based learning medium on microbiology practicum courses. This product is in the form of a website with a [medicalweblearning.id](http://medicalweblearning.id) domain. Assessment of media was performed by two experts that are not related with this research. The criterias are used in this assessment are (1) Usability (2) Functionality (3) Visual Communication.

Table 2 Media-Expert Eligible-Validation Results  
(the aspect of studying the feasibility of learning media by experts)

Aspect	Validator 1			Validator 2		
	N	Percentage Result	Category	N	Percentage Result	Category
Usability	32	80%	Eligible	33	82.5%	Very Eligible
Functionallity	56	86.15%	Very Eligible	54	83%	Very Eligible
Visual Communication	46	76.66%	Eligible	44	73.33%	Eligible

The two media validation results above, then summed up and produced an average percentage value of 80.38%. Thus, this web-based learning media from the aspect of studying the feasibility of learning media by experts was declared worthy (eligible) of use in learning activities.

The results of the assessment of 2 media experts are seen from several aspects, namely: (1) Learning Design, (2) Aspects / Content of Materials, (3) Language and Communication.

Table 3. The validation results  
(aspect of studying the feasibility of the content / learning materials by experts)

Aspect	Validator 1			Validator 2		
	N	P	K	N	P	K
Learning Design	27	90%	Eligible	25	83.33%	Very Eligible
Aspects/Content of material	32	80%	Very Eligible	33	82.5%	Very Eligible
Language and Communication	24	80%	Eligible	26	86.6%	Eligible

The two validation results from above, then summed up and produced an average percentage value of 87.74% with the Category Very feasible. Thus, this web-based learning media from the aspect of studying the feasibility of the content/learning materials by experts was declared very suitable (very eligible) for use in learning activities.

## Discussions

Methodologists in R&D are required in educational research to create effective and efficient products or services related to pedagogical or educational practices. In the steps outlined above, this method develops or designs the proposed models for educational practices. Method by Borg & Gall (Gall et al., 1996), is the widespread use of this method and many literature have mentioned several revisions regarding this method. (Gustiani, 2019)

However, in this study we still performed research and development by using this method by Borg & Gall. We thought that this method is the suitable method for a novice R&D educational designer like us. The second reason was all the R&D steps formulated better in this method.

Regarding microbiology, this lack of enthusiasm for microbiology can be attributed to a number of factors, including the volume of study material, new terminology – particularly the names of microorganisms – complex concepts, the quality of presentations/lectures, and the subject's negative reputation, which is perpetuated by senior students telling juniors that medical microbiology is a 'dreadful' module. (Struwig, 2010)

Bacterial identification in a microbiology course is considered a tedious subject when taught traditionally. Using this web-based learning media in this subject, enables students to identify bacteria, compare bacteria within different groups, and describe the nature of bacteria. Our expert validation results demonstrated that this media was appropriate for delivering the learning objectives. Although we did not conduct a qualitative study to describe our students' perceptions (which was our limitation), we observed that many students are motivated by this interactive media. The similar interactive session was seen with the using of game in teaching microbiology, the positive acceptance of the students and teachers of this innovative course, and also the positive change in the perception towards so-called difficult subject to an enjoyable subject.(Struwig et al., 2014)

Limitation. The perception of students and whether the learning objectives were achieved was unknown in this study. Future studies about perception of students about this web-learning media are worth performing.

## Conclusion

Web-based learning media for identification of bacteria in microbiology laboratory activities has been shown to be innovative and capable of supporting learning activities.

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