PPSDP International Journal of Education
Volume 3 (2) (Special Issue) 22 October 2024, 140-145
2nd PPSDP International Conference on Educational Sciences (IConEds 2024)
E-ISSN 2829-5196, P-ISSN 2830-3229

The ADDIE Method in Digital Atlas-Based Learning Media on Practicum Learning Outcomes in Histology of Medical Students

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Article History: Received on 18 August 2024, Revised on 19 October 2024, Published on 8 November 2024

Abstract: Histology is one of the basic sciences that is difficult to learn, as evidenced by low practicum scores. The purpose of this research is to develop histology digital atlas-based learning media for medical students at Universitas Negeri Gorontalo. This digital atlas-based media aims to enhance student learning outcomes. The ADDIE method was used to develop the learning media. The results show an improvement in the learning outcomes of medical students in the histology practicum. It implies to use ADDIE for everyone who wants to develop learning media. It contributes to all teachers to use ADDIE method in Digital Atlas based learning media on practicum learning outcome.

Keywords: ADDIE, Atlas, Histology, Learning Media, Learning Outcome

A. Introduction

Histology is one of the basic sciences that medical students must study. However, many students find it difficult to pass histology (Hortsch, & Mangrulkar, 2015; Door, 2023; Ross, & Pawlina, 2006). According to Ambardini (2009), the challenge in learning histology is the difficulty in identifying three-dimensional structures on flat histology slides. Histology practicum is generally conducted by observing prepared slides under a microscope and drawing the observed specimens. This process requires significant time, while the practicum schedule is often too short (Susilowati et al., 2016).

In today's digital era, using technology in education has become essential to enhance learning effectiveness (Qureshi et al., 2021; Ghavifekr, & Rosdy, 2015; Shah, 2022). At the Faculty of Medicine, Universitas Negeri Gorontalo, the need for innovative and interactive learning media is increasing, particularly for the histology practicum, which requires a deep understanding of microscopic structures. Traditional histology education often faces limitations in visual aids and resources. Students frequently struggle to clearly understand and identify tissue structures. Hence, developing learning media can provide better and more in-depth visualization is necessary

(Hanif, 2020).

An atlas is a systematic collection of information or data related to specific objects (Khasanah et al., 2019). Digital learning is a system that facilitates broader, more extensive, and varied learning (Rennie, & Smyth, 2019; Castro, 2019). Through digital learning systems, learners can study anytime and anywhere without being limited by space or time. Learning materials are more varied and are not limited to verbal formats but can include text, visuals, audio, and motion (Munir, 2017). A digital atlas is accessible at anytime and anywhere via devices connected to the internet (Khasanah et al., 2019).

Initial observations revealed that the results of the first histology practicum exams in Biomedicine 1 at the Faculty of Medicine, Universitas Negeri Gorontalo, in 2021 and 2020 showed that 74% and 81% of students, respectively, failed the exam. The passing score was 65 in 2021 and 60 in 2020, with average scores of 52.1/100 and 45.5/100, respectively. An initial survey involving interviews with two medical students at Universitas Negeri Gorontalo found that one of the challenges in the histology practicum was students' difficulty in identifying histology structures under a microscope, while the allocated practicum time was insufficient.

The problem statement of this research is to analyze the importance of digital atlas-based learning media, its design, development method, implementation among students, and its impact on learning outcomes in the histology practicum. This research aims to develop histology digital atlas-based learning media that can be used by students of the Faculty of Medicine at Universitas Negeri Gorontalo. By utilizing digital technology, this learning media is expected to facilitate a more interactive and effective learning process. The development of this digital atlas is expected to contribute significantly to the quality of education at the Faculty of Medicine, enabling students to understand histology concepts more easily and apply them in clinical contexts. The histology digital atlas will provide clear microscopic images, detailed descriptions, and interactive features to facilitate independent learning.

B. Methods

This research is a development study using the ADDIE model (Widyastuti, 2019; Muruganantham, 2015; Nadiyah, & Faaizah, 2015), which includes five phases: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE method is a systematic approach to learning development that consists of five main stages:

1. Analysis: Assessing the needs and feasibility of new learning media by analyzing key issues, such as low histology practicum scores, support facilities, and lecturers' capability to implement the media.
2. Design: Creating learning objectives, activities, materials, and evaluation tools.

In this stage, the design of the learning media is conceptualized to guide the subsequent development process.

3. Development: Transforming the design into a ready-to-use product, such as a digital atlas in this study, to help students study histology without relying on microscopes.
4. Implementation: Applying the learning media in the classroom, ensuring the media functions as intended, and conducting an initial evaluation for future improvements.
5. Evaluation: Assessing the effectiveness of the media through formative and summative tests. The results show a significant improvement in exam scores after using the new media.

C. Results and Discussion

1. Analysis The primary task at this stage is to analyze the need and feasibility of developing new learning media. The analysis is carried out by answering several key questions: 1) Can the new learning media address the challenges faced in histology practicum exams? 2) Are there sufficient support facilities to implement it? 3) Are the lecturers capable of implementing the new learning media? During this analysis, an excellent media design may not be implementable due to certain limitations, such as inadequate facilities. A thorough analysis is necessary to determine whether the new learning media is feasible for use. Several analyses performed include: 1) Performance Analysis: This stage identifies the fundamental issues in learning. The primary issue here is the low practicum scores among medical students at Universitas Negeri Gorontalo; 2) Student Analysis: it involves studying their characteristics based on knowledge, skills, and development. This analysis aims to understand the varying abilities of students. The findings regarding students' critical and creative thinking skills can be used as a basis for developing the learning media (Supriyatno et al., 2020; Kelana, 2018).

2. Design: this stage begins by setting learning objectives, designing learning activities, and preparing learning materials and evaluation tools. The learning media design remains conceptual and serves as the foundation for the next development process. At this stage, the learning objective is for students to be able to identify cells histologically using a digital atlas. The learning materials include histological cell images, and the evaluation tools consist of pre-tests and post-tests.

3. Development, The ADDIE model includes all necessary actions to achieve the product design goals. The conceptual framework for implementing the new learning media is created during the design phase. This framework is then realized into a ready-to-use product during the development stage. In this study,

the developed learning media is a digital atlas, which students previously replaced microscopes or LCD screens. The atlas allows students to learn from any location.

4. Implementation, the implementation process involves applying the developed learning media. During this phase, everything developed is installed and configured according to its function, making it ready for use in a classroom setting. The developed media is used to deliver the material, and an initial evaluation is conducted to provide feedback for future applications. Implementation also helps improve the developed product draft based on feedback (Tegeh et al., 2015). The main goal of implementation is threefold: 1) Help students achieve learning objectives; 2) Ensure that problem-solving or solutions to student learning gaps are addressed; 3) Develop students' competencies, including knowledge, skills, and attitudes.

5. Evaluation, the final stage of the ADDIE model is evaluation, aimed at assessing whether the developed learning media meets the initial expectations (Wardani & Sudarwanto, 2020; Ilmudinulloh, 2021). The evaluation involves formative assessments through responses to each topic of the body system and summative evaluations covering all practicum materials. This study presents the results of post-tests from the histology practicum exam. The majority of respondents, 51.8%, were in the failing category during the pre-test. The post-test results, based on the proportion of passing and failing students, show that the majority of respondents who initially failed decreased to 18.5% (5 students), while the majority moved to the passing category, with a success rate of 81.4% (22 students).

D. Conclusions

1. An analysis is needed on the common difficulties encountered in learning histology through conventional methods, as well as users' preferences for interactive digital media;
2. The design includes an accessible layout and the organization of material based on key histology topics;
3. Developers ensure that the atlas is accessible via various devices such as computers and tablets;
4. During implementation, the digital histology atlas is tested on users (e.g., medical students) to ensure that the material is easy to access and understand. Users are also provided with training on how to use the atlas features, if necessary;
5. An evaluation is conducted to assess the effectiveness of the atlas in aiding the histology learning process. This evaluation involves user feedback and measuring improvements in material comprehension. Based on the evaluation

results, revisions or improvements are made to enhance the quality of the digital atlas; and

6. By using the ADDIE method, the development of the Digital Histology Atlas can be carried out in a structured and systematic manner, resulting in an effective, interactive learning tool that meets the needs of users in studying histology.

E. Acknowledgement

All praise be to Allah for making it easy for the author to conduct this research and compose this article. Special thanks are also extended to everyone who has helped in carrying out the research and compiling this article.

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