

The 'HOTS Link' application: A consistent tool for designing lessons that support SDG 4 goals

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Abstract. Lesson planning is a key element in improving student learning outcomes. Teachers must be skilled and competent in designing effective lesson plans. In addition, using of technology in education is essential in modern learning. One of UNESCO's goals, SDG 4, aims to achieve quality education. The HOTS Link application was developed to support that. Therefore, this study seeks to examine the consistency of the HOTS Link application in lesson planning that supports SDG 4 among students in Teacher Professional Education and prospective teachers. This research adopts a mixed-methods approach, with quantitative data obtained by measuring the consistency of using the HOTS Link application and qualitative data gathered through in-depth content analysis of lesson plans to assess the alignment of their components with SDG 4 principles. Quantitative data were analyzed using the non-parametric Mann-Whitney U test. The findings indicate no significant difference between the abilities of students in Teacher Professional Education and prospective teacher students in designing quality lesson plans using the HOTS Link application. The resulting lesson plans support SDG 4 goals through equitable and adaptive learning access, emphasis on critical and scientific thinking skills, integration of global issues and sustainability values, reinforcement of character development, and self-reflection.

1 Introduction

Education continues to change and develop, and the integration of technology has become a force to reshape the foundations of teaching and become the center of attention, promising innovative approaches, as well as increasing efficiency [1]. The continuous evolution of technology has opened new avenues for learning in engaging and interactive ways that train students' reasoning and encourage meaningful learning experiences [2]. Therefore, researchers are increasingly interested in this and changing teaching practices by integrating technology.

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Research has proven that an education system prioritizing student achievement significantly contributes to national development and individual well-being [3,4]. Although some variables determine student learning outcomes, the learning strategy designed by the teacher is the most important thing. Research acknowledges lesson planning as a vital contributor to improved student learning outcomes [5]. A well-designed lesson plan is a competency that teachers must master. Lesson planning allows teachers to facilitate student success in achieving learning goals [6]. The skill of designing lesson plans is crucial for all teachers, as it positively influences their professional development and student engagement [7]. Lesson planning is the basis of teacher effectiveness in the classroom [8,9]. Lesson planning guides teachers in carrying out the learning process [10]. Thus, lesson planning is an integral part of teacher professional development, functioning both in the training of prospective teachers and the effectiveness of teacher practice in the classroom [11].

Referring to the description above, teachers and prospective teachers must know about HOTS-based lesson plan design [12]. First, teachers or prospective teachers should master HOTS before transferring to their students [13,14]. That is important so that the HOTS level of teachers and prospective teachers is at a high level so that they can apply ways of understanding HOTS and know how to incorporate the required sub-skills into sequential learning stages. Apart from that, the existence of appropriate learning media can improve HOTS learning which many studies have developed learning media to master HOTS, such as in the form of e-books [15], games [16], and mobile learning applications [17]. The typical technology-based learning media above is relevant to the current technology-based learning process, where the use of sophisticated IT tools and software is considered important amid modern learning [18].

The HOTS Link is an application developed by researchers at Surabaya State University, Indonesia. Users can widely download this application from the Play Store. This application has been tested for validity in the valid category and shows that it can be used by biology teachers to design HOTS-based learning [19]. However, this application has never been used in experimental research to see the consistency of its support for students in Teacher Professional Education and prospective teachers to develop learning designs. Students in the Professional Education Program undertake a one-year teacher training program following their undergraduate studies. Prospective teacher students are students in the 4th semester taking the microteaching course. In addition, this application aligns with SDG 4, one of UNESCO's seventeen goals, namely quality education, holding global aspirations towards progress and development by promoting inclusive, accessible, and quality education for all [20].

This research aims to evaluate the consistency of using the HOTS Link application in lesson planning, focusing on comparing students in Teacher Professional Education with prospective teacher students. This study also deeply examines the relationship between the components of the lesson plan and the principles of SDG 4. The novelty of this research lies in the consistent application of HOTS Link to train students in Teacher Professional Education and prospective teachers in developing high-quality lessons by the goals of SDG 4. This research provides practical recommendations to enhance the application of HOTS Link as a tool for designing lessons that support SDG 4. Through this research, the researcher intends to contribute concretely to implementing the HOTS Link application in support of SDG 4 and the advancement of quality education.

2 Methods

This research uses a mixed methods approach, namely combining quantitative and qualitative data in a balanced manner to obtain a comprehensive understanding [21]. This study collected

quantitative data by measuring the consistency of using the HOTS Link application to design lesson plans in the Teacher Professional Education and prospective teachers based on systematic criteria in the form of lesson plan assessment rubrics standardized by the Ministry of Primary and Secondary Education of the Republic of Indonesia. Qualitative data was obtained through in-depth descriptive analysis of the contents of the lesson plan to assess the relationship between the components of the lesson plan and the principles of SDG 4, namely Quality, Inclusive, and Fair Education.

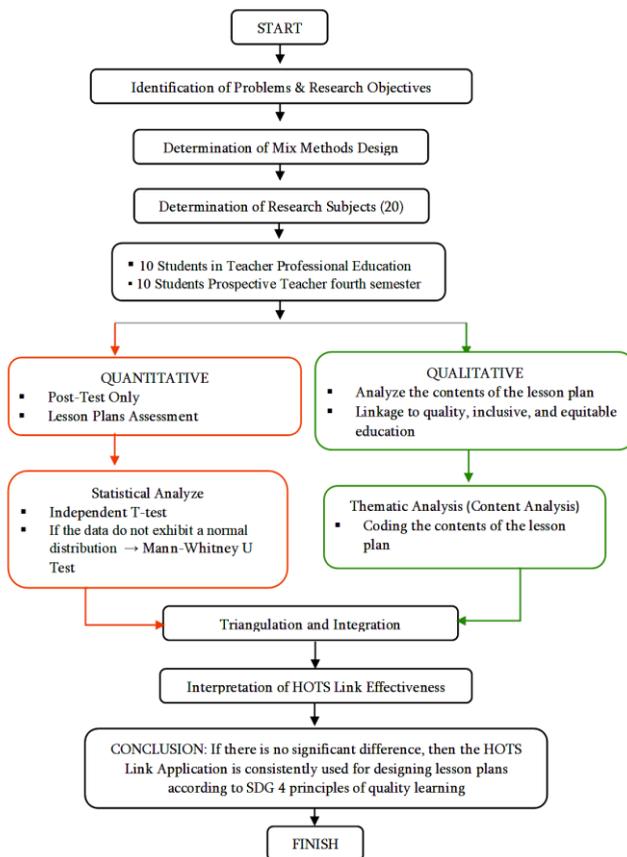


Fig. 1. Research flowchart

The subjects in this research consisted of two groups, namely 10 students in Teacher Professional Education and 10 prospective teacher students in semester 4. Quantitative data was analyzed statistically using the independent t-test to determine the differences in the results of the two groups. However, if the data do not show a normal distribution, the analyst applies the Mann-Whitney U, non-parametric test. If the results of the two groups show no significant differences, then the HOTS Link application is consistent for training teachers or prospective teachers in planning quality learning according to SDG 4.

3 Results and Discussion

Data resulting from the average value of the learning implementation plan document per aspect are presented in Table 1.

Table 1. The Average Value of the Learning Implementation Plan Document Per-Aspect

No	Aspect	PPG Teacher		Prospective Teacher Students	
		Average Value	Category	Average Value	Category
1	Applying the curriculum in a student-centered learning process	8.9	Good	8.8	Good
2	Using learning content and how to teach it	9.0	Very Good	8.9	Good
3	Use knowledge of curriculum components and how to use them to design learning designs	8.0	Good	8.2	Good
4	Implementing effective learning centered on students	8.6	Good	8.6	Good
5	Implement safe and comfortable learning environment strategies for students	8.8	Good	8.9	Good
6	Using knowledge in determining characteristics that will influence the way students learn	8.8	Good	8.8	Good
7	Use understanding of curriculum components and how to use them to design learning assessments	8.8	Good	8.4	Good

Based on the results of the normality test with Shapiro Wilk, it is known that the Significance for the students in the Teacher Professional Education group is 0.003, and the Sig. for the group of prospective teacher students is 0.557. The significance value for the Teacher Professional Education students group is less than 0.05, indicating that the data are not normally distributed. Therefore, the analysis proceeds with the non-parametric Mann-Whitney U test. In the homogeneity test, the significance value based on the mean is 0.214, which is greater than 0.05, indicating that the variances of the two groups are equal or homogeneous.

Table 2. Result of Mann-Whitney U Test

Test Statistics ^a	
	Score
Mann-Whitney U	34.000
Wilcoxon W	89.000
Z	-1.219
Asymp. Sig. (2-tailed)	.223
Exact Sig. [2*(1-tailed Sig.)]	.247 ^b
a. Grouping Variable: Students Group	
b. Not corrected for ties.	

The results of the Mann-Whitney U test analysis obtained a Sig. The value $0.223 > 0.05$ means no difference in results between the two groups of students in the Teacher Professional Education and prospective teacher. The findings suggest that the HOTS Link application consistently supports students in Teacher Professional Education and prospective teachers in designing high-quality learning categorized as Good. Both groups have relatively equal levels of competence in designing learning. Several factors caused that, including exposure to similar curricula and training uses the same application, namely the HOTS Link application.

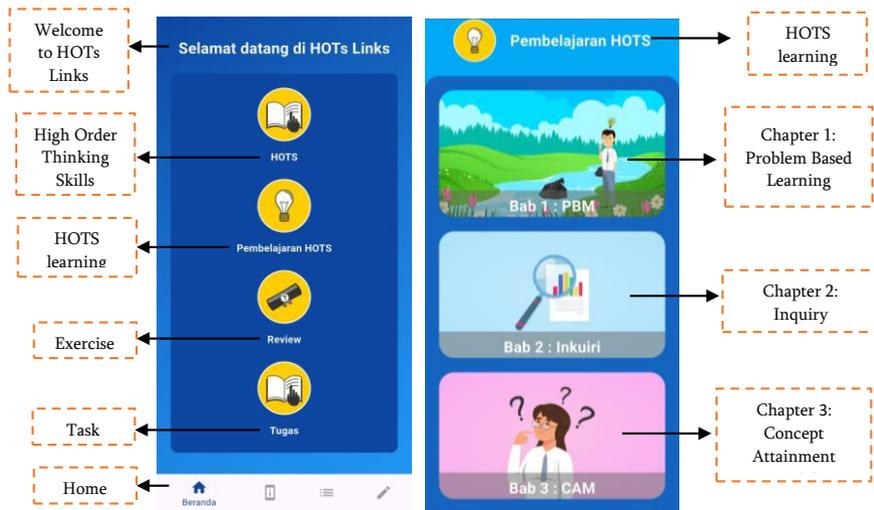


Fig. 2. The HOTS link application feature trains lesson plan design

The HOTS Link is an application developed at Surabaya State University to practice preparing lesson plans. This application includes sharing features that allow users to study the material independently, anytime and anywhere. Students in Teacher Professional Education and prospective teachers have received training or learning related to quality lesson planning through a curriculum that prioritizes 21st-century learning approaches. Thus, their basic knowledge and technical skills in designing quality learning activities do not differ significantly.

Students in prospective teachers are provided with sufficient knowledge and skills to design quality learning, equivalent to students in Teacher Professional Education. The HOTS Link application used in developing lesson plans can help standardize the process and make it easier for users from various backgrounds, thereby minimizing competency gaps. That is because mobile learning applications can expand the reach of teaching and learning [22-24], thereby increasing the capacity to interact with conceptual knowledge [25,26]. SDG 4 covers the entire scope of education for sustainable development and global citizenship [26]. The lesson plan designs created by both groups effectively address the objectives of SDG 4. Table 2 summarizes the qualitative analysis of the lesson plan documents.

Table 3. Qualitative analysis of lesson plan documents

Aspects of SDG 4	Results of analysis of lesson plans description	Conformity with SDGs 4
Inclusivity and Equity of Access	<ul style="list-style-type: none"> Accommodate regular students, high achieving students (HOTS), and students with learning difficulties. Remedial and enrichment strategies available. The learning approach is adapted to student needs (guidance, peer tutoring, etc.). 	Supporting SDGs 4.5: reducing learning gaps and ensuring inclusive access.
Quality of Learning	<ul style="list-style-type: none"> Using Problem-Based Learning, Discovery Learning, Project Based Learning, and Inquiry with a scientific approach. 	Supporting SDGs 4.1: improving the quality of active and meaningful learning.

Aspects of SDG 4	Results of analysis of lesson plans description	Conformity with SDGs 4
	<ul style="list-style-type: none"> Students actively look for and solve problems, not passively receive material. 	
Real-Life Context and Relevance	Topics are related to issues of climate change and body health.	Supporting SDGs 4.7: contextual learning relevant to a healthy lifestyle.
Human Values	Instill spiritual values and social empathy, admire God's creation, show a scientific attitude (curiosity, discipline, politeness), work together in groups, and foster a sense of gratitude, and health concern.	Support education based on human values and social responsibility.
Pancasila Student Profile	Explicitly integrated: faith and morals, critical reasoning, creativity, and cooperation.	Supporting the formation of superior character in 21st-century education.
Holistic Assessment and Reflection	<ul style="list-style-type: none"> Assessment includes cognitive and psychomotor skills and attitudes. There is student and teacher reflection for continuous learning evaluation. The learning process is assessed through observation sheets and holistic rubrics (not just final grades). 	Supports lifelong learning and comprehensive evaluation of the learning process.
Use of Media & ICT in Learning	Use e-worksheet, Google Form, a video compilation of practice results, Quizziz, PowerPoint, internet, e-modules, and Student Worksheets.	Increasing digital access and technology readiness in education.

Based on the descriptive analysis above, the learning design created strongly supports SDG 4, namely quality education. The resulting lesson plans support SDGs 4.5, 4.1, and 4.7. One of the targets of SDG 4.5 is policies and practices regarding gender equality in education [28], which is demonstrated by accommodating everyone in learning. Target 4.7 combines gender inequality with several other transformational and policy themes, ensuring that by 2030, all students acquire the knowledge and skills necessary to promote sustainable development, including, inter alia, through education for sustainable development, which constitutes SDGs 4.1 and sustainable lifestyles, human rights, gender equality, a culture of peace and non-violence, global citizenship and respect for cultural diversity and the contribution of culture to sustainable development [29].

International development frameworks identify quality education as the core objective of the fourth Sustainable Development Goal (SDG 4), which, along with other behaviors and attitudes, can influence societal development in different areas such as health and well-being, cultural preservation, environmental sustainability, and even peace and stability, all of which are also listed as SDGs [30,31]. This initiative responds to global educational challenges that undermine national productivity, competitiveness, and innovation capacity. SDG 4 emphasizes knowledge acquisition and the development of competencies that support informed decision-making, active societal engagement, and the ability to confront emerging challenges [32,33].



Fig. 3. Example of a lesson plan created in accordance with SDGs 4

4 Conclusion

Based on the data analysis, this study found no significant difference between the abilities of Teacher Professional Education students and prospective teachers in designing high-quality lesson plans using the HOTS Link application. This indicates both groups possess comparable understanding and skills in developing efficient learning tools. Additionally, the lesson plans created strongly align with Sustainable Development Goal 4 (SDG 4), which focuses on quality education. These findings emphasize the effectiveness of the teacher education curriculum in preparing future educators and the vital role of technology in professional development. Despite no significant differences, ongoing training and mentorship remain crucial for effective lesson planning. Institutions should continue integrating practical and contextual training to ensure educators apply concepts creatively in real-world settings.

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