Profile content and context of biology modules based analytical thinking skill on the material of the human reproductive system

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Abstract. This research aims to analyze biology modules based on the analytical thinking skill on the material of the human reproductive system. Research procedure was conducted by making indicators are used to analyze the content and context of modules through observation of classroom learning activities. The results of the analysis are presented in the form of percentage graphs which show that: 1) the five modules display the aspect of attributing the lowest percentage, 2) content has a lower percentage than the context of modules.

Keywords: biology module, analytical thinking skill, human reproductive system

1. Introduction
Analytical thinking skill is a Higher Order Thinking Skill (HOTS) needed in the 21st century [1,2]. Analytical thinking skills have strategic values that are important in developing knowledge and the potential to compete internationally because students can evaluate, plan, and decide the best choices and directions for the future [3–5]. Analytical thinking ability is interpreted to think from sequential events into parts of problem-solving presented with reasons, principles, functions, linking issues, answering problems by looking back at previous problems [6–8]. The ability to think analytically consists of three aspects, namely differentiating (determining the relevant and irrelevant parts of information), organizing (building parts of information systematically and coherently), and attributing (determining the purpose of information) [9,10].

The ability to think analytically is not only about memorizing facts but an attempt to improve complex and creative understanding to achieve better learning goals. Learning with an emphasis on analytical thinking allows students to learn managing problems, overcome challenging situations, and apply what students learn to the activities of everyday life [11]. Learning science involves understanding content, ways of teaching, and strategic use of technology information [12–15].

Improving analytical thinking skills in learning is a goal in the fields of science, social, arts, and humanities as the main learning objectives [16]. Learning is context-bound activities, and teachers with the use of Technological Pedagogical Content Knowledge (TPACK) are developed to design learning experiences tailored to the content and context of particular learning [17–19]. Science learning is not enough to only understand material content but also how to use and deliver teaching
materials [20,21]. Teaching materials are a set of subject matter that refers to the curriculum used in order to achieve basic competency and competency standards [22]. A module as one of the teaching materials in schools helps teachers and students to learn learning material [23–25].

Human Reproduction System is one of biology learning material in high schools which deals with biological phenomena about organs, reproductive mechanisms, and disorders/diseases [26]. Mastery of Human Reproductive System material in one of the schools in Karanganyar Regency based on National Examination result data has decreased from three consecutive years, namely from the 2014/2015 school year (42.55%), 2015/2016 (41.67%), and 2016/2017 (28.09%). The results of the teacher and student interviews stated that the material of the human reproduction system is material that is difficult to learn because it is required to analyze complex mechanisms. Factors that influence the low mastery of learning materials include mastery of the material conveyed by the teacher to students, the use of teaching methods, and the module which is used [27–29].

The biology learning module is self-instructional to help students learn independently since in the module various directed and structured activities are summarized [30]. Biology modules in schools are used as learning resources, guidance on understanding material, motivators in learning, and tools for measuring learning outcome competencies [22]. Modules in schools are used as an effort to improve the learning outcomes of biology, especially in the material of the human reproduction system which has a low students’ understanding. A strong relationship between content and module context with students’ thinking skills is very important to ensure students’ needs and expectations and the success of future education programs [31,32]. The importance of analyzing the content and context of modules that are adapted to students’ thinking skills is to achieve learning objectives based on the expected curriculum [33]. The content profile and context of the biology module based on analytical thinking skills can be used to inform and consider the development of modules and evaluate the learning process, especially in biology learning.

2. Research Methodology

This research employed the quantitative descriptive method. The research procedure was conducted by making module indicators to analyze the content and context of the modules used in schools through observation of classroom learning activities. Module indicators were based on aspects of analytical thinking skill adjusted to the material of the human reproduction system. Field surveys were conducted by interviewing and giving questionnaires to teachers and students. The sample consisted of 5 modules focusing on the material of the human reproduction system used in the Senior High School / Islamic Senior High School Karanganyar Regency based on the 2013 curriculum. Module content was analyzed based on goals, material, activities, and questions. Module context was analyzed based on delivery and use data from content analysis and module context used descriptive percentage, to determine aspects of analytical thinking skills.

3. Results and Discussion

3.1. The result of the research

Content refers to subject matter knowledge that must be mastered in biology learning, which includes facts, concepts, principles, laws, and theories [19]. Context is a way of delivering and using teaching materials in accordance with learning material [34]. The analysis of the content and context of the biology module based analytical thinking skill on the material of the human reproductive system is shown by the percentage in Figure 1 and Figure 2.
Figure 1. Percentage of the average aspect of thinking ability content analysis of five biology modules of the human reproductive system

Percentage of analytical thinking skill aspects based on Figure 1 shows the percentage of differentiating aspects, Module 1 (6.42%), Module 2 (13.57%), Module 3 (16.42%), Module 4 (7.85%), and Module 5 (12.85%). Organizing aspects of Module 1 (5.88%), Module 2 (5.88%), Module 3 (8.08%), Module 4 (10.29%), and Module 5 (5.88%). Attributing aspects of Module 1 (2.42%), Module 2 (1.61%), Module 3 (2.42%), Module 4 (3.22%), and Module 5 (0.80%). The results of the three modules content analysis (Module 2, Module 3, and Module 5) showed the same pattern with the highest percentage of differentiating aspects and the lowest attributing aspect. Module 1 showed the differentiating aspect percentage and organizing there are not many differences and the lowest attributing aspect. Module 4 showed the most different pattern because of the highest aspect of organizing and the lowest attributing aspect.

Figure 2. Percentage of the average aspect of thinking ability context analysis five biology modules of the human reproductive system
Percentage of analytical thinking skill aspect based on Figure 2 shows the percentage of differentiating aspects, Module 1 (8.57%), Module 2 (19.99%), Module 3 (18.56%), Module 4 (10%), and Module 5 (21.42%) Organizing aspects of Module 1 (7.35%), Module 2 (10.29%), Module 3 (13.23%), Module 4 (14.70%), and Module 5 (7.35%). Attributing aspects of Module 1 (4, 83%), Module 2 (3, 22%), Module 3 (3, 22%), Module 4 (6, 45%), and Module 5 (1, 61%). The results of the context analysis of three modules (Module 2, Module 3, and Module 5) showed the same pattern with the highest percentage of differentiating aspects and the lowest attributing aspect. Module 1 showed the differentiating and organized there are not much difference and the lowest percentage attributing aspect. Module 4 showed the most different pattern because of the highest aspect of organizing aspect and the lowest attributing aspect

3.2. Discussion of the research
The pattern of content analysis and the context of the module based on analytical thinking skills with the results of the highest percentage sequence is differentiating, and the lowest is attributing aspect. The differentiating aspect involved the process of sorting out relevant or important parts of a structure. The differentiating aspect had a different meaning from the cognitive process in the category of understanding and comparing because differentiating involved the process of mimicking structurally and determining the parts of information that were relevant and irrelevant according to the overall structure [9,35]. The attributing aspect involved the process of determining relevant and irrelevant parts of information, building systematic, and coherent relationships between pieces of information, and determining goals. The attributing percentage of analytical thinking was seen from the inability of students to describe data in tables and graphs, could not present data in graphs that were interconnected, could not identify experimental variables, could not formulate problem formulas and experiment hypotheses [36,37]. The low aspect of attributing students was caused by a lack of accuracy in building relationships between elements so that students found it difficult to construct concepts [37,38]. Students had difficulty organizing different structures and processes and making connections between structures and functions at various organizational levels to provide explanations of biological phenomena during the learning process [39].

Content and context related to learning in schools to change prior knowledge, familiarity, learning approaches, and cognitive burden and seek consistent interactions [40]. Context analysis showed a higher percentage than module content but not significant seen from Figure 1 and Figure 2, because context can better describe an idea so that it arouses interest in learning activities [41]. Context may stimulate prior knowledge activation by triggering the retrieval of information about the content that a student has already stored. This activation of prior knowledge might not happen if the content was presented without context [40]. Content profile and module context had not fully optimized the ability of students to think analytically in the learning process. Research on the analysis of biology modules related to content and context in Iran and Turkey showed that the learning module had problems and did not reflect the biology curriculum requirements [31,42,43] so it needed to be rearranged to meet the requirements of the new curriculum and support the teaching and learning process more effectively [44–47]. Analytical thinking skills in the countries of Thailand and Malaysia showed that level of achievement is not optimized so need to be repaired [48,49]. The main requirements that were considered for optimization and developing analytical thinking skills lie in efforts to integrate content and context through TPACK [50]. The teacher integrates analytical thinking skills in the school learning module to carry out activities and build their knowledge [51], so that the improvement of the content and context of the module needs to be done to achieve effective biology learning objectives in accordance with the applicable curriculum

4. Conclusion
The conclusion of this study is that the highest percentage is differentiating and the attributing aspect has the lowest percentage of biology modules of Senior High School. The results of the analysis
indicate that there is a need to improve the content and context of biology modules that are integrated with high order thinking skill to achieve effective and optimal learning goals.

5. References

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