

College Students' Perspectives on Creating Plant Anatomy and Physiology Worksheets in the View of Constructivism Theory

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Abstract

The aim of this study was to explore college students' perspectives on creating worksheets for Junior High School students. Plant anatomy and physiology were used as the topic of the project. The participants included 30 undergraduate students in the 5th semester of the Science Education Study Program who took the Anatomy and Physiology of Living Things course at the Faculty of Teacher Training and Education, Tidar University. Open-ended questions were applied to gather students' perceptions of the project. Moreover, the data on college students' satisfaction with the course and the instructor were taken through a questionnaire. The result of this study showed creating students' worksheets gave beneficial effects even though some obstacles should be handled during the process. In the other side, students were satisfied with the project. Based on the constructivism theory, this student-centered learning process gave a wide opportunity for college students to construct knowledge and meaning from their experiences in the creation of student worksheets. The findings of this study can be used as considerations regarding learning strategies to improve classroom practices.

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Introduction

The high quality of learning can be achieved in a variety of ways. According to [Pulungan, et al. \(2020\)](#), using student worksheet in the learning activities is one way to achieve it. It has an important role to support the success of students in acquiring and mastering knowledge that has been received through the presented activities ([Widodo, 2017](#)). It can also help the occurrence of effective interactions in learning activities and as an alternative for teachers to be able to direct learning activities to become more structured ([Umbaryati, 2016](#)). [Khotimah, et al. \(2017\)](#) stated the student worksheet makes the material easily to be understood, provides questions to improving the students' ability, trains independence learning, and helps teachers to assess the abilities of students. Thus, student worksheet supports the quality of learning by systematic students' activities on it.

Student worksheet contains both learning activity and other elements to support student independence. Content, summaries, tools, materials, and instructions for completing tasks or information and instructions given to carry out learning activities independently are provided in the student worksheet ([Prastowo, 2014](#)). [Diella, et al. \(2019\)](#) stated that student worksheet consists of the title, time allocation, learning objectives, summary of essential materials, and procedures for learning activities. Besides, basic competencies, indicators developed into learning objectives, and material to be taught have been adjusted when creating student worksheet ([Wulandari, et al., 2021](#)). Those elements of students' worksheet are needed to be well-prepared before the learning activity to reach the learning goals.

As professionals, teachers are positioned as learning agents to improve the quality of education. [Muhajirah \(2020\)](#) explained that the quality of learners is comparable to the professionalism of teachers.

Moreover, teacher competence is positively related to students' interest and achievement that is mediated by the actual teacher-student-interactions in the classroom (Fauth, et al., 2019). Teachers who are qualified and able to carry out learning in the 21st century are needed in the education to create required high quality of human resources (Mardiyah, et al., 2021). However, teachers today face challenge to master digital competence since the lack of teacher training and insufficient ICT training provided for them (Fernández-Batanero, et al., 2022). Because of the importance of the role and duties of educators for the human resources advancement in the digital era, they should be able to develop their capacity particularly in digital competency to achieve success in learning activities in the 21st century.

One of the main competencies that must be mastered by educators is the competence to be able to develop teaching materials using digital technology to facilitate meaningful learning activities and support the independent learning. Compiling teaching materials can certainly facilitate students in learning activities because educators who design these teaching materials have adjusted to the needs of their respective students (Subarjo, 2022). The teachers be able to carry out their duties optimally if they have sufficient preparedness (Maipita and Mutiara, 2018). Hendri (2023) explained that educators, students, and teaching materials are the supported elements in the implementation of learning activities. In this case, the readiness not only reflected in the ability to master the material but mentally and physically competencies also. Hence, the ability on creating teaching materials using digital technology to improve the competence of students should be owned by teachers.

Although the previous research literature emphasizes the development and the impacts of students' worksheets in the learning process, there are lack studies that focus on the college students' perspective on creating science students' worksheets for Junior High School. This study was conceived due to this lack of research on this topic and designed to find appropriate learning strategy in the Science Education Study Program to improve classroom practices in the creation of Junior High School student worksheets.

Based on the previous explanation, the purpose of this study is to explore college students' perspectives on creating worksheets for Junior High School students. The findings of the study will be described based on constructivism. Constructivism is a learning theory explaining how people learn and acquire knowledge from their experiences (Bada and Olusegun, 2015). In constructivist learning, students are active to construct the meaning and knowledge to be achieved (Sugrah, 2020). They build their own knowledge, search the meaning, and develop mindset they already have (Suparlan, 2019). In the class, teacher is a facilitator who manages activities and provides appropriate information that facilitates learners to construct, create, invent, and improve knowledge and meaning (Liu and Chen, 2010). It can increase the interest and learning outcomes of students (Anggraeni, 2019). Moreover, the active learners facing the existing problems in accordance with the principles of discovery learning and meaningful learning (Masgumelar and Mustafa, 2021; Andriati, 2014). Hence, the university students' satisfaction, the advantages, the disadvantages, and the students' recommendations on creating worksheets will be clear in the view of constructivism theory.

Methods

Thirty undergraduate students in the 5th semester of the Science Education Study Program who took the Anatomy and Physiology of Living Things course at the Faculty of Teacher Training and Education, Tidar University were employed as participants in this study. During the project, they worked in teams with each group consisting of six students. Developing college students' skills in creating worksheets for Junior High School students on plant anatomy and physiology theme is the main objective of the project. One of products of this project can be seen in Figure 1. This project was conducted eight times of meetings. The study of the project was carried out by the lecturer. Thus, the goal of this study was to explore college students' perspectives on creating worksheets for Junior High School students by answering the research questions as follows:

1. What are the undergraduate students' perceived advantages and disadvantages of developing worksheets for Junior High School students?
2. What was the overall satisfaction with the learning activity and the lecturer?

Open-ended questions were used for gathering students' perspectives about creating worksheets for Junior High School students on plant anatomy and physiology topic. The difficulties, advantages, and disadvantages of the project and their recommendations were addressed by questions. An adapted questionnaire namely the Instructor and Course Evaluation Questionnaire from Gülbahar and Tinmaz (2006) was used to take students' satisfaction with the course and the lecturer. It consisted of 16 questions that were delivered to all students after completing the project.

The Likert scale 1 to 5 was used in the questionnaire. The collected data were analyzed in a descriptive statistical by determining the mean value and standard deviation. The mean values were

interpreted with the following conditions: very bad in the range of 1.00-1.80, bad in the range of 1.81 - 2.60, sufficient in the range of 2.61 - 3.40, good in the range of 3.41 - 4.20, and very good in the range of 4.21 - 5.00 (Pimentel, 2010).

Results and Discussion

In the first semester of 2022/2023, research subjects started face-to-face course in Anatomy and Physiology of Living Things class. Students participated project-based learning model to compile student worksheet with plant anatomy and physiology theme (Figure 1). Each group created student worksheet with distinct topics. Learning activities were carried out during eight meetings in class. The key features of project-based learning, namely learning goals, engaging in scientific practices, driving questions, collaboration, learning technologies, and artifacts based on Sawyer (2018) were implemented in this study.



Figure 1. One of the student worksheets

The student activity in the student worksheet was tested by each group. The result of the test could be used to revised the activity in the student worksheet. The college students documented it in the video. One of part of videos of based on the student worksheet activity can be seen in the Figure 2. They explained the tools and materials, experiment steps, collected data, and conclusion.



Figure 2. Video-based on the activity in the worksheet

Based on collected data through open-ended questions, creating student worksheet was a beneficial activity for improving knowledge and thinking skills. Respondents stated that they know how to compile student worksheet properly and correctly, have opportunities to correct mistakes, understand the student worksheet sections, improve creative thinking, and develop critical thinking skills. In addition, the project motivated the students to create student worksheet in the future. They were inspired to develop student worksheet in their research. They also explained that the experience would be useful for the further student worksheet development.

However, during the production of student worksheet, students experienced some obstacles related to time, cooperation, and creating the student worksheet structure. Students needed more time for compiling student worksheet and making schedule to work together. When working together, the team was not solid enough. They faced difficulty on determining the goals that should be achieved by students, discussion questions, valid references, design, variables, material for student activities, and experimental concepts. In addition to these obstacles, determining simple experimental topics and schemes, simple tools and materials for student activities, and external factors that have the potential to affect experimental schemes (e.g., weather in photosynthesis experiments) were challenges during the project. These obstacles could be solved through consultation with lecturers, learning from various references, and developing the teamwork.

Based on their experiences on this project, respondents provided several suggestions for project-based learning with the topic of creating student worksheet in the future. The implementation of project-based learning should be monitored by appropriate media. Moreover, the time to create student worksheet needs to be extended and the scope of material should be determined clearly. The suggestions are useful as considerations for improving the learning quality through project-based learning classroom in the future.

The student satisfaction data were gathered through questionnaires. The questionnaires were distributed by *Google form* at the end of the program. Based on the data, the average value and standard deviation were measured. The results of data analysis related to college students' satisfaction can be shown in Table 1. The mean values of each indicator were interpreted based on these criteria: very bad in the range of 1.00-1.80, bad in the range of 1.81 - 2.60, sufficient in the range of 2.61 - 3.40, good in the range of 3.41 - 4.20, and very good in the range of 4.21 - 5.00 (Pimentel, 2010). The results of this study will be explained by constructivism learning theory. Policies related to project-based learning implementation can be defined due to the results of this research.

Table 1. University Students' Satisfaction

SN	Indicators	Mean	SD
1	The goal of the project was briefly explained at the beginning of the semester.	4,40	0,62
2	Information from main and additional resources to support the creation of student worksheets was provided sufficiently.	4,17	0,59
3	The lecturer was well-prepared to guide the project on creating student worksheets.	4,60	0,56
4	The lecturer had come on time during the lessons related to the project.	4,37	0,67
5	The lecturer could be contacted during working hours.	4,47	0,63
6	The course related to the creation of student worksheets project was conducted according to described plan.	4,50	0,63
7	Students were encouraged to use resources that support the project.	4,47	0,68
8	Students got individual opportunities to participate in projects, presentations, and discussions.	4,63	0,56
9	The language used in conveying instructions could be clearly understood.	4,57	0,57
10	Lecturer communicated effectively with students during the project.	4,67	0,55
11	The course hours to conduct the project were used effectively.	4,30	0,70
12	The lecturer tried to use various tools, methods, and techniques as needed.	4,40	0,56
13	The lecturer shared innovations related to the creation of student worksheets.	4,47	0,57
14	Lecturer had given value to students' ideas in teaching and learning.	4,53	0,57
15	The assessment questions were prepared related to the project.	4,37	0,61
16	Students were given feedback on the projects such as the presentation of results and the opportunity to revise.	4,57	0,57

Based on the mean scores in [Table 1](#), almost all indicators shown an excellent level of student satisfaction with the program. Only one indicator showed good result, namely "Information from main and additional resources to support the creation of student worksheets was provided sufficiently." This indicator had the lowest score because the students developed student worksheet with different topic for each group. This showed that the information related to references in the creating of student worksheet project needed to be increased.

The results of this study showed that project-based learning was accordance with the characteristics of the constructivism approach, namely students learn actively, it implements authentic learning, it uses challenging and interesting learning activities, students associate new information with previous information, students reflect on the knowledge being learned, and lecturers become facilitators for students ([Masgumelar and Mustafa, 2021](#)). Students conducted discussions and shared the task of the project in the groups. The learning process was authentic and contextual because it was related to college students' competencies that need to be improved such as the skills to create appropriate teaching materials for junior high school students. Interesting and challenging learning activities were evidenced by the students' responses that expressed motivation to develop student worksheet in the future. During the process, students associated new information with previous information that had been owned. Besides, students reflected the knowledge from the project. In this learning activity, lecturer helped the students as facilitators who supervised and gave suggestions for improvement the product.

Conclusions

The project-based learning model on creating student worksheet in the plant anatomy and physiology theme was beneficial for students even though there were several obstacles and challenges. The learning model improved knowledge and thinking skills. However, the obstacles related to time, cooperation, and the student worksheet structure were found. In addition to these obstacles, students faced challenges in determining topics, experimental schemes, simple tools, and materials for student activities. Besides, external factors affected experimental schemes. Most of all indicators show a very good level of student satisfaction with the program. Only one indicator (information from main and additional resources to support the creation of student worksheets was provided sufficiently) showed good result.

Recommendations

The results of this study are useful as consideration in the implementation of project-based learning in the future. Based on the data, discussion, and conclusion on this study, there are some recommendations regarding the development of student worksheet. The structure of worksheet should be explained clearly by the lecturer. Besides, collaboration in each team needs to be controlled continuously, media to supervise the implementation of project-based learning needed to be provided, the time to completed the project should be extended, and the scope of material should be specified. The college students should manage their time during the project and mastering communication skills either with their team members or lecturer. Moreover, the larger of sample and population are recommended to be employed for the future research.

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