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A Pop-Up Book Workshop on Cell Biology for Students at Junior High School 1 Samarinda

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ABSTRACT

This community service activity aims to train students in creating pop-up books focused on cell biology. It was conducted in June 2026 in partnership with Junior High School 1 Samarinda, involving 13 students from grades 7 and 8. Eight lecturers were involved, serving as facilitators throughout the event. The activity consists of planning, implementation, and evaluation. The evaluation used descriptive pretest–posttest data and a questionnaire to examine students' understanding and responses to the activity. The outcome of this workshop was a series of pop-up books about cells, successfully created by groups of students from partner schools. Each group produced a pop-up book featuring cells, organelles, and their functions. Additionally, the activity yielded questionnaire results. The mean pretest score increased from 92.22 to 95.56 on the cell material assessment, while conceptual understanding increased from 75.3% to 82.3%. Student interest and attitudes increased from 81.3% to 83.0%, while the material and delivery aspect obtained 82.9%. The skills and practice aspect reached 82.3%, and media usefulness received the highest response at 85.2%. These findings indicate that students responded positively to the workshop and perceived the pop-up book as a useful learning medium.

INTRODUCTION

Science education, particularly biology at the junior high school level, plays a crucial role in building students' understanding of the basic concepts of living organisms and their environments. One of the fundamental topics in biology is the cell (Beck et al., 2024; Seliya & Bihari, 2024), which serves as the foundation for understanding the structure and function of living organisms as a whole. The cell is even referred to as the basic unit of biology which is one of the abstract concepts in biology and forms the basis for the study of life (Luthfyanti et al., 2024).

The microscopic and abstract nature of cells often poses a unique challenge for middle school students. For seventh-grade students, cell-related material is often considered difficult due to the breadth of the subject matter. Furthermore, misconceptions are commonly experienced by

students studying abstract material, and if these misconceptions persist, their understanding of subsequent concepts will also be flawed.

Based on observations and discussions with partners, including science teachers at the Junior High School 1 Samarinda, it was found that students generally exhibited a high level of activeness and creativity in participating in the learning process. Teachers also implemented interactive learning methods utilizing digital media such as PowerPoint presentations and illustrative images. However, a problem persisted, namely that the use of digital media was deemed less than optimal in helping students understand cell concepts in depth. This was because two-dimensional visualizations on LCD screens were less able to provide a concrete and memorable learning experience, so that cell concepts remained abstract for some students. Furthermore, the material on cells tended to be abstract, containing many new terms for students, and each part had a specific function.

The current use of digital learning media has not fully addressed students' difficulties in understanding abstract cell concepts. Although teachers at the partner school have used PowerPoint presentations and illustrative images, these two-dimensional media were still considered less effective in providing concrete and memorable representations of cell structures and functions. This finding is consistent with [Hidayati and Nurmawati \(2025\)](#), who reported that students may experience difficulties in understanding biological concepts when learning characteristics are not adequately supported. Therefore, more interactive and concrete learning media are needed, particularly those that actively involve students in the learning process. In this context, pop-up books offer a relevant alternative because their three-dimensional and movable elements can help make abstract biological concepts more tangible and engaging ([Ahmad et al., 2024](#)).

One alternative learning medium that can be used is a pop-up book. Pop-up books are paper-based media that have three-dimensional, moving elements, thus providing a more concrete and interactive visual experience ([Ahmad et al., 2024](#)). Through pop-up books, cell structure can be visualized in a more realistic form, making it easier for students to understand the parts of a cell and their functions. Furthermore, the process of creating pop-up books by students themselves can also enhance creativity, motor skills, and conceptual understanding through project-based learning.

Various studies have been conducted on the benefits of using pop-up books for learning. Pop-up books on cell material are suitable for use as learning media, producing excellent student readability results. Learning cell material supported by cell media can influence student learning outcomes ([Alfira et al., 2024](#)). Other research also shows that pop-up books on science and biodiversity materials are also valid and suitable for use in learning ([Resta & Kodri, 2023](#); [Widianti et al., 2024](#)). The use of Pop-up Books in learning can improve students' understanding of concepts ([Sholihah et al., 2025](#)), student learning outcomes, student activity in class ([Saputri et al., 2025](#)), improve storytelling skills ([Nisyah et al., 2024](#)), and improve students' memory of genetic material through special learning experiences by sliding, opening, and folding the pop-up book sections ([Saputra et al., 2021](#)). Instruction using pop-up books as a medium has not yet been implemented at the partner school.

Seeing this potential, this Community Service activity was designed in the form of training in creating biology learning media in the form of pop-up books on cell material for students of Junior High School 1 Samarinda. This Community Service activity, in partnership with school teachers, with the training participants being students. Student selection was carried out by purposive sampling with the criteria of students who have completed science lessons and have a good level of activity in class. The students were from grades 7 and 8, and their average Science scores were above the minimum passing standard. This community service activity not only focuses on the final result in the form of learning media, but also on the learning process that involves students actively, creatively, and collaboratively.

This community service activity is designed to strengthen students' understanding of cell biology through concrete and engaging learning media. By creating pop-up books, students are encouraged not only to learn cell structures and functions but also to develop basic skills in

producing simple learning media independently. The activity also provides teachers with an alternative instructional medium that can complement existing classroom practices. Thus, the program is expected to support both students' conceptual learning and teachers' efforts to create more engaging biology instruction.

The use of pop-up books represents an innovative approach to promoting more active and learner-centered science learning. Unlike conventional two-dimensional media, pop-up books allow students to interact with three-dimensional representations while participating directly in the process of constructing the learning material. This active involvement can make abstract biological concepts more concrete and meaningful for students. Therefore, pop-up book activities provide a practical way to integrate creativity, visualization, and active learning in biology education.

Participation in the workshop also provides opportunities for students to develop competencies beyond academic knowledge. Through group discussions, media construction, and collaborative problem solving, students are encouraged to practice communication, teamwork, creativity, and decision-making skills. The hands-on nature of the activity gives students direct experience in applying knowledge and working collaboratively in an authentic learning context. Consequently, the workshop supports the development of both conceptual understanding and transferable skills that are important for students' broader learning experiences.

Overall, the activity aims to improve students' knowledge of cell biology while developing their skills in creating pop-up books as learning media. The learning process requires students to understand relevant cell concepts, select appropriate information, visualize the content, and collaborate with peers during media development. These activities are expected to strengthen creativity and cooperation while allowing students to apply biological knowledge in a tangible form. Accordingly, the program combines conceptual learning, creativity, and collaborative media production as the main outcomes of the community service activity.

METHODS

The community service activity was conducted at Junior High School 1 Samarinda on June 11, 2026, through a structured sequence of planning, implementation, and evaluation. Participants were selected purposively based on their completion of science learning and level of classroom engagement. The activity involved lecturers, university students, and science teachers as facilitators, with 13 university students serving as demonstrators and mentors during the practical sessions and eight lecturers providing overall facilitation. The implementation stage consisted of several activities, including socialization, material delivery, training and hands-on practice, and mentoring. This structured approach was designed to ensure that participants received both conceptual guidance and practical experience throughout the program.

At the First stage, planning, initial activities were carried out to ensure the smooth running of the program. This activity began with coordinating activities with the school (Junior High School 1 Samarinda) regarding the time, place, and participants of the activity, then compiling a training module for making pop-up books, preparing tools and materials (cardboard, scissors, glue, markers, etc.) and compiling evaluation instruments (pre-test and post-test).

The socialization stage aims to provide participants with an initial understanding of the activities that will be carried out with a series of activities introducing the community service program and the objectives of the activity, explaining the benefits of pop-up book learning media, and motivating students to participate actively. At material delivery stage, students are given reinforcement of basic concepts: about cells and their functions by providing Cell Material handouts.

At training and practice stage, students demonstrated how to make a pop-up book and provide examples of finished pop-up books. Students were then asked to practice making pop-up books in groups. During mentoring stage such as practicum, students, lecturers, and teachers provided intensive support. Students were guided in developing appropriate content, assisted in resolving technical issues, and directed to ensure their work aligns with biological concepts.

The evaluation stage was conducted to assess changes in students' understanding and their responses to the learning activities. Students completed a 20-item pre-test before the activity and the same 20-item post-test after the activity to measure changes in their understanding of cell-

related concepts. In addition, a student response questionnaire was administered to assess perceptions of the material, delivery process, practical activities, and the usefulness of the pop-up book as a learning medium. The scores were converted to a 100-point scale and classified into four categories: 25–43.75 (Very Low), 44–62.50 (Low), 62.75–81.25 (High), and 81.50–100 (Very High). Pre-test and post-test data were analyzed descriptively by comparing the scores before and after the activity, while student response data were analyzed using percentage scores for each assessed aspect. This evaluation provided descriptive evidence of changes in students' conceptual understanding as well as their perceptions of the learning process and the usefulness of the pop-up book media.

RESULTS AND DISCUSSION

The implementation of the pop-up book workshop began with reinforcement of students' understanding of cell structure and function using prepared handouts. This initial stage provided students with the conceptual foundation needed to select and organize biological information for inclusion in their pop-up books. The facilitators then demonstrated how cell-related concepts could be transformed into visual representations and introduced basic techniques for constructing the pop-up book. This sequence enabled students to connect biological concepts with the practical process of developing three-dimensional learning media.

After receiving the materials and demonstrations, students worked in groups to determine which parts of the cell material would be developed into a pop-up book. They then chose the visualization format, organized the information, created patterns, cut, folded, and assembled the media pieces. This activity provided an opportunity for students to integrate biological knowledge with media-making skills.



Figure 1. Students determine the material to be created in the pop-up book.

The mentoring stage played an important role in supporting students after they had completed the initial construction of their pop-up books. Teachers, university students, and lecturers acted as mentors by guiding students in refining the content, improving the design, and resolving difficulties encountered during the development process. This mentoring created a cooperative learning environment in which students could interact, exchange ideas, and clarify concepts with peers and facilitators. Such collaborative interaction can strengthen students' understanding while also encouraging active participation in the learning process (Kusuma et al., 2025). Thus, the mentoring process not only supported the technical completion of the pop-up books but also reinforced collaborative and meaningful learning experiences.

At this stage, students actively study the material on cells using provided handouts. They engaged in discussions with peers and student mentors regarding concepts they do not yet fully grasp, thereby facilitating the clarification and reinforcement of their conceptual understanding (Saputra et al., 2026). Such interactions involving discussion and guidance help students identify areas of the material they have not yet mastered and develop the metacognitive skills needed to monitor their own learning processes (Firmansyah et al., 2025).

After grasping the material on cells, students determine which concepts or sub-topics to include as content for their pop-up books. During this process, they are given the opportunity to consider various material options, select the most relevant information, and prioritize the content

to be visualized. These activities not only support the mastery of biological concepts but also provide students with experience in deliberation and decision-making. Decision-making skills within the learning process can be fostered through activities that allow students to gather and compare information and select logical rationales (Fitri et al., 2024).



Figure 2. The process of assisting in making a pop-up book.

During the pop-up book creation process, students experimented with different ways of arranging two-dimensional paper sheets to produce three-dimensional pop-up structures. They tested several construction techniques before selecting the design that was considered most appropriate for their pop-up books. Student participation was observed through six indicators: participation in group discussions, distribution of roles, hands-on involvement, experimentation and problem solving, collaboration and peer assistance, and completion of assigned tasks. The observation showed that students participated in various stages of the activity, including cutting, folding, gluing, arranging layouts, preparing materials, and modifying designs when construction problems occurred. Students also distributed responsibilities within their groups and assisted one another during the assembly process. These activities indicate that the workshop provided students with direct opportunities to practice learning-media development while engaging in collaborative problem solving. Development of a pop-up book supported an active learning atmosphere and increased students' learning motivation in science learning (Yanuwardianto et al., 2023). Figure 2 shows students during the pop-up book-making activity.

After the media was completed, each group presented their work to the class. Students explained the parts of the cell shown and their respective functions. The presentation activity provided an opportunity for students to communicate their work while also strengthening their understanding of the material they had learned. Figure 3 shows students demonstrating a pop-up book.



Figure 3. Students show their Pop-up Book work

Learning media in learning activities is a means to convey learning messages, make it easier for students to gain understanding and can encourage learning motivation so that students get good learning results (Karomah et al., 2024). Based on Figure 4 regarding the pretest and posttest results, it is known that the average pre-test score was 92.22 and increased to 95.56 in the post-test.

Although the increase in score is relatively small, the high pre-test results indicate that students have a good initial understanding of the cell material. The increase in post-test results shows that the activity of providing material and the use of pop-up book learning media still makes a positive contribution to student understanding. Thus, this activities can be said to be able to maintain and improve students' understanding of the concept of cell material.

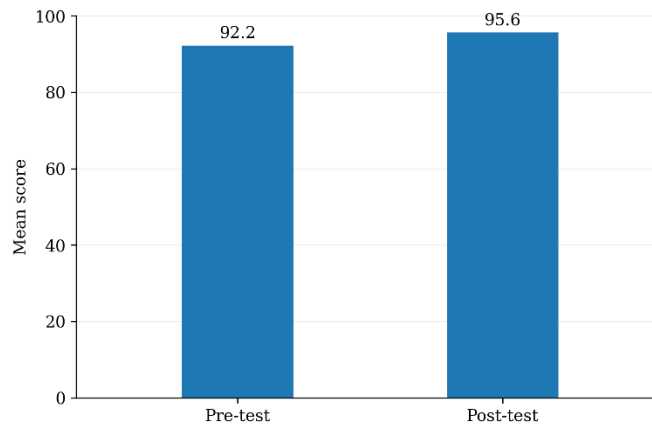


Figure 4. Pretest and Posttest Data for Cell Material

Understanding is the ability to grasp or comprehend an object after it has been learned or remembered. This includes the ability to grasp the meaning and significance of the material being studied (Islamiyah & Lestari, 2024). Based on the pretest and posttest results in Figure 5, students' conceptual understanding increased from 75.3% to 82.3%. This indicates that the pop-up book making training has a positive impact on students' understanding of the concept of cell structure and function. This is in line with the results of research Arip & Aswat (2021) which shows that the use of pop-up book media in learning can improve students' science learning outcomes.

Furthermore, student interest and attitude increased from 81.3% to 83.0%. These results indicate that the pop-up book preparation activity can increase students' interest and positive attitudes towards biology learning, although the increase is relatively less than the conceptual understanding aspect. The material and delivery aspect obtained a score of 82.9%, indicating that the training material and its delivery method were considered very good by participants. The material was considered quite clear and supported students in participating in the activity.

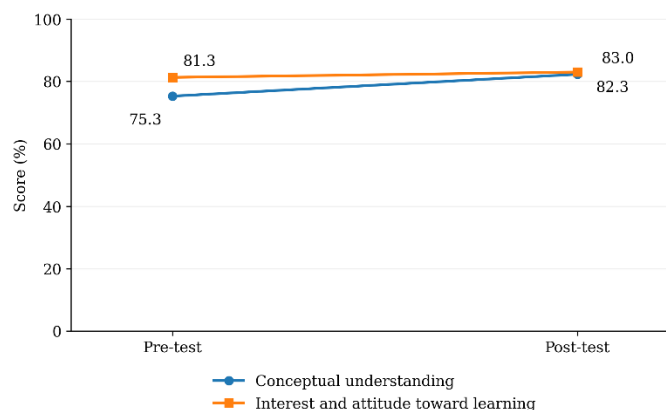


Figure 5. Data from the Pretest and Posttest Results of Student Attitudes

Based on Figure 6, the skills and practice aspect obtained a score of 82.3%, while the media usefulness aspect received the highest score of 85.2%. The relatively high score for skills and practice suggests that the workshop provided students with an opportunity to engage directly in the process of designing and producing pop-up books. This finding is consistent with recent

primary research showing that pop-up book development can support students' active involvement in science learning. For example, [Silmi et al., \(2025\)](#) reported that the use of pop-up books was associated with improvements in students' science process skills, particularly because the three-dimensional characteristics of the media provided students with a more concrete representation of scientific concepts. Similarly, [Utami et al., \(2025\)](#) found that a digital pop-up book could contribute to the development of higher-order thinking skills in science learning, suggesting that pop-up books may function not merely as visual aids but as tools that facilitate active cognitive engagement.

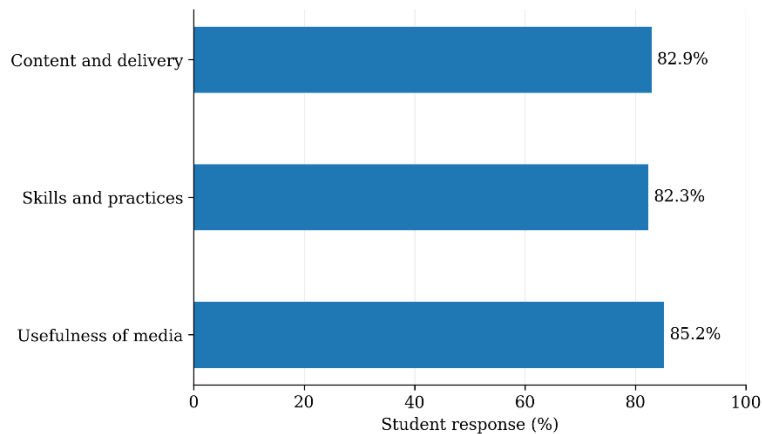


Figure 6. Student Satisfaction Data on the Training Process

However, the skills and practice score of 82.3% should not be interpreted as evidence that students had fully mastered pop-up book development. The score is lower than the usefulness response of 85.2%, indicating that students appreciated the media somewhat more strongly than they perceived their own practical experience or ability to produce it. This difference is pedagogically meaningful. It suggests that recognizing the value of a learning medium may develop more rapidly than acquiring the technical skills required to construct it. In the present workshop, students had to translate biological content into a three-dimensional visual representation, select appropriate information, arrange components, and physically construct the pop-up mechanism. These processes involve several skills simultaneously and are therefore more demanding than simply using a completed pop-up book.

This interpretation is supported by [Regina & Wulandari \(2025\)](#), whose development study showed that a pop-up book integrated with problem-based learning could improve science learning, but the development process itself required systematic stages of analysis, design, development, implementation, and evaluation. Likewise, [Sumadi & Setyawan \(2024\)](#) emphasized that interactive pop-up books become more meaningful when they are integrated with a learning approach rather than being treated solely as attractive physical media. Thus, the 82.3% score in the present study may reflect the benefit of hands-on practice while also indicating that students would require repeated practice and more intensive mentoring to achieve higher levels of technical proficiency.

The 85.2% score for media usefulness provides stronger evidence regarding students' acceptance of the pop-up book as a learning medium. This result is comparable with recent empirical evidence from Indonesian junior high schools. [Utami et al., \(2025\)](#) found a strong positive relationship between the use of pop-up book teaching media and students' interest in science ($r = 0.781$, $p < 0.05$). This supports the present finding that students perceived pop-up books as interesting and useful. Nevertheless, the present result extends rather than simply replicates this finding because students in this workshop were not only users of the media but also participated in its production. Their positive perception may therefore have been influenced by both the characteristics of the pop-up book and the experience of creating the learning medium themselves.

The three-dimensional structure of a pop-up book can make spatial relationships and biological structures more concrete, which may explain why students perceived the medium as

useful for understanding cell material. Recent studies on pop-up media similarly emphasize their potential to make abstract scientific concepts more concrete and engaging. However, the present finding should be interpreted as evidence of perceived usefulness, rather than direct evidence of improved conceptual understanding, unless the study also included an objective cell-biology achievement test or a pretest–posttest measure of conceptual understanding.

Overall, the findings indicate that the workshop was successful in two related but distinct dimensions: students responded positively to pop-up books as a learning medium (85.2%), while their experience in designing and producing the medium was also favorable, although somewhat lower (82.3%). The difference between these scores suggests that students may find the finished product easier to appreciate than the process of producing it. This finding has practical implications for future workshops: rather than allocating most of the activity to producing the final product, facilitators should provide staged demonstrations, templates, examples of pop-up mechanisms, and repeated opportunities for practice. Such an approach may reduce the technical difficulty of construction while allowing students to focus more strongly on translating biological concepts into accurate and meaningful visual representations.

Therefore, the contribution of this workshop should not be framed simply as demonstrating that students liked pop-up books. More importantly, the findings suggest that student-produced pop-up books can combine hands-on skill development with positive perceptions of a concrete learning medium. At the same time, the relatively lower skills score and the reliance on perception data indicate that future studies should evaluate students' actual construction skills and conceptual understanding using performance-based assessments and pretest–posttest measures. This would provide stronger evidence regarding whether producing pop-up books merely increases students' engagement or also produces measurable improvements in their ability to communicate and understand biological concepts.

CONCLUSION

The biology learning media development training through pop-up books on cell material at Junior High School 1 Samarinda was implemented through planning, implementation, and evaluation stages and provided students with opportunities to engage directly with cell biology content while developing learning media through hands-on and creative activities. The findings indicate that the activity was positively received, particularly regarding the usefulness of pop-up books as learning media, while the practical component also gave students experience in designing and producing the media. Future implementation should involve a larger and more diverse sample and employ more sensitive assessment instruments, especially because participants in the present activity demonstrated relatively high baseline scores. In addition, extending the duration of the training and providing repeated practice and follow-up activities would allow students more opportunities to design, construct, revise, and refine their pop-up books. Such improvements are expected to provide stronger evidence of learning gains and the extent to which the skills developed during the workshop can be retained and applied independently.

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