

# Enhancing Entrepreneurial Skills and Pancasila Student Profiles through Digital Learning Tools in Science Education

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## ABSTRACT

**This research examines the effect of project-based learning (PjBL) assisted by ethnoscience animation videos on students problem-solving skills and their Pancasila character profile in science education. The study employed a quasi-experimental design to evaluate the impact of independent variables (PjBL and animated videos) on dependent variables (problem-solving skills and character development). The research objectives were to assess the effectiveness of the PjBL model in improving problem-solving skills and to determine its role in developing Pancasila character dimensions in students. The study involved students from classes VII-1 and VII-6 at Dr. Wahidin Sudirohusodo Middle School as the sample. Data collection included test instruments to measure problem-solving abilities and non-test instruments for assessing character dimensions of the Pancasila student profile. Results showed significant differences in the average scores of problem-solving skills between the experimental and control classes, with a significance value (2-tailed) of  $0.00 < 0.05$ . Similarly, for the Pancasila student profile dimensions, the significance value was also  $0.00 < 0.05$ , indicating a significant improvement in the experimental group. **These findings confirm that the PjBL model assisted by ethnoscience animation videos is valid, practical, and effective for improving both problem-solving skills and character development. In conclusion, integrating PjBL with ethnoscience animation videos addresses the challenges in science education by aligning with skill-based and culturally relevant learning approaches. The model supports students cognitive and character development, making it suitable for application in the Society 5.0 era.****

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## 1. INTRODUCTION

The very rapid changes in science and technology require us to be ready to face world changes, especially in the field of education [1]. Character education is needed as a guide for Generation Z in facing the current Era of Society 5.0 [2]. One form of this change is Society 5.0. The Era of Society 5.0 is humans who can solve various social challenges and problems by utilizing various innovations that were born in the

era of the Industrial Revolution 4.0 and are centered on technology. Society 5.0 itself was first introduced by the Japanese government in 2019 [3]. Society 5.0 is a development of the industrial revolution 4.0. Industrial revolution 4.0 uses artificial intelligence, while Society 5.0 focuses on technological and human components [4]. for the sake of progress in national development, especially science and technology education.

National Development covers various fields, one of which is education. While existing PjBL models effectively foster collaboration and critical thinking, they often lack a cultural dimension that resonates with students local contexts. This gap highlights the need for models that integrate cultural education, as seen in ethnoscience animations, providing both academic and character-building benefits. Development in the education sector is one of the efforts to increase Indonesia human resources who believe in God Almighty, are virtuous, intelligent, creative and responsible. In the entire educational process, the learning process is the most important and dominant activity. [5] this learning process can occur due to interaction between a person and the environment, so learning can occur at any time, with anyone and anywhere. The success or failure of achieving educational goals depends largely on the learning process experienced by a person [6, 7].

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble morals, and the skills needed by themselves, society, nation and state [8]. This research is unique as it integrates ethnoscience animation videos specifically designed to enhance cultural and character education aligned with Indonesia Pancasila principles. Compared to previous studies, which primarily focused on general multimedia tools, this approach incorporates local wisdom, making it culturally adaptive and relevant to Society 5.0.

One of the educational problems faced by the Indonesian nation is the low quality of education. Even though various efforts have been made by the government, to date the quality of education has not shown significant improvement either at the primary and secondary education levels, or at the higher education level [9, 10]. In the implementation of education, attention to the meaning of learning and its achievements is very important and meaningful in the development of education in the future. In reality, student learning outcomes are still far from what was expected, especially the problem solving skills and character values of the Pancasila student profile (P3) which are very necessary in the era of society 5.0. The low problem solving skills of students are also proven by the low scores obtained by Indonesian students in taking the Trends International Mathematics and Science (TIMSS) test.

Based on the results of TIMSS research which measures students level of knowledge from just knowing facts and concepts and using them to solve simple problems to problems that require high levels of reasoning. The results of the TIMSS research in 2011 showed that the score obtained by Indonesia was 406, which was the fifth smallest score, while in 2015 Indonesia obtained a score of 397, which was the fourth smallest score out of 64 countries [11, 12]. Meanwhile, in 2019, based on TIMSS 2019 Participants, Indonesia did not participate. Indonesian students only have some basic knowledge of biology, chemistry, physics and science. the predicate obtained by Indonesia at TIMSS 2011 and 2015. Students have not been able to demonstrate and convey knowledge of biology, chemistry, physics and science in various contexts. Students are also less able to communicate, explain and solve problems, concepts related to biology, chemistry, physics in everyday life well [13].

Program for International Student Assessment (PISA) results measure science, reading and mathematics skills for 15 year old students. The PISA assessment is held every three years. The 2022 PISA study report was recently announced on December 5, 2023. Indonesia is ranked 68th.

On the subject of reading skills, Indonesia recorded an average score of 359, 117 points away from the global average score of 476, and down 12 points from the previous edition. Apart from that, the decline in scores in this subject has also been the most significant in the last 5 editions [14]. Furthermore, on the subject of mathematics skills, which is the main topic in PISA 2022, Indonesia average score fell 13 points to 366, from the score in the previous edition of 379. This figure is also 106 points away from the global average score [15].

A decrease in the average score of 13 points was also recorded in the science skills subject. In PISA 2022, Indonesia obtained an average score of 383 in this subject, 102 points behind the global average score. These results again match the scores obtained in PISA 2009. Based on these results, Indonesian students are still less capable in the concepts of scientific literacy, reading literacy and mathematical literacy. For more clarity, see Figure 1.

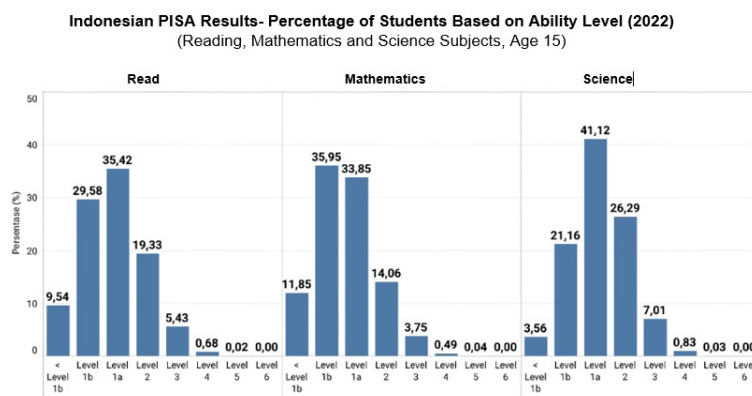


Figure 1. PISA Indonesia results-Percentage of total number of students based on skill level (2022)

The results of observations in the field in 2023 in an interview with the head of the Science Subject Teachers Conference stated that the science learning results for the North Medan sub-rayon of SMP Negeri 5 Medan, which consists of several schools, showed that 65% of students did not have good science learning results. This is because the majority of teachers still use learning models that do not involve students actively contributing to the learning process, students still often use gadgets. When teachers explain learning using the method method because they are bored with the teacher's explanation, so the character does not reflect the profile of Pancasila students [16–18]. The majority of teachers have not optimized the use of technology as a medium such as video and have not related learning to real life, and the cultural context and local wisdom in accordance with the noble values of Pancasila, furthermore in terms of curriculum the replacement of the 2013 Curriculum with the Independent Curriculum is not all schools ready to implement This independent curriculum is due to the lack of optimal driving teachers and driving schools that have been trained by the government to be able to spearhead the implementation of the independent curriculum with efforts to strengthen educational autonomy at the school level. The Merdeka Curriculum gives schools greater freedom to create a curriculum that is more suited to student demographics and needs [19].

To overcome this problem, there are many things that must be done in order to improve the quality of education, the most important thing is that it lies in the learning process activities in the classroom which involve educators and students because the learning process activities that occur in schools are activities carried out in the classroom which are not only based on mastery of fundamental principles, but also developing a positive attitude towards learning, research, discovery and problem solving [20, 21]. The low quality of science learning can be seen from various events or symptoms in people's daily lives. The behavior of many community members shows that they have never received science education, or that science education at school seems to have no impact on the way of life and way of thinking of the majority of Indonesian people [22]. This research contributes to addressing broader educational challenges, such as Indonesia performance in PISA and TIMSS, by fostering problem-solving skills through culturally relevant and innovative teaching models. By integrating character education with technological advancements, it provides a scalable model for improving scientific literacy and skills in diverse contexts.

The solution to follow up on this problem is to apply a learning model that is able to actively involve students and contribute to the learning process in class so that students science problem solving skills improve and the learning process becomes more meaningful. One innovative model that can improve students problem solving skills is the Project Based Learning (PjBL) model. The learning process through PjBL allows educators to learn from students and learn with students. Learning through PjBL can be used as a learning model to develop students skills in planning, communicating, solving problems and making decisions. Project-based learning relies on the idea that students construct their own knowledge based on their own experiences. Project-based learning is seen as an approach to creating a learning environment that can encourage students to construct knowledge and skills personally. Students will learn collaboratively in small groups as a means so that they can convey ideas, listen to other people's ideas, and reflect their own ideas to others [23]. It is with this concept that the project-based learning model is considered relevant and can be further developed if adapted to the spirit of independent learning. Conceptually, project-based learning and the spirit of independent learning

have similarities, namely that they both give students the freedom to explore [24, 25]. In project-based learning, students are given the opportunity to be active in class, but the teacher is still the main control. Apparently this can be overcome if project-based learning is adapted to the spirit of independent learning. The teacher is no longer the main actor in learning, but is now only a facilitator. Teachers are free to determine the methods and how they want learning to be carried out. However, the process is completely left to the students [26, 27]. The PjBL model can improve learning activities linked to objects that are able to explore and develop the academic skills possessed by students. Apart from that, it can bring out students skills and creativity so that students will be more proactive in learning activities. The PjBL model can encourage students to think more creatively through solving problems together.

## 2. RESEARCH METHOD

This research was conducted at Dr. Wahidin Sudirohusodo Middle School, Medan, North Sumatra. The selection of the selected experimental and control classes was carried out using a cluster random sampling technique using a quasi-experimental method with a post test only control group design research design. The following research design is shown in Table 1.

Table 1. Details of Field Test Research Samples (Field Test)

| No. | Sampel Class | Treatment | Result ( <i>Posttest</i> ) |       |
|-----|--------------|-----------|----------------------------|-------|
| 1.  | Experiment   | $X_1$     | $O_1$                      | $O_2$ |
| 2.  | Control      | $X_2$     | $O_1$                      | $O_2$ |

Information :

$X_1$ : Video-Assisted PjBL Learning Model

$X_2$  : Project Based Learning Model (PjBL)

$O_1$ : Problem Solving Skills

$O_2$ : Pancasila Student Profile Character

The research subjects were all students of class VII-SMP Dr. Wahidin Sudirohusodo for the 2023/2024 academic year. Sampling was carried out using purposive sampling technique for the experimental class and control class. This carefully designed experimental setup ensures that the results directly reflect the effectiveness of the PjBL learning model with ethnosience animation, providing a robust basis for analyzing its impact on problem-solving skills and character development. The sample class was determined randomly to determine the control class and experimental class after homogeneity testing, so classes VII-1 and VII-6 had the most similar characteristics. The experimental class that was intervened with the PjBL model assisted by ethnosience animation videos was class VII-1, while the control class was intervened with the project-based learning model, namely class VII-6. The instrument used to obtain data on the level of effectiveness of the video-assisted PjBL learning model is to build problem-solving skills and the Pancasila student profile character of students. This instrument is used to measure problem solving skills through test instruments in the form of essay questions and the character profile of Pancasila students through non-test instruments in the form of questionnaires.

Several analyzes were carried out in testing the implementation of the PjBL learning model assisted by ethnosience animated videos.

### 2.1. Normality test

The purpose of the normality test is to find out whether the sample data is normally distributed or not. Normality test analysis in this research uses the Kolmogorov Smirnov test using SPSS 25 software. The basis for decision making in the normality test in this research is that if the significance value is  $> 0.05$ , then the research sample data comes from a normally distributed population. The implementation of the PjBL learning model assisted by ethnosience animation utilized the following tools and software, namely:

- SPSS 25 for statistical analysis.
- Adobe Animate for developing ethnosience animation videos.
- Microsoft Excel for data recapitulation and visualization. These tools ensured accuracy in data analysis and the creation of engaging visual content tailored for the target demographic.

## 2.2. Homogeneity test

The homogeneity of variance test was carried out on data on problem solving skills and character profiles of Pancasila students to prove whether the two sample groups had the same or homogeneous variance and whether the data was not distributed homogeneously. Analysis of the homogeneity test in this study uses the Levene test using SPSS 22 software. The hypothesis of the homogeneity test in this study is that if the significance value is  $> 0.05$ , then the data distribution is homogeneous.

## 2.3. Independent Sample T-Test

The independent sample t-test was carried out to see whether there was a significant difference between problem solving skills and the character of the Pancasila student profile of students who applied the PjBL learning model assisted by ethnosience animated videos and those who applied the Project based Learning model. The basis for decision making in the independent sample t-test is that if the significance value is  $< 0.05$  then  $H_0$  is rejected and  $H_1$  is accepted.

## 3. RESULT AND DISCUSSION

The field test of the PjBL learning model assisted by the AN ethnosience animation video was carried out at Dr. Wahidin Sudirohusodo Middle School for 10 lesson hours in 5 meetings, each meeting 2 lesson hours. At this stage, we will test the effectiveness of the PjBL learning model assisted by ethnosience animated videos on problem solving skills and Pancasila student profile characters between the control class and the experimental class.

The results of the comparison of the average problem solving skill scores and character profiles of Pancasila students in the experimental class and control class can be seen in Figure 2.

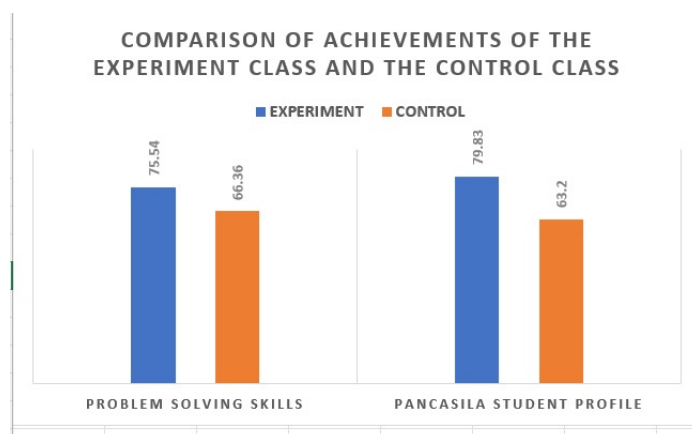


Figure 2. Comparison of the achievement of problem solving skills and profiles of Pancasila students in the Experiment Class and Control Class

Data on problem solving skills and character profiles of Pancasila students are then carried out pre-requisite tests to see the normality and homogeneity of the data group. Test calculations Recapitulation of normality test results of data on problem solving skills and profiles of Pancasila students in the experimental class and control class can be seen in Table 2.

Table 2. Comparison of Problem-Solving Skills and Pancasila Student Profile Scores

| Skill                     | Class      | N  | Average | Sig.  |
|---------------------------|------------|----|---------|-------|
| Problem Solving           | Experiment | 33 | 75,54   | 0,161 |
|                           | Control    | 33 | 66,36   | 0,200 |
| Pancasila Student Profile | Experiment | 33 | 79,83   | 0,200 |
|                           | Control    | 33 | 63,20   | 0,200 |

### 3.1. Normality Test

The normality test was conducted using the Kolmogorov-Smirnov test. The significance value for both the experimental and control classes exceeded 0.05, indicating that the data were normally distributed. In Table 3, the SPSS output results for testing the normality of data on problem solving skills using the Kolmogorov-Smirnov test, the significance value is 0.161,  $> 0.05$  for the experimental class and the significance value is  $0.200 > 0.05$  for the control class, this shows that the overall data the experimental and control classes are normally distributed.

Table 3. Normality Test Results for Problem-Solving Skills and Pancasila Student

|                         | Kolmogorov-Smirnov <sup>a</sup> |    |       | Shapiro-Wilk |    |      |
|-------------------------|---------------------------------|----|-------|--------------|----|------|
|                         | Statistic                       | df | Sig.  | Statistic    | df | Sig. |
| <b>Control_Class</b>    | .114                            | 33 | .200* | .965         | 33 | .351 |
| <b>Experiment_Class</b> | .131                            | 33 | .161  | .973         | 33 | .582 |

\* This is a lower bound of the true significance.

Table 4 presents the normality test results for Pancasila student profiles, including the Kolmogorov-Smirnov and Shapiro-Wilk tests. For both the "P3.Experiment.Class" and "P3.Control.class", the Kolmogorov-Smirnov test showed p-values of 0.200 and 0.161, respectively, indicating no significant deviation from normality. The Shapiro-Wilk test also supported this conclusion, with p-values of 0.268 for the experiment class and 0.778 for the control class, further suggesting that both data sets follow a normal distribution. The note for the Kolmogorov-Smirnov test indicates that the reported significance is a lower bound of the true significance, implying that the actual p-values could be slightly higher, which would further confirm the normality of the data.

Table 4. Normality Test Results for Pancasila Student Profiles

|                            | Kolmogorov-Smirnov <sup>a</sup> |    |       | Shapiro-Wilk |    |      |
|----------------------------|---------------------------------|----|-------|--------------|----|------|
|                            | Statistic                       | df | Sig.  | Statistic    | df | Sig. |
| <b>P3.Experiment.Class</b> | .090                            | 33 | .200* | .961         | 33 | .268 |
| <b>P3.Control.class</b>    | .131                            | 33 | .161  | .980         | 33 | .778 |

\* This is a lower bound of the true significance.

Based on the results of both the Kolmogorov-Smirnov and Shapiro-Wilk tests, it can be concluded that the data for both the experimental and control classes, as well as for the Pancasila student profiles, are normally distributed. This suggests that the assumptions required for parametric testing are met, and subsequent statistical analyses can proceed without concerns related to non-normality. The significance values above 0.05 further support the conclusion that the data follows a normal distribution, ensuring the reliability of the statistical results that will follow in the analysis.

### 3.2. Homogeneity Test

The results of the homogeneity test of data variance on Problem Solving skills and the character profile of Pancasila students in the experimental class and control class are presented in Table 5.

Table 5. Homogeneity Test Results

| <b>Skills</b>                       | <b>Class</b> | <b>Sig.</b> |
|-------------------------------------|--------------|-------------|
| Problem Solving                     | Experiment   | 0,072       |
|                                     | Control      |             |
| Pancasila Student Character Profile | Experiment   | 0,052       |
|                                     | Control      |             |

Table 5 shows that the distribution of data on the achievement of problem solving skills and the profile character of Pancasila students in the experimental class and the control class are completely homogeneous.

Table 6. Homogeneity of Problem-Solving Skills Data.

|                        |                                      | <b>Levene Statistic</b> | <b>df1</b> | <b>df2</b> | <b>Sig.</b> |
|------------------------|--------------------------------------|-------------------------|------------|------------|-------------|
| Problem_Solving_Skills | Based on Mean                        | 3.357                   | 1          | 64         | .072        |
|                        | Based on Median                      | 2.744                   | 1          | 64         | .103        |
|                        | Based on Median and with adjusted df | 2.744                   | 1          | 52.919     | .104        |
|                        | Based on trimmed mean                | 3.155                   | 1          | 64         | .080        |

The significant improvements in the experimental group may stem not only from the innovative use of ethnosience animation but also from the active engagement fostered by the PjBL model. However, it's worth considering that the novelty of the method might have temporarily heightened student interest, suggesting the need for longitudinal studies to evaluate sustained impact. In Table 6, the results of the SPSS output to test the homogeneity of the data of problem solving skills using the Levene Statistics test with a significance value of  $0.072 > 0.05$  for the experimental class and for the control class, this shows that the overall data of the experimental and control classes are homogeneous.

Table 7. Homogeneity of Pancasila Student Profile Data

|                           |                                      | <b>Levene Statistic</b> | <b>df1</b> | <b>df2</b> | <b>Sig.</b> |
|---------------------------|--------------------------------------|-------------------------|------------|------------|-------------|
| Pancasila_Student_Profile | Based on Mean                        | .410                    | 1          | 64         | .524        |
|                           | Based on Median                      | .383                    | 1          | 64         | .538        |
|                           | Based on Median and with adjusted df | .383                    | 1          | 62.352     | .538        |
|                           | Based on trimmed mean                | .395                    | 1          | 64         | .532        |

In Table 7, the SPSS output results for testing the normality of Pancasila student profile character data using the Levene Statistics test with a significance value of  $0.524 > 0.05$  for the experimental class and control class, this shows that the overall experimental and control class data is homogeneous, next Data on problem solving skills and character of the Pancasila student profile were tested using independent sample t-test analysis.

### 3.3. Independent Sample T-Test

An independent sample t-test was conducted to assess the significance of differences between the experimental and control groups. Table 8 presents the results:

Table 8. T-test results of problem solving skills and character profiles of Pancasila student

| <b>Skills</b>                       | <b>Class</b> | <b>Sig.</b> |
|-------------------------------------|--------------|-------------|
| Problem Solving                     | Experiment   | 0,00        |
|                                     | Control      |             |
| Pancasila Student Character Profile | Experiment   | 0,00        |
|                                     | Control      |             |

Based on Table 8, for the problem solving skills and profile character of Pancasila students, a significance value of  $0.00 < 0.05$  is obtained, so there is a significant difference in the problem solving skills and profile character of Pancasila students in classes that use the PjBL learning model assisted by ethnosience animation videos with those in classes that using the PjBL learning model. The test results can be interpreted that the PjBL learning model assisted by ethnosience animated videos is effective in building problem solving skills and Pancasila Student Profile Characteristics.

The results obtained show that the PjBL learning design assisted by ethnosience animated videos has an influence on students problem solving skills and Pancasila student profiles [28]. Furthermore, the PjBL learning model assisted by ethnosience animated videos has high effectiveness on problem solving skills and the profile of Pancasila students. This is because almost the entire syntax of the PjBL learning model assisted by ethnosience animated videos facilitates students to build these skills. Furthermore, the use of model books, student books and project-based learning modules helps students to build problem-solving skills and a Pancasila student profile [29]. The use of ethnosience animated video media in learning can also influence the character of students Pancasila student profiles, The findings suggest practical applications in curriculum development,

particularly in schools transitioning to the Independent Curriculum. However, scaling this approach would require significant investment in teacher training and digital infrastructure, ensuring that schools in under-resourced areas can also benefit [30]. This is because the use of technology in learning can improve the character of students Pancasila student profiles. states that being able to teach with technology requires an understanding of how technology and content interact to support learning. This skill involves the knowledge to use a digital tool or application with all the features. This is reinforced by [31] that lecturers can continue to model the use of technology so that teachers can further update their technological knowledge through learning.

The problem solving skills and character profile of Pancasila students have high effectiveness, this is because the syntax supports these skills. Apart from that, the use of ethnoscience animated video media in learning can help students to develop the character of a Pancasila student profile, can support science learning [32] and is suitable for investigation and problem solving [33]. The learning approach must provide a favorable environment for students so that they gain more experience in understanding the science process [34], similar to project-based learning which can help students achieve learning outcomes [35]. PjBL is the core in developing the PjBL model assisted by ethnoscience animated videos. PjBL has been widely applied in science classrooms to support students in developing a deeper understanding of science concepts [36] developing skills that are relevant in the 21st century [37]. Apart from that, it can improve the quality of learning. The findings of [38] show that with projects students feel enthusiastic and actively discuss with other students, and improve communication skills, creativity, teamwork and critical thinking [39] and metacognitive [40]. Project learning has the potential to increase student engagement by focusing on driving questions that connect scientific practice, this allows students to collaborate and seek answers to driving questions and allows students to produce real products as a result of the project [41]. However, the approach may face limitations in regions where ethnoscience resources are scarce or underdeveloped [42]. Additionally, the integration of animation videos might present challenges in schools with limited technological access [43]. Compared to other project-based approaches, such as generic multimedia tools, ethnoscience animations provide contextual relevance but may require extensive customization [44].

#### 4. MANAGERIAL IMPLICATIONS

Educational managers are encouraged to adopt innovative teaching methods by integrating PjBL with animated videos, as this approach has been shown to enhance both problem-solving skills and character development. To support this, schools should invest in comprehensive teacher training programs that equip educators with the necessary skills to effectively utilize digital tools in their classrooms, thereby ensuring higher levels of student engagement and improved learning outcomes. Furthermore, curriculum design needs to be enriched by embedding PjBL combined with digital media to achieve a balance between cognitive skill improvement and character-building in line with modern educational objectives.

#### 5. CONCLUSION

The findings of this study show that there is a significant influence of the Project-Based Learning (PjBL) model assisted by ethnoscience animated videos on problem-solving skills and the character profile of Pancasila students. The use of ethnoscience animated video media provides a meaningful learning experience by integrating cultural values and scientific concepts, making learning more relevant and engaging for students. This approach not only enhances students problem solving abilities but also fosters the development of the Pancasila character dimensions, including critical thinking, collaboration, and cultural awareness.

The significant improvement observed in the experimental group indicates that the PjBL model, when supported by multimedia tools such as ethnoscience animated videos, can bridge the gap between theoretical understanding and practical application. Furthermore, the use of technology in learning positively influences character development by encouraging students to apply Pancasila values namely creativity, independence, and mutual respect through collaborative projects and problem-based tasks.

The results emphasize that adopting the PjBL model assisted by ethnoscience animated videos is a valid, practical, and effective solution to address current challenges in science education. It aligns with the demands of the Society 5.0 era, where skill-based and culturally relevant education is essential. Future implementation of this model can support students in developing both cognitive skills and character dimensions, equipping them to become well-rounded individuals who are ready to face global challenges while upholding local values.

## 6. DECLARATIONS

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### 6.2. Author Contributions

Conceptualization: PJ; Methodology: FD; Software: SD; Validation: LI and YI; Formal Analysis: YI and KM; Investigation: FD; Resources: PJ; Data Curation: FD; Writing Original Draft Preparation: KM and LI; Writing Review and Editing: PJ and FD; Visualization: SD; All authors, PJ, FD, SD, LI, YI, and KM, have read and agreed to the published version of the manuscript.

### 6.3. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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The authors received no financial support for the research, authorship, and/or publication of this article.

### 6.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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