p-ISSN 2355-5343
e-ISSN 2502-4795
http://ejournal.upi.edu/index.php/mimbar

Article Received: 09/12/2024; Accepted: 16/01/2025
Mimbar Sekolah Dasar, Vol.12(1), 37-48
DOI: 10.53400/mimbar-sd.v12i1.81858

# The Impact of Independent Learning on Academic Achievement in Social and Science Education Among Sixth Grade Elementary Students

**Nur Isdha Meilany✉[1], Sekar Purbarini Kawuryan[2] & Banu Setyo Adi[3]**

[1,2,3] Faculty of Education and Psychology, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia

✉ nurisdha.2023@student.uny.ac.id

**Abstract.** This study explores the relationship between independent learning and academic performance among sixth-grade students in the Gugus SD Karangmojo 2 cluster. The background of the problem lies in the increasing demand for self-directed learning skills in modern education, driven by technological advancements and the need for students to adapt to rapidly changing environments. Using a quantitative research design, data were collected from 30 students across five elementary schools through a questionnaire assessing independent learning with 15 Likert-scale items. Academic performance was evaluated based on students' recent test scores in key subjects, including mathematics, science, and social. The analysis, utilizing univariate and bivariate statistical methods, revealed a significant positive correlation between independent learning and academic performance. This research finds that students who exhibited higher levels of self-directed learning tended to achieve better academic outcomes, highlighting the crucial role of independent learning in educational success. The contribution of this research lies in its empirical evidence supporting the integration of self-regulation and autonomy-promoting strategies in elementary education, which can enhance academic achievement and foster lifelong learning skills. These findings suggest that fostering self-regulation and autonomy in students can enhance their academic achievement.

**Keywords:** Academic Performance; Independent learning; Natural; Quantitative Analysis; Social.

## 1. Introduction

Education is one of the most important pillars of personal and societal development. In today's rapidly evolving world, the ability to learn independently has become an increasingly valuable skill. Independent learning, often referred to as self-directed learning, involves individuals taking control of their learning process, setting their own goals, managing their time efficiently, and assessing their progress (Morris, 2019). As educational systems shift toward more student-centered approaches—particularly in 21st-century learning environments—fostering independent learning has been identified as a key factor in enhancing academic performance. The present study seeks to examine the relationship between independent learning and performance outcomes among elementary school students, specifically focusing on sixth-grade students in the Gugus SD Karangmojo 2 cluster.

As the global education landscape continues to evolve, students are increasingly required to take responsibility for their own learning. This shift toward learner autonomy has been driven by numerous factors, including technological advancements, access to information, and changing societal needs. Today's learners are expected to be self-reliant, adaptive, and capable of navigating complex and dynamic environments. Consequently, educational institutions must prepare students to develop these competencies early in their academic journeys. In this context, fostering independent learning is crucial, as it not only enhances immediate academic performance but also equips students with lifelong learning skills essential for success in the modern world (Yu, 2024).

The concept of independent learning is closely related to self-regulated learning (SRL) theory, which emphasizes the role of metacognition, motivation, and behavior in the learning process. Self-regulated learners are proactive in their educational pursuits: they set clear goals, monitor

their progress, and adjust their strategies to optimize outcomes. This approach contrasts with traditional teacher-directed learning, where students rely heavily on external guidance and feedback. In the self-regulated model, learners take an active role in shaping their educational experiences, which has been shown to improve academic performance (Mammadov & Schroeder, 2023). Therefore, understanding how independent learning influences academic achievement is essential for educators and policymakers seeking to enhance student outcomes.

### 1.1. Problem Statement

Ideally, students' independent learning should positively correlate with their academic performance, fostering better educational outcomes and equipping them with essential lifelong learning skills. However, in the Gugus SD Karangmojo 2 cluster, there is insufficient understanding of how different levels of students' independent learning relate to their academic performance in social and natural sciences. If unaddressed, this gap could result in suboptimal educational strategies that fail to meet students' diverse needs, potentially hindering their academic growth and future opportunities. This issue requires urgent attention, particularly in developing regions of Indonesia where continuous improvement and comprehensive research are crucial for advancing educational practices and outcomes.

### 1.2. Related Research

Multiple studies have emphasized the significance of cultivating independent learning in students. Wang et al. (2022) found that students demonstrating higher levels of independent learning typically achieve better academic outcomes than those who depend more on external support. This suggests that self-directed learners are better prepared to handle learning challenges, leading to improved academic performance. Additionally, Admiraal et al. (2024) observed that interventions granting students greater control enhanced their self-regulated learning strategies—including task orientation, planning, and process evaluation—though they noted a slight reduction in perceived autonomy support, which also influences academic success.

In the Indonesian context, Nasution et al. (2018) examined the impact of independent learning on student achievement at MTs Darul Ihsan Cibungbulang. Using quantitative methods and questionnaires with 42 eighth-grade students, they analyzed independent learning (X) and learning outcomes (Y). Their findings revealed that most students exhibited strong independent learning skills. Regarding academic performance, the study found that 6% of students scored between 0-65, 19% scored 66-75, 71% scored 76-85, and 3% scored 86-100. This distribution indicates that the majority achieved high scores, correlating independent learning with positive academic results.

Further research underscores how self-regulated learning boosts motivation, engagement, and a sense of ownership in education (Wang, C. et al., 2022). Given these benefits, understanding how independent learning develops—and its effects on achievement—is crucial. However, traditional teacher-centered classrooms often fail to nurture these skills. Díaz and Nussbaum (2024) argue for student-centered approaches that promote autonomy, critical thinking, and self-regulation through methods like project-based learning, collaboration, and self-assessment. Such strategies empower students to take charge of their education.

This study focuses on sixth graders in the Gugus SD Karangmojo 2 cluster, addressing a gap in research on younger learners. By exploring independent learning in this unique context, the findings aim to guide educational practices and policies, ultimately enhancing 21st-century readiness. The research contributes to the existing literature by providing insights into how independent learning manifests at an earlier stage of education, particularly in an Indonesian elementary school setting.

### 1.3. Research Objectives

The primary objective of this research is to examine the level of independent learning among sixth-grade students in the Gugus SD Karangmojo 2 cluster. Specifically, it evaluates students' capacity to manage their own learning processes, including time management, goal setting,

and self-motivation. Furthermore, the study investigates the relationship between independent learning and academic performance, analyzing how varying degrees of self-directed learning influence student achievement.

In conclusion, this study contributes to the growing body of literature on independent learning by examining its relationship with academic performance among elementary school students. Using a quantitative approach that incorporates both univariate and bivariate analyses, the research provides valuable insights into how independent learning affects academic outcomes. The findings emphasize the importance of cultivating self-directed learning skills and highlight the need for educational systems to adapt teaching practices and curricula accordingly. Ultimately, this research offers evidence-based recommendations that could inform educational policies and practices, with the broader goal of enhancing student achievement and preparing learners for success in our rapidly evolving 21st-century world.

## 2. Theoretical Framework

### 2.1. Independent learning

Independent learning, also known as self-directed learning, is a process where learners take control and ownership of their educational journey (Bhat & Dahal, 2023). This approach involves setting personal goals, determining how to achieve them, and self-assessing progress. Independent learners assume responsibility for their own learning by planning, monitoring, and evaluating their learning activities (Livingston, 2012).

Key aspects of independent learning encompass several critical skills that empower learners to manage their educational process effectively. First, self-motivation serves as a fundamental driver, as individuals draw upon their personal interests and goals to maintain proactive engagement. Second, goal setting enables learners to establish clear, measurable objectives that direct their learning trajectory. Third, regular self-assessment allows for ongoing evaluation of progress and necessary strategy adjustments. Fourth, critical thinking skills facilitate problem-solving and informed decision-making through analytical reasoning. Finally, adaptability helps learners remain flexible when encountering new methods or changing environments. Collectively, these components create a comprehensive framework that supports independent learning and promotes academic achievement (Nurhayati & Bahtiar, 2024).

### 2.2. Academic Performance

Academic performance refers to how well students meet their educational institution's standards, typically measured through grades, test scores, and assessments that evaluate their understanding of course material (Niromand et al., 2020). However, academic achievement is not determined solely by individual effort; rather, it results from complex interactions among multiple factors.

Individual characteristics significantly influence academic performance (Mamun et al., 2024). Motivation drives students to engage deeply with their studies and persist through challenges, while self-discipline enables effective time management and prioritization of academic responsibilities. Cognitive abilities—particularly critical thinking and problem-solving skills—directly affect students' capacity to comprehend and apply new concepts.

Family environment plays an equally crucial role in academic success (Kraus et al., 2020). Parental involvement through homework support and educational activities fosters positive learning habits. Socioeconomic status affects access to essential resources like tutoring, technology, and adequate study spaces. Furthermore, a stable home environment that values education significantly shapes students' learning attitudes and behaviors.

School-related factors substantially impact academic outcomes. Teacher quality matters greatly, as educators who employ engaging instructional methods can enhance student understanding and motivation. Institutional resources—including well-equipped libraries, extracurricular programs, and counseling services—provide critical support systems. Peer relationships within the school environment also influence academic engagement, as students often seek and respond to social validation (Adams et al., (2022).

Broader societal factors complete this multidimensional framework. Cultural values placed on education can motivate students to excel, while limited access to advanced coursework or enrichment programs may constrain achievement potential. As Maqableh et al. (2021) demonstrate, these interconnected individual, familial, institutional, and societal factors collectively shape students' academic trajectories.

### 2.3. Natural Science Subject

Natural science is a comprehensive field that systematically studies the natural world through observation and experimentation. It comprises two main branches: life sciences and physical sciences. The life sciences focus on living organisms and their interactions with each other and their environments (Rollwagen-Bollens et al., 2022). This branch includes several key disciplines: biology (examining the structure, function, growth, and evolution of living organisms), botany (the study of plants), zoology (the study of animals), and microbiology (focusing on microorganisms). The physical sciences, in contrast, investigate non-living systems and the physical properties of the universe. This branch encompasses: physics (exploring matter, energy, and fundamental forces), chemistry (studying substances and their interactions), earth science (including geology, meteorology, and oceanography), and astronomy (examining celestial objects and cosmic phenomena). Together, these complementary branches provide a holistic understanding of both living and non-living aspects of the natural world (UoPeople, 2024).

### 2.4. Social Science Subject

Social science is a vast field dedicated to the study of human society and social relationships, encompassing various disciplines that each explore different facets of human behavior (Mandal, 2022). Key areas include sociology, which examines the development, structure, and functioning of societies and social institutions; psychology, focusing on the human mind and behavior both individually and in groups; anthropology, which studies human cultures and their evolution, often through archaeological research; economics, analyzing the production, distribution, and consumption of goods and services; political science, investigating political systems, behavior, and government practices; and geography, studying the Earth's landscapes and the relationships between people and their environments. These disciplines collectively contribute to a deeper understanding of human interactions and societal dynamics.

## 3. Method

### 3.1. Research Design

This study employs a quantitative approach, drawing inspiration from the work of Hasnor et al. (2013), to explore the relationship between independent learning and academic performance among sixth-grade students in the Gugus SD Karangmojo 2 cluster. The research utilizes an analytical survey method with a cross-sectional design, allowing for the simultaneous collection of data on both independent and dependent variables. The primary objective is to assess the level of independent learning and its impact on academic performance. A sample of 30 students from five elementary schools was selected to ensure a diverse representation of academic backgrounds. A structured questionnaire, consisting of 15 Likert-scale items, was developed to measure independent learning, following a similar approach to that used by Hasnor et al. Data collection involved administering the questionnaire to students and gathering their recent test scores in key subjects such as mathematics, science, and social studies. The data were analyzed using univariate and bivariate statistical methods, with logistic regression employed to examine the relationship between independent learning and academic performance (Hasnor et al., 2013).

### 3.2. Respondent

The respondents of this study consist of 30 sixth-grade students from five elementary schools in the Gugus SD Karangmojo 2 cluster, specifically selected from SDN Ngagel Karangmojo, SDN Karangmojo II, SDN Karangmojo IV, SDN Karangmojo V, and SD Muhammadiyah Ngepung.

The sample includes an approximately equal distribution of male and female students, ensuring gender diversity in the analysis of independent learning and academic performance. All participants are typically aged 11 to 12 years, which is the standard age range for sixth-grade students in Indonesia. These students come from a variety of educational settings, including both public and private schools, which may offer different curricular emphases and resources. While specific socioeconomic data were not collected, the schools in the Gugus SD Karangmojo 2 cluster serve a range of communities, providing a mix of socioeconomic backgrounds. Additionally, the schools vary in terms of class size, teacher-student ratios, and available educational resources, contributing to a diverse learning environment for the respondents. These characteristics are relevant to the research objectives as they provide a comprehensive understanding of the factors that may influence independent learning and academic performance among the students, capturing a holistic view of the educational experiences within the cluster.

### 3.3. Data Collection

The questionnaire was structured into two main sections. The first section consisted of 15 Likert-scale questions related to independent learning, with each question rated on a scale of 1 to 5, where 1 indicated "Strongly Disagree" and 5 indicated "Strongly Agree." These questions assessed the students' ability to self-direct their learning, including aspects like time management, goal setting, and motivation.

Additionally, academic performance data were collected through students' recent test scores or grades in key subjects. These were used to classify performance as either high (1) or low (0). The questionnaire responses and performance data were then analysed to assess the relationships between independent learning, the environment, and academic outcomes. With instruments explained in Table 1.

### 3.4. Data Analysis

The data collected in this study were processed and analyzed using both univariate and bivariate statistical methods. In the univariate analysis, descriptive statistics were computed for each variable independently, summarizing the characteristics of independent learning, and academic performance. This involved calculating frequencies. For bivariate analysis, the relationships between key variables were examined. Specifically, the influence of independent learning on academic performance was analyzed using logistic regression. This approach helped to identify significant correlations and insights regarding how independent learning affects students' academic success.

### 3.5. Validity and Reliability

To ensure the validity and reliability of the instrument measuring independent learning, an empirical test was conducted on a separate sample of students, typically ranging from 20 to 30 individuals, to avoid bias from the main study group. Validity was assessed using Pearson correlation, where each item's correlation with the total score was compared against a critical R value from the table at a 0.05 significance level. For instance, with a sample size of 30, an R table value of 0.361 was used as a benchmark, and items exceeding this value were deemed valid. Reliability was evaluated using Cronbach's alpha, with a value above 0.7 indicating acceptable internal consistency, thus confirming that the items consistently measured the intended construct. By conducting these tests on a different sample, the instrument's applicability and robustness were verified, ensuring that it reliably captured the construct of independent learning across diverse groups.

#### *3.5.1. Validity*

The validity was analyzed using Pearson correlation analysis. This analysis is shown in Table 1.

**Table 1.** Pearson Correlation Analysis

| Instrument | Pearson Correlation | Valid |
|---|---|---|

| | | |
|---|---|---|
| I always focus on studying and decline invitations to play during study time. | 0.849** | Yes |
| I strive to study harder to understand material I find challenging. | 0.837** | Yes |
| I accept all consequences, positive or negative, of my learning activities responsibly. | 0.856** | Yes |
| I always complete assignments given by teachers on time. | 0.893** | Yes |
| I consistently complete school assignments on time without delay. | 0.836** | Yes |
| I enjoy using new methods to complete tasks to enhance variety in solutions. | 0.888** | Yes |
| I actively try new approaches to learning to improve my understanding. | 0.866** | Yes |
| I prioritize completing assignments even when invited by friends to play. | 0.832** | Yes |
| I trust in my ability to complete tasks assigned by teachers independently. | 0.915** | Yes |
| I explore new ways of completing tasks while considering suggestions from friends. | 0.806** | Yes |
| I decline invitations to play during lessons to stay focused on learning. | 0.840** | Yes |
| I voluntarily and consistently choose to study daily. | 0.901** | Yes |
| I am confident in completing tasks independently without fully relying on friends. | 0.907** | Yes |
| I consider friends' advice to help me make well-informed decisions. | 0.877** | Yes |
| I am open to using alternative methods to solve tasks effectively. | 0.874** | Yes |

Based on Table 1, the strong correlations between each instrument and the total value of the instrument demonstrate that these variables are significantly associated with the outcome being studied. This implies that the items show great validity, as they are likely to capture the intended theoretical constructions.

#### *3.5.2. Reliability*

Cronbach's alpha of 0.976, indicating an excellent level of internal consistency among the instruments. Cronbach's alpha is a widely used statistic to assess the reliability of a set of scale or test items. A value above 0.9 is generally considered to reflect outstanding reliability, suggesting that the items measure the same underlying construction effectively. This high reliability indicates that the variables are consistently related to each other, which enhances the credibility of the data and supports its use in further analysis. In conclusion, the combination of high internal consistency and significant correlations with the outcome variable suggests that the dataset is both reliable and valid for subsequent research analyses.

## 4. Findings

This research utilized both univariate and bivariate analyses to explore the distribution of independent learning and its relationship with academic performance among sixth-grade students. These analyses are crucial for understanding how the research design effectively captured the dynamics between these variables.

### 4.1. Univariate Analysis

Univariate analysis shows the data distribution of each variable independently. This analysis shown in Table 2.

**Table 2.** Univariate Analysis

| Variable | Category | Frecuency | (%) |
|---|---|---|---|
| Independent learning | Low | 11 | 36,7 |
| | High | 19 | 63,3 |
| Performance | Low | 12 | 40 |
| | High | 18 | 60 |

The univariate analysis independently examined the distribution of independent learning and academic performance among the respondents. As shown in Table 2, the analysis revealed that 63.3% of students demonstrated a high level of independent learning, while 36.7% exhibited low independence. This suggests that a majority of the students are inclined towards self-directed learning, which is likely to enhance their educational outcomes. In terms of academic performance, 60% of the students were categorized as high performers, while 40% were low performers. This distribution indicates that most students are achieving commendable academic results, highlighting the potential positive impact of independent learning on performance.

### 4.2. Bivariate Analysis

Bivariate analysis using logistic regression shows the effect of independent learning to performance. This analysis shown in Table 3.

**Table 3.** Bivariate Analysis

| Variable | | Performance | | Total | (%) | P-value | Odds Ratio |
|---|---|---|---|---|---|---|---|
| | | Low | High | | | | |
| Independent learning | Low | 9 | 2 | 11 | 36,7 | 0.002 | 5,333 |
| | High | 3 | 16 | 19 | 63,3 | | |

The bivariate analysis employed logistic regression to assess the relationship between independent learning and academic performance, as detailed in Table 3. The results showed a clear distinction between students with varying levels of independent learning. Among those with low independence, 81.8% (9 out of 11) were low performers, whereas only 18.2% (2 out of 11) achieved high performance. Conversely, students with high independent learning had a significantly different outcome, with 84.2% (16 out of 19) achieving high performance and only 15.8% (3 out of 19) performing poorly. The analysis revealed a statistically significant association, with a p-value of 0.002, indicating that the relationship between independent learning and performance is unlikely to be due to chance. The odds ratio of 5.333 further demonstrates that students with high independent learning are over five times more likely to perform well academically compared to their peers with low independence. These findings validate the research design's effectiveness in capturing the influence of independent learning on academic performance, underscoring its critical role in enhancing educational outcomes.

## 5. Discussion

In this study, the findings of this study provide valuable insights into the relationship between independent learning and student performance. The univariate and bivariate analyses highlight critical patterns and associations that have meaningful implications for educational practices. Data collection for independent learning and performance was conducted simultaneously. This study only measures independent learning. Other factors influencing

performance were not included in this study. The research was limited to sixth-grade students only at Gugus SD Karangmojo 2 cluster.

Learning outcomes refer to the mastery of knowledge by an individual, which can be observed through their behavior, one of which is the behavior in the form of knowledge mastery. The minimum mastery criteria for the natural social sciences subject are 75. Students who score below 75 are categorized as having low learning outcomes, while those who score at least 75 are categorized as having high learning outcomes (Prøitz, 2010).

The univariate analysis shows that a majority of the students (63.3%) demonstrate high independent learning, suggesting that most participants engage in self-directed learning. This high level of independent learning could be linked to a positive learning environment that encourages autonomy and self-motivation. Previous research has consistently shown that students who take ownership of their learning process tend to perform better academically (Wang, J. et al., 2022). The 60% high-performance rate observed in this study reinforces this understanding, indicating that a significant portion of the sample is achieving favorable educational outcomes (Rogelberg et al., 2021).

The bivariate analysis further strengthens the association between independent learning and academic performance. The logistic regression results reveal a statistically significant relationship ($p = 0.002$), with an odds ratio of 5.333. This means that students with high independent learning are over five times more likely to exhibit high performance compared to those with low independence (Prayekti, 2018). This finding is consistent with self-regulated learning theory, which posits that learners who are more autonomous in their learning are better equipped to manage their time, resources, and strategies, leading to enhanced academic outcomes (van der Graaf et al., 2022).

The strong relationship between independent learning and performance highlights the need for educational systems to cultivate self-directed learning skills among students (Rashid & Asghar, 2016). Teachers and educators should focus on creating an environment that promotes autonomy, encourages critical thinking, and provides students with the tools necessary to manage their learning processes. This may involve implementing teaching strategies that emphasize active learning, problem-solving, and the use of feedback to enhance self-reflection and goal setting (Yu, 2024).

Furthermore, educational policies and curricula should consider integrating programs that enhance students' self-regulation abilities. For instance, introducing workshops or modules that teach time management, goal-setting, and self-monitoring techniques could significantly boost independent learning and, in turn, academic performance (Guo, 2022).

In comparing the results of this study with existing theories and research, the findings align with the self-regulated learning theory, which emphasizes the importance of autonomy and self-direction in achieving academic success. Similar studies, such as those by Mammadov and Schroeder (2023), have also demonstrated that students with higher levels of independent learning tend to perform better academically. However, this research has certain limitations, including a relatively small sample size and a focus on a specific geographic area, which may limit the generalizability of the findings. Additionally, the study did not account for other potential factors influencing academic performance, such as parental involvement or teacher support. These limitations suggest potential avenues for further research, such as expanding the sample size, including diverse geographic locations, and exploring additional variables that may impact independent learning and academic outcomes. Despite these limitations, the study reaffirms the significant finding that independent learning is a critical factor in enhancing academic performance, with implications for educational practices and policies. By fostering self-directed learning skills, educators can better prepare students for lifelong learning and success in an increasingly complex world.

## 6. Conclusion

This study underscores the significant relationship between independent learning and academic performance in social and natural sciences among sixth-grade students in the Gugus SD Karangmojo 2 cluster. The primary objective was to evaluate the level of independent learning and its impact on academic outcomes, and the findings clearly indicate that a majority of students demonstrate high levels of self-directed learning, which correlates positively with superior performance in key subjects. Through both univariate and bivariate analyses, the research confirms that students with enhanced self-directed learning capabilities are more likely to achieve commendable academic results. The statistical significance of these findings, supported by a strong odds ratio, highlights the critical importance of fostering independent learning within educational settings. As educational systems evolve, it is imperative for educators and policymakers to integrate strategies that promote self-directed learning, equipping students with the skills necessary for lifelong success in an increasingly complex and dynamic world. This research contributes valuable insights into the pivotal role of independent learning in shaping academic achievement, emphasizing the need for ongoing exploration and support of this essential educational component.

## Limitation

The study has several limitations that may affect the generalizability and applicability of its findings. First, the research was conducted within a specific cluster of schools (Gugus SD Karangmojo 2), which may limit the diversity of the student population. A larger and more varied sample could yield more comprehensive insights into the relationship between independent learning and academic performance across different demographics. Additionally, the use of a cross-sectional design captures data at a single point in time, limiting the ability to infer causation, as it does not account for changes in students' independent learning or academic performance over time. The reliance on self-reported measures to assess independent learning may introduce bias, as students might overestimate or underestimate their levels of independence. Moreover, the study primarily evaluates academic performance in specific subjects, potentially overlooking other areas of achievement influenced by independent learning. Various external factors, such as socioeconomic status, family background, and school resources, were not controlled for, which could significantly influence both independent learning and academic performance. Furthermore, the concept of independent learning is multifaceted, and the study may not capture all dimensions of this construct, suggesting that future research could explore additional aspects. Lastly, the findings may be influenced by the specific educational context and policies in place during the study period, with changes in curriculum, teaching methods, or assessment practices potentially altering the dynamics of independent learning and academic performance. Acknowledging these limitations is crucial for interpreting the findings and indicates areas for future research to further investigate the intricate relationship between independent learning and academic success.

## Recommendation

Based on the findings and limitations of the study, several recommendations can be made to enhance students' independent learning and overall academic performance. Educational institutions should implement structured programs that foster skills such as self-regulation, time management, and goal-setting, encouraging students to take responsibility for their own learning. Incorporating these programs into the curriculum and providing opportunities for independent learning activities, such as project-based tasks and research-driven assignments, can cultivate a more self-reliant academic mindset. Moreover, teacher training and professional development should emphasize student-centered teaching approaches, equipping educators with the tools to create environments that promote independent thinking and active learning.

In addition, it is recommended that parents and guardians play a more active role in encouraging independent learning at home. Schools can facilitate this by providing parents with resources and strategies to support their children's autonomy in education. Establishing a stronger link between home and school can reinforce these efforts and ensure a more consistent development of independent learning habits. Further research should also explore how different interventions can impact independent learning in various educational contexts, including longitudinal studies to measure its long-term effects on student performance. Finally, policymakers should consider prioritizing the promotion of independent learning within educational frameworks, ensuring that both schools and students are adequately supported in fostering these essential skills.

To address the limitations identified in this study, future research should aim to include a larger and more diverse sample of students from various geographic and demographic backgrounds to enhance the generalizability of the findings. Longitudinal studies are recommended to capture changes in independent learning and academic performance over time, providing a clearer understanding of causation. Additionally, incorporating objective measures alongside self-reported data could reduce bias and provide a more accurate assessment of independent learning. Expanding the scope of academic performance evaluation to include a broader range of subjects and skills will offer a more comprehensive view of how independent learning influences different areas of achievement. Researchers should also consider controlling for external factors such as socioeconomic status, family background, and school resources to better isolate the effects of independent learning. By addressing these limitations, future studies can provide deeper insights into the multifaceted nature of independent learning and its impact on academic success, ultimately informing more effective educational strategies and policie

## Acknowledgments

We would like to express our sincere gratitude to all those who contributed to the completion of this study. Special thanks go to the faculty and staff of Institute for their support and guidance throughout the research process. We are also deeply appreciative of the students who participated in the study, whose insights and experiences were invaluable in shaping the findings.

Additionally, we are grateful for the continuous encouragement from our colleagues and peers, whose feedback helped refine our work. Lastly, we extend our appreciation to our families and friends for their unwavering support and understanding during this research endeavour.

## Conflict of Interest

The authors affirm that there were no financial, commercial, or personal relationships that could be construed as potential conflicts of interest in the research, data collection, analysis, or writing of this manuscript. All parties involved in the study-maintained impartiality and transparency throughout the research process, ensuring that the results and conclusions are unbiased and solely based on the data and evidence collected. Any support received for this research was acknowledged appropriately, and there were no competing interests that could have influenced the objectivity of the work presented.

## Declaration of Generative AI-assisted Technologies

This manuscript was prepared without the assistance of Generative AI. All intellectual contributions, critical analyses, and final revisions were conducted by the authors. The authors take full responsibility for the accuracy, originality, and integrity of the content presented in this work.

## References

Adams, C., Adigun, O., & Fiegener, A. (2022). Student trust in school peers: a relational condition for optimal school functioning. *Journal of Educational Administration, 60*(6), 545-560. https://doi.org/10.1108/jea-02-2022-0028.

Admiraal, W., Lockhorst, D., Post, L., & Kester, L. (2024). Effects of Students' Autonomy Support on their Self-Regulated Learning Strategies: Three Field Experiments in Secondary Education. *International Journal of Research in Education and Science*, *10*(1), 1–20. https://doi.org/10.46328/ijres.3343.

Bhat, N., & Dahal, A. (2023). Self-Directed Learning, its Implementation, and Challenges: A Review. *Nepal Journal of Health Sciences*, *3*(1), 102–115. https://doi.org/10.3126/njhs.v3i1.63277.

Díaz, B., & Nussbaum, M. (2024). Artificial intelligence for teaching and learning in schools: The need for pedagogical intelligence. *Computers & Education*, *217*, 105071. https://doi.org/10.1016/J.COMPEDU.2024.105071.

Guo, L. (2022). The effects of self-monitoring on strategy use and academic performance: A meta-analysis. *International Journal of Educational Research*, *112*, 101939. https://doi.org/10.1016/j.ijer.2022.101939.

Hasnor, H. N., Ahmad, Z., & Nordin, N. (2013). The Relationship between Learning Approaches and Academic Achievement Among Intec Students, Uitm Shah Alam. *Procedia - Social and Behavioral Sciences*, *90*, 178–186. https://doi.org/10.1016/j.sbspro.2013.07.080.

Krauss, S., Orth, U., & Robins, R. (2020). Family environment and self-esteem development: a longitudinal study from age 10 to 16. *Journal of Personality and Social Psychology, 119*(2), 457-478. https://doi.org/10.1037/pspp0000263.

Livingston, K. (2012). Independent Learning. In *Encyclopedia of the Sciences of Learning* (pp. 1526–1529). Springer US. https://doi.org/10.1007/978-1-4419-1428-6_895.

Mammadov, S., & Schroeder, K. (2023). A meta-analytic review of the relationships between autonomy support and positive learning outcomes. *Contemporary Educational Psychology*, *75*. https://doi.org/10.1016/j.cedpsych.2023.102235.

Mamun, M., Alam, K., Talukder, H., Jahan, S., Islam, N., & Chowdhury, M. (2024). Medical students' motivational factors and academic performance – undergraduate level of bangladesh. *Bangladesh Journal of Medical Education, 15(*1), 67-74. https://doi.org/10.3329/bjme.v15i1.70951.

Mandal, F. (2022). Rethinking the views on the nature of human culture. *Cultural Communication and Socialization Journal, 3*(1), 13-16. https://doi.org/10.26480/ccsj.01.2022.13.16.

Maqableh, M., Jaradat, M., & Azzam, A. (2021). Exploring the determinants of students' academic performance at university level: The mediating role of internet usage continuance intention. *Education and Information Technologies*, *26*(4), 4003–4025. https://doi.org/10.1007/s10639-021-10453-y.

Morris, T. H. (2019). Self-directed learning: A fundamental competence in a rapidly changing world. *International Review of Education*, *65*(4), 633–653. https://doi.org/10.1007/s11159-019-09793-2.

Nasution, N., Rahayu, R. F., Yazid, S. T. M., & Amalia, D. (2018). The influence of independent learning on student learning outcomes. *Journal of Non-Formal Education, 12*(1), 9. https://doi.org/10.32832/jpls.v12i1.2879.

Niromand, E., Salehi, A., Khazaei, M., & Khazaei, M. (2020). The influential factors in the academic achievement and failure of medical students in iran: a review study. *Educational Research in Medical Sciences,* 9(2). https://doi.org/10.5812/erms.105860.

Nurhayati, & Bahtiar. (2024). Student independent learning to improve communication and collaboration skills in view of gender. *Journal of Education and E-Learning Research*, *11*(2), 239–252. https://doi.org/10.20448/jeelr.v11i2.5450.

Prayekti. (2018). The Influence of Cognitive Learning Style and Independent learning on the Students' Learning Outcomes. Higher Education Studies, 8(2), 37. https://doi.org/10.5539/hes.v8n2p37.

Prøitz, T. S. (2010). Learning outcomes: What are they? Who defines them? When and where are they defined? *Educational Assessment, Evaluation and Accountability*, *22*(2), 119–137. https://doi.org/10.1007/s11092-010-9097-8.

Rashid, T., & Asghar, H. M. (2016). Technology use, self-directed learning, student engagement and academic performance: Examining the interrelations. *Computers in Human Behavior*, *63*, 604–612. https://doi.org/10.1016/j.chb.2016.05.084.

Rogelberg, S. L., Starrett, A., Irvin, M. J., & DiStefano, C. (2021). Examining motivation profiles within and across socioeconomic levels on educational outcomes. *International Journal of Educational Research*, *109*, 101846. https://doi.org/10.1016/j.ijer.2021.101846.

Rollwagen-Bollens, G., Nelson, T., & Wait, J. (2022). Actively participating in university-sponsored ecological research increases high school students' knowledge of and attitudes about science. Frontiers in Environmental Science, 9. https://doi.org/10.3389/fenvs.2021.797769.

UoPeople. (2024, June 19). *What Is Natural Science? 5 Definitions*. University of the People. https://www.uopeople.edu/blog/what-is-natural-science-5-definitions.

van der Graaf, J., Lim, L., Fan, Y., Kilgour, J., Moore, J., Gašević, D., Bannert, M., & Molenaar, I. (2022). The Dynamics Between Self-Regulated Learning and Learning Outcomes: an Exploratory Approach and Implications. *Metacognition and Learning*, *17*(3), 745–771. https://doi.org/10.1007/s11409-022-09308-9.

Wang, C., Mirzaei, T., Xu, T., & Lin, H. (2022). How learner engagement impacts non-formal online learning outcomes through value co-creation: an empirical analysis. *International Journal of Educational Technology in Higher Education*, *19*(1), 32. https://doi.org/10.1186/s41239-022-00341-x.

Wang, J., Tigelaar, D. E. H., Luo, J., & Admiraal, W. (2022). Teacher beliefs, classroom process quality, and student engagement in the smart classroom learning environment: A multilevel analysis. *Computers & Education*, *183*, 104501. https://doi.org/10.1016/J.COMPEDU.2022.104501.

Yu, H. (2024). Enhancing creative cognition through project-based learning: An in-depth scholarly exploration. *Heliyon*, *10*(6), e27706. https://doi.org/10.1016/J.HELIYON.2024.E27706.