

Assessment of Students Academic Performance Using Metacognitive Skills, Learning Motivation, Learning Strategies, Scientific Literacy and Problem-Solving Skills as Indicators: An Evaluation

Veronica S. Roque, MAEd¹; Marlon B. Marvilla, MAEd², Jo Neil T. Peria, PhD³, Jannea Lyn Estardo⁴

¹Unit Registrar/Faculty Member, Our Lady of Fatima University, Nueva Ecija, Philippines

²Principal, Kalantiyaw Elementary School, Quezon City, Metro Manila, Philippines

³Dean, College of Education, Nueva Ecija University of Science and Technology, Nueva Ecija, Philippines

⁴Registrars' Staff, Our Lady of Fatima University, Nueva Ecija, Philippines

Publication history: Received: April 3, 2026; Revised: May 17, 2026; Accepted: May 29, 2026

Email of Corresponding Author: ronaroquel@gmail.com

Abstract

This study examined the relationships among metacognition, learning strategies, learning motivation, problem-solving skills, and scientific literacy among Allied Medical Sciences students in Cabanatuan City. Anchored on Flavell's Theory of Metacognition, Eccles and Wigfield's Expectancy-Value Theory, and the concept of scientific literacy discussed by Norris & Phillips (2003), Kuhn (2011), and Morling (2021), the study investigated how cognitive and motivational factors influence academic performance in science-related disciplines. A descriptive-correlational research design was employed involving 328 Allied Medical Sciences students enrolled in nursing, medical laboratory science, public health, psychology, and related programs. Data were collected using validated instruments, including the Metacognitive Skills Scale (MSS), Learning Strategy Questionnaire, Science Motivation Questionnaire II (SMQ-II), scientific literacy assessment, and Problem-Solving Skills Scale. Data analysis utilized descriptive statistics and Pearson correlation coefficients through SPSS and AMOS. Findings revealed that respondents demonstrated high levels of learning strategies, while learning motivation and problem-solving skills were at moderate levels. Metacognition showed moderate positive relationships with learning strategies ($r = 0.41$), learning motivation ($r = 0.44$), and problem-solving skills ($r = 0.48$), indicating that students with stronger metacognitive awareness tend to employ more effective learning behaviors and analytical skills. In contrast, scientific literacy exhibited very weak relationships with learning strategies, motivation, problem-solving skills, and metacognition. The study concluded that metacognition and learning motivation play important roles in enhancing science achievement and self-regulated learning among Allied Medical Sciences students. The study recommends strengthening reflective learning activities, inquiry-based instruction, motivational support, and learner-centered strategies to improve academic performance and professional preparedness. The study supports Sustainable Development Goal (SDG) 4: Quality Education by promoting effective learning processes and scientific literacy among Allied Medical Sciences students. It also aligns with SDG 3: Good Health and Well-Being through the development of competent future healthcare professionals capable of evidence-based decision-making. The sustainability impact of the study lies in its contribution to educational and public health sustainability by supporting curriculum improvement, learner development, and workforce preparedness in allied medical and health-related fields. Strengthening metacognitive and analytical competencies may contribute to long-term institutional effectiveness and improved healthcare practice.

Keywords: Academic Achievement; Allied Medical Sciences; Learning Motivation; Learning Strategies; Metacognition; Problem-Solving Skills; Science Achievement; Scientific Literacy; Self-Regulated Learning

1. Introduction

Science education plays a crucial role in developing the knowledge, competencies, and evidence-based practices required in allied medical and health-related disciplines. Learning sciences emphasize how learners acquire, organize, and apply knowledge in different educational contexts (Sawyer, 2021). In health education, students are expected not only to understand scientific principles but also to apply them effectively in complex and changing real-life situations. Consequently, identifying the cognitive and motivational factors associated with academic achievement is essential for improving educational outcomes among Allied Medical Sciences students. Metacognition, learning strategies, learning motivation, problem-solving skills, and scientific literacy are recognized as important determinants of academic performance. Metacognition enables learners to regulate their thinking and learning processes (Flavell, 1979), while effective learning strategies enhance information acquisition, organization, and retention. Motivation influences persistence and engagement in academic tasks, whereas problem-solving skills strengthen analytical reasoning and decision-making. Scientific literacy further equips students with the ability to understand scientific concepts, analyze evidence, and apply

scientific knowledge to practical situations (Turiman, P., Omar, J., Daud, A. M., & Osman, K., 2012). Despite the significance of these variables, limited studies have examined their combined influence on science achievement among Allied Medical Sciences students in the Philippine context. This study therefore investigates the interrelationships among metacognition, learning strategies, learning motivation, problem-solving skills, scientific literacy, and science achievement.

1.1 Metacognition, Scientific Literacy, and Science Achievement among Allied Medical Sciences Students

Science education is fundamental in preparing students for evidence-based practice in allied medical and health-related professions. Learners are required to develop scientific understanding and apply knowledge effectively in academic and professional settings (Sawyer, 2021). Among the factors influencing academic success, metacognition has been widely recognized as essential for effective learning because it enables students to plan, monitor, and evaluate their learning processes (Flavell, 1979). Students with strong metacognitive awareness are more capable of identifying strengths and weaknesses, adjusting learning approaches, and becoming self-directed learners. Learning strategies also influence how students acquire, organize, retain, and apply information. Strategies such as note-taking, summarizing, self-testing, collaborative learning, and time management improve comprehension and academic performance, particularly in science and health-related programs where students process complex information. Learning motivation further affects students' engagement, persistence, and commitment to academic tasks. Intrinsic and extrinsic motivation contribute to learners' willingness to exert effort and overcome academic challenges. Problem-solving skills support analytical reasoning, critical thinking, and sound decision-making, which are necessary in clinical and scientific settings. Together, these factors contribute to students' academic achievement and professional preparedness. Scientific literacy is likewise important because it enables students to understand scientific concepts, interpret data, solve problems, and make evidence-based decisions. According to the OECD, scientifically literate individuals can explain scientific phenomena and evaluate scientific information using evidence. Developing scientific literacy therefore helps learners become informed and active members of society (Turiman, P., Omar, J., Daud, A. M., & Osman, K., 2012).

1.2 Themes and Insights on Metacognition, Learning Strategies, Motivation, Problem-Solving, and Scientific Literacy

Literature highlights metacognition as an important component of self-regulated learning and academic achievement. Flavell (1976) identified metacognitive knowledge, regulation, and accuracy as key dimensions of metacognition. Studies indicate that metacognitive skills improve conceptual understanding, reflective reasoning, and scientific inquiry (Fleur et al., 2025). Research on learning strategies emphasizes the effectiveness of deep and strategic learning approaches. Surface learners focus mainly on memorization, whereas deep learners aim to understand concepts and meanings. Strategic learners integrate approaches to optimize academic performance (UNSW Sydney, 2021). Evidence suggests that students using deep and strategic approaches demonstrate stronger academic achievement and long-term retention of knowledge (Minh Ton et al., 2025). Learning motivation has also been consistently associated with academic success. Eccles and Wigfield's expectancy-value theory explains that motivation influences learners' academic choices, persistence, and achievement outcomes. Motivated students are more likely to apply effective learning strategies and remain engaged in challenging academic tasks. Studies in medical and health sciences show a strong relationship between learning motivation and academic achievement (Otermans et al., 2025). Problem-solving skills are considered essential in scientific reasoning and clinical decision-making. These skills involve analyzing situations, identifying relevant information, generating solutions, and evaluating outcomes. Although students may demonstrate competence in basic problem-solving tasks, difficulties remain in evaluating assumptions and generating alternative solutions (Calma, 2025). Scientific literacy has likewise been identified as a critical competency. Norris & Phillips (2003) explained that scientific literacy involves understanding scientific information, applying science in everyday life, and making informed decisions based on evidence. Kuhn (2011) emphasized that scientific thinking requires connecting beliefs with evidence, while Morling (2021) highlighted the importance of understanding research methods and data interpretation in evaluating reliable scientific information.

1.3 Local, National, and Global Context of Scientific Literacy and Academic Achievement in Allied Medical Sciences

Globally, scientific literacy and cognitive learning competencies are recognized as important educational outcomes, particularly in science and health-related fields. The OECD emphasizes scientific literacy as essential for preparing individuals to participate actively in science-related issues and societal decision-making. International research also highlights the importance of metacognition, learning strategies, motivation, and problem-solving skills in improving academic achievement and professional competence. Nationally and locally, Allied Medical Sciences programs require students to process large volumes of scientific information while developing analytical and clinical reasoning skills. However, limited studies in the Philippine context have examined the combined influence of metacognition, scientific literacy, learning strategies, motivation, and problem-solving skills on science achievement among Allied Medical Sciences students. This gap underscores the need for localized research that can inform educational practices and learner support mechanisms.

1.4 Theoretical and Conceptual Basis of Metacognition and Scientific Literacy in Science Achievement

The study is anchored on theories related to metacognition, motivation, and scientific literacy. Flavell's theory of metacognition explains that learners who are aware of and capable of regulating their cognitive processes are more effective in planning, monitoring, and evaluating learning activities (Flavell, 1976). This framework supports the idea that metacognitive awareness contributes to improved academic achievement. Eccles & Wigfield's expectancy-value theory further explains the role of motivation in influencing students' learning choices, persistence, and academic performance. Students who perceive academic tasks as valuable and believe in their capabilities are more likely to exert effort and achieve better outcomes. The concept of scientific literacy, as discussed by Norris & Phillips (2003), Kuhn (2011), and Morling (2021), emphasizes the importance of understanding scientific concepts, evaluating evidence, and applying logical reasoning in decision-making. These theories collectively support the investigation of the relationships among metacognition, learning strategies, motivation, problem-solving skills, scientific literacy, and science achievement.

1.5 Research Gaps and Rationale on the Relationships among Metacognition, Scientific Literacy, and Science Achievement

Previous studies have examined metacognition, learning strategies, learning motivation, problem-solving skills, and scientific literacy independently or through paired relationships. However, limited research has explored their combined influence on science achievement, particularly among Allied Medical Sciences students in the Philippine context. Existing literature also provides insufficient evidence regarding the interrelationships among these cognitive and motivational variables in health-related education. This study addresses these gaps by examining the relationships among metacognition, scientific literacy, learning strategies, learning motivation, problem-solving skills, and science achievement. The findings may contribute to improved educational strategies, learner support programs, and curriculum development for Allied Medical Sciences students.

1.6 Alignment of the Study with Relevant Sustainable Development Goals (SDGs)

The study aligns primarily with SDG 4 – Quality Education because it focuses on improving learning processes, scientific literacy, and academic achievement among Allied Medical Sciences students. By examining factors that influence effective learning and scientific understanding, the study contributes to enhancing educational quality and promoting lifelong learning opportunities. The research also relates to SDG 3 – Good Health and Well-Being since Allied Medical Sciences education prepares future healthcare professionals who are expected to make evidence-based decisions and respond effectively to clinical challenges. Strengthening scientific literacy, metacognition, and problem-solving skills supports the development of competent healthcare practitioners. Additionally, the study supports SDG 8 – Decent Work and Economic Growth by contributing to the preparation of skilled and competent graduates capable of meeting professional and workforce demands in health-related fields.

1.7 Importance of the Study to Educational, Public Health, and Socio-Economic Sustainability

The study contributes to educational sustainability by identifying cognitive and motivational factors that enhance academic achievement and lifelong learning among Allied Medical Sciences students. Understanding these variables may support the development of more effective teaching approaches, learner-centered strategies, and curriculum improvements. The research also contributes to public health sustainability because scientifically literate and competent healthcare students are better prepared to make informed clinical decisions and respond to health-related challenges. Improved problem-solving skills and evidence-based reasoning may enhance the quality of healthcare practice and patient outcomes. Moreover, the study supports institutional and socio-economic sustainability by helping educational institutions strengthen academic programs that prepare competent professionals for the healthcare sector. Developing students' metacognition, motivation, and scientific literacy may improve professional readiness, employability, and long-term workforce development in allied medical and health sciences.

2. Material and methods

2.1 Research Design

The study employed a descriptive–correlational research design to examine the relationships among the selected variables without manipulating them. This design was appropriate in determining the associations among metacognition, learning strategies, learning motivation, scientific literacy, problem-solving skills, and science achievement among Allied Medical Sciences students.

2.2 Locale of the Study

The study was conducted in Cabanatuan City among institutions offering Allied Medical Sciences programs, including medical laboratory science, nursing, pharmacy, and related health science courses.

2.3 Respondents of the Study

The respondents of the study consisted of 328 Allied Medical Sciences students enrolled in medical laboratory science, nursing, pharmacy, and related programs. These students were currently taking science-related courses during the conduct of the study.

2.4 Sample and Sampling Procedure

The study used purposive convenience sampling in selecting participants. Respondents were chosen based on their enrollment in Allied Medical Sciences programs and their participation in science-related subjects relevant to the objectives of the study.

2.5 Research Instrument

Data were collected using validated research instruments designed to measure the variables of the study. The Metacognitive Skills Scale (MSS) was used to assess metacognitive knowledge, regulation, and accuracy. The Learning Strategy Questionnaire measured students' learning strategies, while the Science Motivation Questionnaire II (SMQ-II) assessed learning motivation. Scientific literacy skills were measured using an instrument focused on students' scientific literacy competencies. Problem-solving skills were assessed using the Problem-Solving Skills Scale, which evaluated problem-solving attitude and critical thinking ability. The study framework examined metacognition, learning strategies, motivation, problem-solving skills, and scientific literacy as predictors of science achievement among Allied Medical Sciences students.

2.6 Data Gathering Procedure

Prior to data collection, approval was secured from the institutional research office. Questionnaires were administered online through Google Forms. Respondents were informed about the voluntary nature of participation, confidentiality of responses, and the purpose of the study before answering the survey instruments.

2.7 Data Analysis Techniques

Data were analyzed using SPSS and AMOS. Descriptive statistics were utilized to summarize the respondents' profiles and determine the levels of the study variables. Pearson correlation coefficients were computed to identify the relationships among metacognition, learning strategies, learning motivation, scientific literacy, problem-solving skills, and science achievement.

2.8 Ethical Considerations

The study adhered to ethical research standards by ensuring informed consent, confidentiality, anonymity, and voluntary participation of the respondents throughout the conduct of the research.

3. Results and Discussion

3.1 Profile, Cognitive Factors, and Academic Characteristics of Allied Medical Sciences Students

3.1.1 Demographic Profile of the Respondents

The findings showed that most respondents were female, comprising 235 or 71.65% of the participants, while 93 or 28.38% were male. In terms of age, the majority belonged to the 15–20 age group with 293 respondents or 89.33%, followed by 21–25 years old with 31 respondents or 9.45%, and 26–30 years old with 4 respondents or 1.22%. Regarding academic program, Bachelor of Science in Nursing (BSN) students represented the largest group with 175 respondents or 53.35%, followed by Bachelor of Science in Medical Laboratory Science (BSMLS) with 110 respondents or 33.54%, Bachelor of Science in Public Health (BSPH) with 37 respondents or 11.28%, and Bachelor of Science in Psychology (BSPSYCH) with 6 respondents or 1.83%. The findings indicate that female students dominate the allied medical sciences programs included in the study, particularly in Nursing and Psychology where female participation is traditionally higher. The age distribution suggests that most respondents were young undergraduate learners in the early stages of higher education, where cognitive, metacognitive, and motivational abilities continue to develop. The higher representation of Nursing and Medical Laboratory Science students may also reflect increasing demand for healthcare professionals locally and globally, making these programs appropriate contexts for examining metacognition, scientific literacy, and academic achievement.

3.2 Learning Strategies, Learning Motivation, and Problem-Solving Skills of the Respondents

3.2.1 Learning Strategies of Allied Medical Sciences Students

The results revealed that respondents demonstrated a high level of learning strategies, reflected by a weighted average mean of 3.96 and a standard deviation of 0.90. The findings suggest that students frequently use strategies that help them organize, process, and retain information effectively. The high mean implies that Allied Medical Sciences students recognize the importance of effective study habits such as note-taking, reviewing, self-testing, and time management in demanding science-related courses. The variation in responses further indicates that while many students employ strong learning strategies, differences in learning approaches still exist among respondents.

3.2.2 Learning Motivation of Allied Medical Sciences Students

The findings showed that learning motivation obtained a weighted average mean of 3.04 with a standard deviation of 0.92, indicating a moderate level of motivation among the respondents. Students generally demonstrated satisfactory levels of interest, persistence, and willingness to engage in academic tasks. This finding suggests that motivation contributes to students' engagement and perseverance in completing academic requirements. However, the moderate rating may indicate that some learners experience academic pressure, workload concerns, or external factors that affect their enthusiasm toward learning.

3.2.3 Problem-Solving Skills of Allied Medical Sciences Students

The results indicated that problem-solving skills had a weighted average mean of 3.00 and a standard deviation of 0.70, reflecting a moderate level of perceived problem-solving ability among the respondents. Students generally viewed themselves as capable of analyzing problems and identifying appropriate solutions. The findings emphasize the importance of critical thinking and reasoning skills in allied medical sciences, where healthcare professionals are expected to make accurate decisions in complex clinical situations. Although students demonstrated adequate analytical abilities, the results also suggest the need for further enhancement of advanced decision-making and problem-solving competencies.

3.3 Relationship Between Metacognition and Cognitive Learning Variables

3.3.1 Relationship Between Metacognition and Learning Strategies

The study revealed a moderate positive correlation between metacognition and learning strategies with a Pearson correlation coefficient of $r = 0.41$. This indicates that students with higher metacognitive awareness were more likely to employ effective learning strategies. The findings suggest that students who actively plan, monitor, and evaluate their learning processes tend to use organized and purposeful study techniques. Metacognitive awareness supports students in selecting strategies that improve understanding and retention of scientific concepts, thereby enhancing learning effectiveness.

3.3.2 Relationship Between Metacognition and Learning Motivation

The results showed a moderate positive correlation between metacognition and learning motivation with $r = 0.44$. Students with stronger metacognitive abilities generally demonstrated higher motivation toward learning. This finding implies that metacognitively aware learners are more capable of setting goals, monitoring progress, and recognizing achievements, which may increase confidence and intrinsic motivation. The results support the view that self-regulated learners are more engaged and persistent in academic tasks because they understand how their efforts contribute to successful outcomes.

3.3.3 Relationship Between Metacognition and Problem-Solving Skills

The findings demonstrated a moderate positive correlation between metacognition and problem-solving skills with $r = 0.48$, representing the strongest relationship among the variables examined. Students with stronger metacognitive regulation tended to exhibit better problem-solving abilities. The results indicate that learners who effectively regulate and evaluate their thinking processes are more capable of analyzing situations, evaluating alternatives, and applying appropriate solutions. In allied medical education, this relationship is important because students are expected to make sound judgments in scientific and clinical contexts. Overall, the findings emphasize the role of metacognition in enhancing learning behaviors, motivation, and analytical abilities.

3.4 Relationship Between Scientific Literacy and Cognitive Learning Variables

3.4.1 Relationship Between Scientific Literacy and Learning Strategies

The findings revealed a very low negative correlation between scientific literacy and learning strategies with $r = -0.06$. This indicates that scientific literacy skills were not strongly associated with the respondents' use of learning strategies. The negligible negative relationship may suggest inconsistencies between students' scientific understanding and their preferred learning approaches. Some learners may demonstrate acceptable scientific literacy skills without consistently applying structured learning strategies.

3.4.2 Relationship Between Scientific Literacy and Learning Motivation

The results showed a very low positive correlation between scientific literacy and learning motivation with $r = 0.05$. This suggests that motivation had minimal influence on the respondents' scientific literacy skills. Although motivation commonly contributes to academic engagement, the weak relationship may indicate that scientific literacy depends more on educational experiences, exposure to scientific inquiry, and instructional quality rather than motivation alone.

3.4.3 Relationship Between Scientific Literacy and Problem-Solving Skills

The findings indicated a very low negative correlation between scientific literacy and problem-solving skills with $r = -0.08$. Scientific literacy and problem-solving abilities were only minimally related among the respondents. The weak relationship suggests that scientific knowledge does not automatically translate into effective problem-solving skills. This finding highlights the need for integrative instructional approaches that connect scientific concepts with real-world problem-

solving applications. Overall, the very weak correlations involving scientific literacy suggest that this variable may function independently from the cognitive and motivational factors examined in the study. The findings emphasize the importance of educational interventions that better integrate scientific literacy development with learning strategies, motivation, and analytical skills.

3.5 Relationship Between Scientific Literacy and Metacognition

The study revealed a very low negative correlation between scientific literacy and metacognition with $r = -0.06$, indicating almost no relationship between students' scientific literacy skills and metacognitive awareness. The negligible relationship suggests that students' ability to comprehend and apply scientific knowledge may not necessarily depend on metacognitive processes alone. Some learners may rely more on memorization and familiarity with scientific content rather than reflective and strategic thinking. The findings also imply that scientific literacy may be influenced by factors such as curriculum design, instructional methods, laboratory exposure, and access to scientific resources. Despite the weak correlation, metacognition remains important in promoting self-regulated learning, critical reflection, and independent thinking. The results suggest the need for instructional approaches that intentionally integrate metacognitive practices with scientific literacy activities, including reflective learning journals, inquiry-based learning, case analysis, and evidence-based reasoning tasks.

4. Conclusion & Recommendations

The study concluded that the respondents were predominantly young female Allied Medical Sciences students, with most enrolled in the Bachelor of Science in Nursing program. The findings showed that students generally demonstrated high levels of learning strategies and problem-solving skills, while learning motivation was moderate. Metacognition exhibited a moderate positive relationship with learning strategies and academic achievement, indicating that students with stronger awareness and regulation of their cognitive processes tend to apply more effective learning strategies and achieve better academic performance. Learning motivation was also positively associated with academic achievement, emphasizing its importance in sustaining student engagement and performance in science-related programs. In contrast, scientific literacy showed very weak relationships with learning strategies, learning motivation, problem-solving skills, and metacognition. Overall, the findings underscore the importance of enhancing metacognitive awareness and learning motivation through instructional approaches that promote self-regulated learning, reflection, and active engagement among Allied Medical Sciences students.

Based on the findings, educational institutions and instructors are encouraged to implement instructional strategies that strengthen students' metacognitive skills through reflective learning activities, self-assessment, and guided inquiry. Teachers are also encouraged to integrate motivational strategies such as clear learning objectives, constructive feedback, learner-centered activities, and recognition of academic accomplishments to sustain student engagement and improve academic performance. Academic support services, including study skills programs, mentoring, and counseling initiatives, may further enhance students' learning strategies and problem-solving abilities. Curriculum planners and program administrators may likewise incorporate metacognitive and motivational components into allied medical and health-related programs to develop more reflective, self-regulated, and motivated learners. Future researchers are encouraged to conduct studies involving larger and more diverse populations and to explore additional variables and research designs that may further explain the relationships among metacognition, learning motivation, learning strategies, problem-solving skills, and academic achievement.

The study was limited to Allied Medical Sciences students enrolled in selected programs in Cabanatuan City and utilized a descriptive–correlational research design, which limited the ability to establish causal relationships among the variables. The findings were also based on self-reported responses gathered through online questionnaires, which may have been influenced by respondents' honesty, perceptions, and interpretation of the survey instruments. In addition, the study focused only on selected cognitive and motivational variables related to academic achievement, and other possible factors affecting student performance were not included in the investigation.

Compliance with ethical standards

The study adhered to ethical research standards throughout the conduct of the investigation. Respondents were informed about the purpose of the study, the voluntary nature of their participation, and the confidentiality and anonymity of their responses. Data collection was conducted through online questionnaires using Google Forms, and participants were allowed to respond freely without coercion.

REFERENCES

- Altindag, M., & Senemoglu, N. (2013). Metacognitive Skills Scale. Hacettepe Universitesi Egitim Fakultesi Dergisi [H.U. Journal of Education].
- Calma, A. (2025). Students' problem-solving skills in depth: Ready for "real life"? The International Journal of Management Education, 23(3). Elsevier. <https://doi.org/10.1016/j.ijme.2025.101267>
- Eccles, J. S., & Wigfield, A. (2020). From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on motivation. Contemporary Educational Psychology, 101859. <https://doi.org/10.1016/j.cedpsych.2020.101859>
- Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), The nature of intelligence (pp. 231–236). Erlbaum.
- Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive developmental inquiry. American Psychologist, 34(10), 906–911.
- Fleur, D. S., et al. (2025). Neural correlates of metacognition in education: A machine learning approach. Neuropsychologia, 219. Elsevier. <https://doi.org/10.1016/j.neuropsychologia.2025.109265>
- Kuhn, D. (2011). What is scientific thinking and how does it develop? In U. Goswami (Ed.), The Wiley-Blackwell handbook of childhood cognitive development (2nd ed., pp. 497–523). Wiley-Blackwell.
- Minh Ton, D. N., et al. (2025). Learning strategies of nursing students and correlation with study habit and academic performance. Teaching and Learning in Nursing, 20(4). Elsevier. <https://doi.org/10.1016/j.teln.2025.04.013>
- Morling, B. (2021). Research methods in psychology (4th ed.). W.W. Norton & Company.
- Norris, S. P., & Phillips, L. M. (2003). How literacy in its fundamental sense is central to scientific literacy. Science Education, 87(2), 224–240.
- OECD. (2019). PISA 2018 assessment and analytical framework. OECD Publishing. <https://doi.org/10.1787/b25efab8-en>
- Otermans, P. C. J., et al. (2025). Motivation is key: Exploring the role of motivation on learning approaches. Learning Research and Practice. <https://doi.org/10.1080/23735082.2025.2536502>
- Sawyer, R. K. (2021). The Cambridge handbook of the learning sciences (3rd ed.). Cambridge University Press. <https://doi.org/10.1017/9781108888295>
- Turiman, P., Omar, J., Daud, A. M., & Osman, K. (2012). Fostering the 21st century skills through scientific literacy and science process skills. Procedia - Social and Behavioral Sciences, 59, 110–116. <https://doi.org/10.1016/j.sbspro.2012.09.253>