INTERNATIONAL JOURNAL OF EDUCATION AND LEARNING RESEARCH

Print ISSN 2785-9568

VOLUME 7, ISSUE 2, 2024, 1 – 33

Online ISSN 2785-955X

Positive Academic Emotions and Academic Self-Efficacy as Mediator Variables in the Relationship Between Metacognitive Awareness and Deep Learning Among University Students

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Abstract: The research aims to explore the relationship between deep learning and each positive academic emotions, academic self-efficacy, and metacognitive awareness, as well as to examine potential gender differences in these variables. Additionally, the research seeks to investigate the mediating role of positive academic emotions and academic self-efficacy in the relationship between metacognitive awareness and deep learning among 430 students (both male and female) at Kafrelsheikh University, with an average age of 22.55 and a standard deviation of 2.48. Valid and reliable scales were used to measure the key variables, and data analysis included calculating means, standard deviations, Pearson's correlation coefficient, t-test for independent groups, and the use of Macro-Process v4.2 by Andrew Hayes in SPSS.

The results revealed a positive relationship between deep learning and each positive academic emotions ($r = .851$, $p < 0.01$), academic self-efficacy ($r = .750$, $p < 0.01$), and metacognitive awareness ($r = .818$, $p < 0.01$). No significant differences were found between male and female students regarding the research variables.

Additionally, a strong linear relationship was found between metacognitive awareness and positive academic emotions ($R^2 = 0.643$) as well as academic self-efficacy ($R^2 = 0.666$), indicating that metacognitive awareness explains 64.35% and 66.60% of the variance in positive academic emotions and academic self-efficacy, respectively, with strong statistical significance (p-value = 0.000).

Furthermore, metacognitive awareness (coefficient = 0.396, $p = 0.000$) showed a significant positive effect on deep learning, and positive academic emotions (coefficient = 0.726, $p = 0.000$) had an even greater positive effect. Academic self-efficacy (coefficient = 0.255, $p = 0.000$) also contributed positively. These results confirm that positive academic emotions and academic self-efficacy act as mediator variables in the relationship between metacognitive awareness and deep learning .These findings highlight the crucial role of positive academic emotions , academic self-efficacy, and metacognitive awareness in enhancing academic and educational outcomes. Based on these findings, recommendations and suggestions were made to further improve educational strategies and student performance.

***Keywords**:* Positive Academic Emotions, Academic Self-Efficacy, Metacognitive Awareness, Deep Learning.

INTERNATIONAL JOURNAL OF EDUCATION AND LEARNING RESEARCH

Print ISSN 2785-9568

VOLUME 7, ISSUE 2, 2024, 1 – 33

Online ISSN 2785-955X

الانفعالات الأكاديمية الإيجابية وكفاءة الذات الأكاديمية كمتغيرات وسيطة في العلاقة بين الوعي ما وراء المعرفي والتعلم العميق لدى طلاب الجامعة

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الملخص

يهدف البحث إلى دراسة العلاقة بين التعلم العميق وكلٍ من الانفعالات الأكاديمية الإيجابية، وكفاءة الذات الأكاديمية، والوعي ما وراء المعرفي، والكشف عن وجود فروق تُعزى للنوع في هذه المتغيرات. كما يهدف البحث إلى التحقق من الدور الوسيط للانفعالات الأكاديمية الإيجابية وكفاءة الذات الأكاديمية في العلاقة بين الوعي ما وراء المعرفي والتعلم العميق لدى 430 طالبًا وطالبة من جامعة كفر الشيخ، بمتوسط عمر 22.55 وانحراف معياري قدره 2.48. تم استخدام مقاييس تتسم بالصدق والثبات لقياس متغيرات البحث، وشمل التحليل الإحصائي حساب المتوسطات، والانحرافات المعيارية، ومعامل الارتباط بيرسون، واختبار t للمجموعات المستقلة، واستخدام macro-Process v4.2 by Andrew Hayes في برنامج SPSS.

أظهرت النتائج وجود علاقة إيجابية بين التعلم العميق وكل من الانفعالات الأكاديمية الإيجابية (r = .851، p < 0.01)، كفاءة الذات الأكاديمية (r = .750، p < 0.01)، والوعي ما وراء المعرفي (r = .818، p < 0.01). ولم تسفر النتائج عن وجود فروق ذات دلالة إحصائية بين الطلاب والطالبات في المتغيرات المدروسة. بالإضافة إلى ذلك، وجدت علاقة خطية قوية بين الوعي ما وراء المعرفي والانفعالات الأكاديمية الإيجابية ($R^2 = 0.643$) وكفاءة الذات الأكاديمية ($R^2 = 0.666$)، مما يشير إلى أن الوعي ما وراء المعرفي يفسر 64.35% و66.60% من التباين في الانفعالات الأكاديمية الإيجابية وكفاءة الذات الأكاديمية على التوالي، مع دلالة إحصائية قوية (p-value = 0.000).

كما أظهر الوعي ما وراء المعرفي (coefficient = 0.396, p = 0.000) تأثيرًا مباشرا إيجابيًا كبيرًا على التعلم العميق، وكان للانفعالات الأكاديمية الإيجابية (coefficient = 0.726, p = 0.000) تأثير أكبر. كما ساهمت كفاءة الذات الأكاديمية (coefficient = 0.255, p = 0.000) أيضًا بشكل إيجابي. وتؤكد هذه النتائج أن الانفعالات الأكاديمية الإيجابية وكفاءة الذات الأكاديمية تعملان كوسيطين في العلاقة بين الوعي ما وراء المعرفي والتعلم العميق. وتسلط هذه النتائج الضوء على الدور الحيوي للانفعالات الأكاديمية الإيجابية، وكفاءة الذات الأكاديمية، والوعي ما وراء المعرفي في تعزيز النتائج الأكاديمية والتربوية. استنادًا إلى هذه النتائج، تم تقديم بعض التوصيات والمقترحات.

الكلمات المفتاحية: الانفعالات الأكاديمية الإيجابية، كفاءة الذات الأكاديمية، الوعي ما وراء المعرفي، التعلم العميق.

INTERNATIONAL JOURNAL OF EDUCATION AND LEARNING RESEARCH

Print ISSN 2785-9568

VOLUME 7, ISSUE 2, 2024, 1 – 33

Online ISSN 2785-955X

Introduction

The university stage is one of the most important phases in students' lives, as it contributes to shaping their academic and professional identity and equipping them with the knowledge and skills necessary to meet the demands of the labor market. According to Tinto (1993), the university environment provides opportunities for academic and social interaction, which positively affects students' integration and persistence in their studies. Astin (1999) also explained that active participation in university activities enhances the development of leadership skills and critical thinking, which, in turn, reflects positively on academic and professional success. Additionally, Kuh (2008) indicated that the learning experience in university influences students' readiness for professional life by equipping them with the competencies required in the 21st century, such as communication and teamwork skills. Accordingly, the university stage is not limited to academic achievement alone but also extends to personality development, fostering independence, and enhancing decision-making abilities, making it a crucial phase in shaping individuals' futures.

Positive academic emotions are a crucial factor in enhancing the learning experience and achieving academic success, as they influence students' motivation and behaviors. According to Pekrun et al. (2002), positive emotions such as joy, satisfaction, and pride are associated with higher levels of academic engagement, promoting the use of deep learning strategies rather than surface approaches. Fredrickson (2001), in the "Broaden-and-Build Theory," also indicated that positive emotions expand cognitive scope, helping students develop more complex cognitive skills and increasing their flexibility in problem-solving. Additionally, a study by Linnenbrink-Garcia and Pekrun (2011) confirmed that positive emotions enhance focus and interaction within classrooms, leading to better academic achievement and increased self-confidence. Accordingly, fostering positive academic emotions in educational environments is a necessary strategy for improving academic performance and enhancing an effective learning experience.

Academic self-efficacy is one of the important psychological factors that significantly affect students' academic performance, as it refers to students' belief in their ability to succeed in educational activities. According to Zimmerman (2000), academic self-efficacy influences students' commitment to achieving their academic goals, helping to

INTERNATIONAL JOURNAL OF EDUCATION AND LEARNING RESEARCH

Print ISSN 2785-9568

VOLUME 7, ISSUE 2, 2024, 1 – 33

Online ISSN 2785-955X

motivate them to put in effort and overcome academic challenges. A study by Pajares (1996) showed that students with high academic self-efficacy tend to use effective learning strategies and achieve better academic performance compared to those with low self-efficacy. Additionally, Schunk (1995) emphasized that enhancing self-efficacy through encouragement of success and positive reinforcement can lead to improved academic performance and greater intrinsic motivation. Therefore, academic self-efficacy is one of the fundamental factors that should be supported within the educational environment to ensure students' success and help them achieve their best academic performance.

Metacognition is one of the core concepts in educational psychology, referring to individuals' ability to monitor, regulate, and organize their cognitive processes during learning. According to Flavell (1979), metacognition is defined as "awareness of and thinking about one's cognitive processes," which includes the ability to identify effective learning strategies and assess personal progress while solving problems. A study by Schraw & Dennison (1994) demonstrated that individuals with a high level of metacognitive awareness show better control over their learning processes, leading to improved academic performance. Zimmerman (2002) also highlighted that enhancing metacognitive awareness can help students develop self-regulation skills, which boosts their motivation and contributes to academic achievement. Therefore, metacognition is considered a critical element in improving learning strategies, fostering critical thinking, and problem-solving in educational contexts.

Deep learning is also an important educational concept that contributes to developing students' ability to understand and deeply comprehend educational content rather than memorizing and recalling information superficially. According to Biggs & Tang (2011), deep learning relies on active interaction with knowledge, where students seek to connect new information with prior knowledge, enhancing their ability to analyze and apply it in different contexts. Marton & Säljö (1976) also indicated that students who adopt deep learning strategies tend to achieve higher academic performance compared to those who follow surface learning, as they focus on understanding meanings rather than mechanically retrieving information. Furthermore, Entwistle (2009) emphasized that educational environments that support critical thinking and scientific inquiry contribute to fostering deep learning, helping students develop independent thinking and problem-solving skills. Accordingly, deep learning is an essential educational strategy for

INTERNATIONAL JOURNAL OF EDUCATION AND LEARNING RESEARCH

Print ISSN 2785-9568

VOLUME 7, ISSUE 2, 2024, 1 – 33

Online ISSN 2785-955X

promoting sustainable understanding and improving the quality of learning across various academic disciplines.

From the above, It is clear that positive academic emotions contribute significantly to enhancing students' self-efficacy, as they contribute to building their self-confidence and ability to face academic challenges (Pekrun et al., 2002). This, in turn, enhances metacognitive awareness, enabling students to control and effectively apply their learning strategies (Flavell, 1979). When students are able to organize their learning effectively, they become better able to use deep learning methods that encourage a profound understanding of content and its application in diverse contexts (Biggs & Tang, 2011). Thus, these psychological and cognitive factors intersect to create an educational environment that fosters sustainable academic success and enhances the overall learning experience.

Problem Statement

Given the challenges faced by university students in the contemporary academic environment, there is an increasing need to understand the effectiveness of educational strategies in achieving sustainable and effective learning. Deep learning is one of the key approaches that help students understand and apply information at a deeper level, thereby contributing to improved learning outcomes (Biggs & Tang, 2011). Metacognitive awareness is also an important factor that enables students to monitor and regulate their learning strategies effectively, which improves their problem-solving abilities and decision-making in educational contexts (Flavell, 1979). Additionally, academic emotions such as enjoyment, hope, pride, and satisfaction play a crucial role in motivating students to engage in the learning process more effectively, enhancing their intrinsic motivation (Pekrun et al., 2002). Studies also indicate that academic self-efficacy significantly influences the use of deep learning strategies and leads to better academic performance (Pajares, 1996).

Thus, deep learning is considered one of the fundamental aspects in improving academic performance among students. Many studies have addressed the role of metacognitive awareness in enhancing it. However, there remains a gap in psychological literature regarding the role of positive academic emotions and academic self-efficacy as mediating factors in this relationship. Furthermore, the differences between males and females in these variables have not received adequate attention, leaving questions about the impact of gender on the relationship between these

INTERNATIONAL JOURNAL OF EDUCATION AND LEARNING RESEARCH

Print ISSN 2785-9568

VOLUME 7, ISSUE 2, 2024, 1 – 33

Online ISSN 2785-955X

variables. Based on this, the current research aims to fill this gap by presenting an integrated model that illustrates the interactions between metacognitive awareness, positive academic emotions, academic self-efficacy, and deep learning, along with analyzing gender differences in these variables.

Based on the previously mentioned literature, this research poses the following questions:

1. Is there a statistically significant correlation between deep learning and positive academic emotions, academic self-efficacy, and metacognitive awareness among university students?
2. Are there statistically significant differences in positive academic emotions, academic self-efficacy, metacognitive awareness, and deep learning based on gender (male and female) among university students?
3. Is there a statistically significant direct effect of metacognitive awareness on positive academic emotions, academic self-efficacy, and deep learning among university students?
4. Is there a statistically significant indirect effect of metacognitive awareness through positive academic emotions and academic self-efficacy on deep learning among university students?
5. Does the proposed model of the relationship between the variables explain the variance in the dependent variable?

Objectives of the Research

1. Examine the significant relationship between deep learning, positive academic emotions, academic self-efficacy, and metacognitive awareness among university students.
2. Explore the significant differences in positive academic emotions, academic self-efficacy, metacognitive awareness, and deep learning based on gender (male and female) among university students.
3. Determine the significant direct effect of metacognitive awareness on positive academic emotions, academic self-efficacy, and deep learning among university students.
4. Assess the significant indirect effect of metacognitive awareness on deep learning through positive academic emotions and academic self-efficacy among university students.

INTERNATIONAL JOURNAL OF EDUCATION AND LEARNING RESEARCH

Print ISSN 2785-9568

VOLUME 7, ISSUE 2, 2024, 1 – 33

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5. Evaluate the proposed model of the relationship between metacognitive awareness and deep learning through the mediation of positive academic emotions and academic self-efficacy.

Significance of the Research

1. Enriching the psychological literature of positive academic emotions, academic self-efficacy, metacognitive awareness, and deep learning by presenting a model that illustrates the interactions between these variables and their impact on academic performance.
2. Highlighting the importance of positive academic emotions and academic self-efficacy as mediating factors that influence the relationship between metacognitive awareness and deep learning.
3. Clarifying the role of metacognitive awareness in enhancing deep learning among university students, contributing to the development of effective educational strategies.
4. The research introduced a new measure of academic self-efficacy to the Arab context, along with three translated and standardized scales for positive academic emotions, metacognitive awareness, and deep learning.
5. Supporting decision-makers in the educational field by providing scientific findings that assist in designing educational programs.

Literature Review

The following presents the theoretical framework that outlines the key variables of the research: positive academic emotions, academic self-efficacy, metacognitive awareness, and deep learning. The purpose of this section is to provide a comprehensive analysis of each variable, including its theoretical and operational definitions, core dimensions, and the key studies and theories that have addressed them. The theoretical framework aims to clarify how these variables influence educational processes and interact with one another, contributing to a deeper understanding of the learning process and enhancing its outcomes.

Positive Academic Emotions

Positive academic emotions are a set of feelings and emotions that students experience during their academic experiences. These emotions enhance their active engagement in

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Print ISSN 2785-9568

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the learning process, motivate them to achieve academic success, and play a significant role in motivation, attention, perception, memory, and decision-making (Wilkinson, 2013). Positive academic emotions also affect many cognitive aspects of learning, such as the ability to solve problems, process information, and self-regulate learning (Pekrun et al., 2009). Learning activities during classes, lectures, studying, and homework, as well as learners' results in tests and school performance, directly correlate with academic emotions. They also predict academic achievement (Pekrun et al., 2006). These emotions include feelings such as pride, satisfaction, enthusiasm, joy, and admiration for academic achievements. Pekrun's (2006) control and value theory suggested positive academic emotions have a direct impact on students' motivation and academic performance. These emotions lead to improving students' internal motivation, enabling them to engage more in academic tasks and actively interact with educational content.

Therefore, students' possession of positive emotions is considered an essential part of effective learning strategies, which include active engagement with the course material and analyzing and interpreting information in depth rather than just superficial memorization. Positive academic emotions are pivotal in the context of student learning because they enhance a set of psychological and cognitive variables that contribute to improving academic performance. According to Efklides (2011), students who experience positive emotions such as satisfaction and pride in their academic achievements are more willing to engage in effective learning strategies such as deep learning. These strategies involve actively engaging with academic content and expanding understanding through analysis and interpretation rather than just superficial memorization. Therefore, positive academic emotions contribute to enhancing learning efficiency and increasing students' ability to deal with academic challenges in creative and self-directed ways.

Furthermore, positive academic emotions exhibit a fundamental role in developing students' academic self-efficacy. According to Bandura's self-efficacy theory, positive emotions such as success and pride help enhance students' perceptions of their academic abilities, making them more confident in their ability to meet future academic challenges (Bandura, 1997). Students' ability to achieve higher academic goals and successfully handle academic tasks is associated with this self-efficacy (Bandura, 1997). Additionally, these emotions can assist in reducing academic burnout levels, which are associated with the psychological stress and exhaustion of academic study (Pekrun et al.,

INTERNATIONAL JOURNAL OF EDUCATION AND LEARNING RESEARCH

Print ISSN 2785-9568

VOLUME 7, ISSUE 2, 2024, 1 – 33

Online ISSN 2785-955X

2002). Students who are able to experience positive emotions on a regular basis show lower levels of anxiety and stress related to studying, which helps them maintain their internal motivation and interact positively with the learning environment (Pekrun et al., 2002).

Academic Self-Efficacy

Self-efficacy is a key factor influencing student success in academic learning environments. It refers to a student's belief in their ability to handle academic tasks and achieve success and is considered one of the most prominent determinants of academic achievement (Zimmerman, 2000). Bandura (1997) defines it as an individual's belief in his ability to achieve success in a particular task. Academic self-efficacy is defined as an individual's belief in his or her ability to achieve success in academic tasks through appropriate strategies (Schunk, 2003). Self-efficacy contributes to enhancing motivation and internal motivation, which drives the student to strive to achieve their academic goals (Bandura, 1997) and contributes to enhancing students' ability to face academic challenges, as belief in their abilities motivates them to adopt more effective learning strategies (Schunk, 2012). Individuals with high self-efficacy believe that they are able to control their academic outcomes through the efforts made, while those who lack self-efficacy suffer from a sense of helplessness and have less belief in their ability to adapt to learning challenges (Schunk & DiBenedetto, 2020).

Several factors, including social support, the educational environment, and educational practices, influence academic self-efficacy, and cognitive skills like metacognitive awareness indicate a major role in building and developing this efficacy (Pintrich, 2000). Academic self-efficacy is a cornerstone of developing self-regulation strategies, as students with strong self-efficacy believe that they are able to regulate their learning effectively, which contributes to improving their academic performance (Zimmerman, 2002). Furthermore, studies indicate a strong connection between academic self-efficacy and deep learning practices, which foster critical thinking and ongoing engagement with the course material. Students with high self-efficacy are more likely to manage learning stress and make informed academic decisions (Schunk & DiBenedetto, 2020).

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Print ISSN 2785-9568

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Metacognitive Awareness

Metacognitive awareness refers to an individual's capacity to comprehend, monitor, and regulate their mental processes during learning, it includes an individual's awareness of the learning methods they use and their effectiveness (Flavell, 1979). Metacognitive awareness consists of two main components: metacognitive knowledge, which relates to an individual's understanding of their learning abilities and strategies, and metacognitive control, which involves the regulation of mental processes such as planning, monitoring, and evaluation (Schraw & Dennison, 1994). Metacognitive awareness is a critical factor in improving academic performance, as it enables students to use more effective learning strategies, which leads to enhanced understanding and academic achievement (Pintrich, 2002). Studies indicate that students with high metacognitive awareness are better able to track their academic progress, which helps them adjust their learning strategies when they encounter difficulties (Efklides, 2011). Furthermore, metacognitive awareness can reduce academic stress by enabling students to adapt to different learning demands (Veenman, 2005). Deep learning closely aligns with metacognitive awareness, as it fosters students' capacity to interact with course content through analytical and interpretive methods rather than relying solely on mechanical memorization (Biggs, 1987).

Students with high metacognitive awareness demonstrate higher levels of critical thinking and analysis, enabling them to effectively connect new knowledge to prior knowledge (Schraw, 1998). Instructional strategies that support conscious reflection and self-evaluation during learning can enhance students' metacognitive awareness (Zimmerman, 2002). Teachers can use activities such as self-assessment, regular monitoring, and guiding students to reflect on their study methods to improve their metacognitive awareness (Paris & Winograd, 1990). Encouraging students to think critically and reflect on their mistakes also helps build their ability to cope with academic challenges (Borkowski, Chan, & Muthukrishna, 2000). This link between metacognitive awareness and deep learning highlights its role in developing students' ability to apply acquired knowledge in a variety of life and academic situations (Marton & Säljö, 1976).

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Print ISSN 2785-9568

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Deep Learning

Deep learning is an educational approach that aims to develop a comprehensive and integrated understanding in students, going beyond the superficial memorization of information to focus on analyzing concepts, connecting new knowledge to real-world contexts, and using it to solve problems (Alt & Boniel-Nissim, 2018; Donnison & Penn-Edwards, 2012). This type of learning is characterized by its focus on promoting critical and creative thinking through strategies that include interactive discussions, project-based learning, and scientific inquiry (Alt & Boniel-Nissim, 2018; Lee & Baek, 2012; Biggs & Tang, 2011). It differs from surface learning, which focuses on memorizing facts, and rote learning. Deep learning involves creating new concepts, connecting them, and critical thinking (Rozgonjuk & Saal, 2018). Marton and Säljö (1976) also point out that deep learning occurs when students connect new knowledge to their previous experiences, which contributes to enhancing understanding and sustainable insight. Furthermore, deep learning supports sustainable learning, as students are able to recall and apply knowledge in complex life and professional situations. This approach requires a supportive learning environment that promotes active interaction between students and educational content, enabling them to develop analytical and critical thinking skills (Beattie et al., 1997).

Adopting strategies such as problem-based learning (PBL) is an effective way to promote deep learning, as it encourages students to analyze real-world problems and apply the acquired knowledge to solve them, which increases their emotional and intellectual connection to the educational material (Prince, 2004). Deep learning is also associated with increased self-motivation among students, as it focuses on making them active participants in the learning process, which enhances their sense of responsibility for their academic progress (Deci & Ryan, 1985). It also enhances metacognitive awareness, which is an essential component of deep learning, as it enables students to reflect on their own thinking, evaluate their performance, and develop effective strategies to improve their learning (Pintrich, 2004). Students who adopt this approach show significant improvement in their ability to organize their time and pursue their long-term goals, which contributes to reducing academic stress and increasing their overall satisfaction with their educational experience (Pintrich, 2004). In addition, adopting deep learning strategies is associated with enhancing the ability to think independently and innovate, as it contributes to improving academic performance and

INTERNATIONAL JOURNAL OF EDUCATION AND LEARNING RESEARCH

Print ISSN 2785-9568

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developing the life skills that students need to face the challenges of the twenty-first century (Hattie, 2009).

Based on the theoretical framework presented, it is evident that the interaction between positive academic emotions, academic self-efficacy, metacognition, and deep learning forms a fundamental basis for understanding how psychological and cognitive factors influence academic performance. Studies have shown that positive emotions, such as motivation and achievement, not only enhance the motivation to learn but also directly impact individuals' ability to develop cognitive strategies like planning and organizing (Schunk, 1991). On the other hand, metacognitive awareness enhances the ability to engage in critical thinking, which contributes to achieving deep learning, enabling learners to process information at a deeper and more effective level, thereby improving learning outcomes (Biggs, 2003). This complex interaction between psychological and cognitive factors reflects a dynamic connection that contributes to improving academic performance and promoting sustainable learning processes.

Hypothesis

1. There is a statistically significant correlation between deep learning and each of positive academic emotions, academic self-efficacy, and metacognitive awareness among university students.
2. There are no statistically significant differences in positive academic emotions, academic self-efficacy, metacognitive awareness, and deep learning based on gender (male and female) among university students.
3. There is a statistically significant direct effect of metacognitive awareness on positive academic emotions, academic self-efficacy, and deep learning among university students.
4. There is a statistically significant indirect effect of metacognitive awareness through positive academic emotions and academic self-efficacy on deep learning among university students.
5. The proposed model of the relationship between the variables explains the variance in the dependent variable.

Methodology

A descriptive-analytical approach was used to study the relationship between variables, explore the differences between males and females, and examine the effect of the

INTERNATIONAL JOURNAL OF EDUCATION AND LEARNING RESEARCH

Print ISSN 2785-9568

VOLUME 7, ISSUE 2, 2024, 1 – 33

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independent variable (metacognitive awareness) and the mediating variables (positive academic emotions and academic self-efficacy) on the dependent variable (deep learning). Pearson's correlation coefficient was calculated, in addition to conducting an independent samples t-test to study gender differences in the variables. Additionally, Andrew Hayes' Process Macro v4.2 in SPSS was used to measure the precise direct and indirect effect of positive academic emotions and academic self-efficacy on the relationship between metacognitive awareness and deep learning.

Participants

The research included 430 students (180 males and 250 females) from Kafrelsheikh University, with an average age of 22.55 years and a standard deviation of 2.48, during the second semester of the academic year 2023-2024. The sample was randomly selected using Steven Thompson's method of random sampling to ensure a fair representation of the target population. This method was chosen to guarantee that every student in the target population had an equal chance of being included in the sample, thereby enhancing the generalizability of the results and minimizing potential bias in the research.

Procedures

The procedure for this research followed a structured approach to ensure the systematic collection and analysis of data related to metacognitive awareness, positive academic emotions, academic self-efficacy, and deep learning among students at Kafrelsheikh University. The following steps outline the research procedure:

Participant Selection:

A total of 430 students from Kafrelsheikh University, Egypt, were selected to participate in the research. Participants were chosen using a stratified random sampling method to ensure diversity in terms of academic disciplines and levels. Inclusion criteria required participants to be enrolled in Kafrelsheikh University.

Development of the Instruments:

Several standardized questionnaires were used to measure the variables of interest:

Metacognitive awareness was assessed using the Metacognitive Awareness Inventory.

Positive academic emotions were measured using a validated questionnaire to assess students' emotional experiences related to their academic work.

INTERNATIONAL JOURNAL OF EDUCATION AND LEARNING RESEARCH

Print ISSN 2785-9568

VOLUME 7, ISSUE 2, 2024, 1 – 33

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Academic self-efficacy was assessed through a modified version of the Academic Self-Efficacy Scale.

Deep learning was evaluated using a questionnaire that measures students' engagement in deep learning strategies, such as critical thinking and reflective learning.

Preliminary Testing:

Prior to data collection, a pilot study was conducted with a smaller sample of 50 students to test the reliability and validity of the instruments. Based on feedback, minor adjustments were made to the survey format and questions.

Data Collection:

Data was collected through online surveys distributed to participants via university email and social media platforms. Students were informed about the purpose of the research.

Data Analysis:

The data were analyzed using SPSS. Descriptive statistics were first used to summarize the demographic characteristics of the participants. Correlation and regression analyses were then conducted to examine the direct and indirect relationships between metacognitive awareness, positive academic emotions, academic self-efficacy, and deep learning. A mediation analysis was performed to test the mediating effects of positive academic emotions and academic self-efficacy.

Interpretation of Results:

The results were interpreted in light of existing literature on the factors influencing deep learning. Mediation analysis helped identify the roles of positive academic emotions and academic self-efficacy as mediators between metacognitive awareness and deep learning. Findings were compared with previous studies to validate the outcomes.

Reporting the Findings:

The results were documented in a comprehensive report, which included the background, methodology, results, discussions, and recommendations. The research's findings were shared with academic stakeholders at Kafrelsheikh University and are intended to inform future interventions aimed at enhancing deep learning among students.

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Instruments

Positive Academic Emotions Questionnaire

Pekrun et al. (2011) designed a questionnaire measuring positive achievement emotions. It consists of 10 items with a five-point scale starting from “totally disagree = 1” to “totally agree = 5" and measures positive emotions, including enjoyment, hope, pride, and relief. The participant's score ranges from 10 to 50. A high score means a high level of positive academic emotions. The current author translated the questionnaire, then compared the two translations and obtained a preliminary version that reflected the translated phrase, the concepts and ideas included in the original phrase and fit the context of the Egyptian environment. Then a reverse translation from Arabic to English was carried out by an Arabic-to-English translation specialist without looking at the original scale to ensure the validity of the translation. The psychometric properties of the translated version were verified, and the Cronbach's alpha reliability coefficient for positive academic emotions was .859; the corrected correlation coefficients ranged between .668 and .872, indicating high internal consistency. We also verified the internal validity indicators of the scale by calculating the correlation coefficients between the degrees of positive emotions (enjoyment, hope, pride, and relief).

Academic self-efficacy Scale

The current author created the Academic Self-Efficacy Scale specifically for this research. It consists of 16 items distributed over four dimensions: academic task management, confidence in academic achievement, academic anxiety management, and intrinsic motivation. Participants respond to the scale using a five-point scale; 1 indicates strong disagreement, and 5 indicates strong agreement. Thus, each participant's score ranges from 16 to 80. A high score indicates a high level of academic self-efficacy.

Face validity was used to verify the psychometric properties of the scale by presenting it to a group of academic experts in psychology and education, who confirmed that the items accurately reflect the targeted academic self-efficacy dimensions. Exploratory factorial validity was also used to look at the internal structure of the academic self-efficacy scale. The scale groups its items around four main factors: managing academic tasks, having faith in one's own ability to succeed, dealing with academic anxiety, and being internally motivated. This fits with the theory. Furthermore, we used Cronbach's

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alpha to measure internal consistency, finding high values ranging from .75 to .81, indicating strong internal consistency between the items. Moreover, we verified the stability of the scale by retesting it on the same sample after a period of time, which revealed a correlation coefficient (r =.85) between the two measurements, thus enhancing its reliability.

Metacognitive Awareness Inventory (MAI)

Schraw and Denison (1994) developed the MAI, a 52-item self-report instrument with a 5-point response scale, to measure an individual's understanding of their cognitive processes and their ability to control them during learning. The scale consists of two main parts: cognitive knowledge and cognitive organization. The first part (cognitive knowledge) refers to an individual's understanding of their cognitive abilities while the second part (cognitive organization) relates to the strategies an individual uses to plan, monitor, and evaluate their learning. The scale was translated by the current author into Arabic and addressed its back translation to ensure its validity. The scale exhibits high internal consistency, with Cronbach's alpha values ranging from .85 to .89, indicating a high degree of reliability. The scale has also demonstrated strong construct validity, with studies showing high correlations with other measures of cognitive and metacognitive functions, providing evidence that it measures relevant metacognitive processes. Schraw and Denison (1994) also highlighted the effectiveness of the scale in identifying learners' metacognitive strengths and weaknesses, thereby making it a valuable tool in educational research and interventions aimed at enhancing learning strategies.

Deep Learning Questionnaire

Panadero et al. (2021) created a deep learning questionnaire with 30 items measuring four dimensions: basic learning self-regulation strategies, visual elaboration strategies, summarizing strategies, deep information processing strategies, and social learning self-regulation. The items 5, 9, 21, and 25 in were formulated in reverse order. The participant responded on a five-point scale, and the participant's score ranges from 30 to 150. The high score indicates a high level of deep learning self-regulation strategies. The questionnaire was translated into Arabic. Experts in educational psychology and English language approved the translation. A correlation of .83 was found between Arabic and original forms, indicating accuracy in both language and translation. The author verified the scale's internal validity by calculating the correlation coefficient between each item's

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score and the total score, subtracting it from the total score, and using the remaining items as tests. The values of the correlation coefficients ranged between .725 and .877. In terms of split-half reliability and internal consistency, the scale likewise demonstrated strong test-retest reliability (r = .88) and internal consistency (coefficient = .88).

Results

In this section, the results of the analysis conducted to evaluate the role of positive academic emotions and academic self-efficacy as mediating variables between metacognition and deep learning will be presented. Descriptive statistics were used to display the basic distributions of the data, and regression analysis was performed to examine the effects of the independent variables on the dependent variables. Additionally, *Process Macro v4.2* by Andrew Hayes, Model 4, was employed to test the direct and indirect relationships between these variables. The results for each hypothesis will be presented, highlighting the statistically significant values and explaining the reciprocal effects between the variables.

H1: There is a statistically significant correlation between deep learning and each of positive academic emotions, academic self-efficacy, and metacognitive awareness among university students.

To calculate the correlations between the variables, Pearson's correlation coefficient was used as shown in Table 1.

Table 1. Correlation Coefficients Between Deep Learning and Positive Academic Emotions, Academic Self-Efficacy, and Metacognitive Awareness

Variable	Positive Academic Emotions	Academic Self-Efficacy	Metacognitive Awareness
Deep Learning	.851*	.750*	.818*

*Correlation is significant at 0.01 level

Table 1 illustrates statistically significant correlational relationships between deep learning and positive academic emotions, academic self-efficacy, and metacognitive awareness among university students. The correlation coefficient ($r = .851$, $p < .01$) indicates a strong positive relationship between deep learning and positive academic emotions, suggesting that students who experience positive academic emotions are more likely to adopt deep learning strategies. Similarly, a significant positive correlation is observed between deep learning and academic self-efficacy ($r = .750$, $p < .01$), implying

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that students with high levels of academic self-efficacy tend to engage more in deep learning. Furthermore, the strong correlation between deep learning and metacognitive awareness ($r = .818$, $p < .01$) highlights that students with advanced metacognitive awareness possess a greater ability to employ deep learning strategies, enhancing their comprehension and knowledge retention.

H2: *There are no statistically significant differences in positive academic emotions, academic self-efficacy, metacognitive awareness, and deep learning based on gender (male and female) among university students*.

To test the hypothesis, an independent samples t-test was conducted as shown in Table 2.

Table 2. Differences in Positive Academic Emotions, Academic Self-Efficacy, Metacognitive Awareness, and Deep Learning Based on Gender

Variable	Males N = 180		Females N = 250		t	*Sig.*	*Cohen's d*
	M	*SD*	*M*	*SD*			
Positive Academic Emotions	37.33	5.53	16.45	5.29	.220	.231	0.221
Academic Self-Efficacy	58.95	8.42	57.72	7.35	1.586	.120	0.157
Metacognitive Awareness	174.08	19.33	175.48	17.20	.319	.995	0.130
Deep Learning	85.26	13.18	84.36	12.59	.709	.728	0.170

According to the results in Table 2, no statistically significant differences were found between males and females in all variables, as the t-values and Sig. values were greater than 0.05 in each case. It is also noted that Cohen's d values were very small, indicating that the differences between genders in these variables are minimal in practical terms. Therefore, it can be concluded that gender does not significantly impact these variables among university students in the sample.

H3: There is a statistically significant direct effect of metacognitive awareness on positive academic emotions, academic self-efficacy, and deep learning among university students.

To verify the hypothesis, the author used process macro v. 4.2 by Andrew Hayes model 4, and Direct effects of metacognitive awareness, positive academic emotions, and academic self-efficacy on deep learning are displayed in Table 3.

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Table 3. Direct Effects of Metacognitive Awareness, Positive Academic Emotions, and Academic Self-Efficacy on Deep Learning

Variables	Coefficient	Standard Error	t	P	LLCI	ULCI
Metacognitive Awareness	0.3968	0.0225	17.6081	0.000	0.3525	0.4411
Positive Academic Emotions	0.7268	0.0695	10.4502	0.000	0.5901	0.8635
Academic Self-Efficacy	0.2559	0.0517	3.0183	0.000	0.0544	0.2575

As shown in Table 3, there are significant positive effects for the studied variables. The coefficient for Metacognitive Awareness indicates a significant positive effect (coefficient = 0.3968, p = 0.000), suggesting a strong relationship between metacognitive awareness and deep learning. Additionally, Positive Academic Emotions show a significant positive effect as well (coefficient = 0.7268, p = 0.000), with a confidence interval ranging from 0.5901 to 0.8635, which confirms the importance of these emotions in enhancing academic performance. Moreover, Academic Self-Efficacy exhibits a significant positive effect (coefficient = 0.2559, p = 0.000), highlighting its role in enhancing students' ability to cope with learning challenges.

Overall, all values recorded in the table show strong statistical significance, as the t values exceed the critical values and support the positive correlations between these variables and deep learning. Furthermore, the LLCI and ULCI values indicate that the effects fall within high confidence intervals, which further strengthens the reliability of the results.

H4: There is a statistically significant indirect effect of metacognitive awareness through positive academic emotions and academic self-efficacy on deep learning among university college students.

To verify the hypothesis, the author used process macro v. 4.2 by Andrew Hayes model 4, and Indirect Effects via Mediators (positive academic emotions and academic self-efficacy) on deep learning are displayed in Table 4.

Table 4. Indirect Effects Via Mediators (Positive Academic Emotions and Academic Self-Efficacy) on Deep Learning

Mediator	Effect	*SE*	*LLCI*	*ULCI*	*P*
Positive academic emotions	0.2628	0.0192	0.1215	0.1970	0.000
Academic self-efficacy	0.2494	0.0171	0.0142	0.0817	0.000
Total Indirect	0.4123	0.0250	0.1598	0.2566	0.000

As shown in Table 4, the results illustrate the effects of the mediators (that positive academic emotions and academic self-efficacy) on the relationship between

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metacognitive awareness and deep learning. The results show that positive academic emotions have a significant positive effect (Effect = 0.2628, P = 0.000) within the confidence interval (LLCI = 0.1215, ULCI = 0.1970). Similarly, academic self-efficacy serves as a mediator with a significant positive effect (Effect = 0.2494, P = 0.000) within the confidence interval (LLCI = 0.0142, ULCI = 0.0817).

The total indirect effect is also statistically significant, with a value of (Effect = 0.4123, P = 0.000) and a confidence interval (LLCI = 0.1598, ULCI = 0.2566). These results highlight the importance of the two mediators in explaining the relationship, emphasizing that positive emotions and academic self-efficacy demonstrate a crucial role in the observed effect.

H5: The proposed model of the relationship between the variables explains the variance in the dependent variable.

To verify the hypothesis, the author used process macro v. 4.2 by Andrew Hayes model 4, and the relationships between the research variables were found as shown in Figure 1and Table 5.

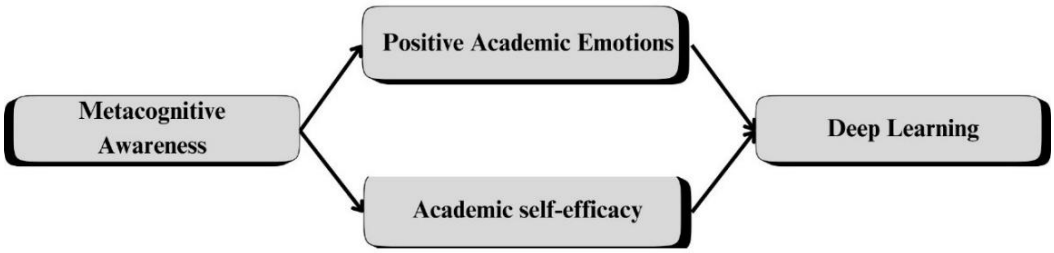

Figure (1) The model expressing the causal relationships between the study variables

Table 5. The Proposed Model of The Relationship Between Metacognitive Awareness and Deep Learning Through The Mediation of Positive Emotions and Academic Self-Efficacy.

Variable	R	R-Sq.	MSE	F	P
metacognitive awareness	0.9375	0.8788	20.1119	1029.98	0.000
Positive academic emotions	0.8022	0.6435	10.3788	772.50	0.000
Academic self-efficacy	0.8161	0.6660	18.8040	853.62	0.000

As shown in Table 5, the R value indicates a strong correlation between variables, indicating a robust model. Additionally, R-sq indicates the model explains 87.88% of the variance in the dependent variable. Furthermore, the mean squared error reflects a high level of prediction accuracy. The high F-value indicates strong statistical

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significance. The p-value is 0.000, so the model is highly statistically significant ($p < 0.05$). Overall, these results indicate that the model explains 87.88% of the variance in the dependent variable (deep learning), reflecting its high predictive accuracy. The F-value further underscores the model's strong statistical significance.

Also, Table 5 showed a strong linear relationship between being aware of how you think and feeling positively about school. With $R^2 = 0.6435$, this means that being aware of how you think explains 64.35% of the variation in emotions. The p-value (0.000) confirms the statistical significance of the model.

Furthermore, there is a strong linear relationship between metacognitive awareness and academic self-efficacy, with $R^2 = 0.666$ indicating that awareness explains 66.60% of the variance in academic self-efficacy. The p-value (0.000) confirms the statistical significance of the model. Based on the previous results, the hypothesis should be accepted.

Discussion

The results of hypothesis (1) align with the study by Pekrun et al. (2002), which demonstrated that positive academic emotions, such as pride and enjoyment, enhance students' motivation, potentially reflecting on deep learning strategies and also consistent with the findings of Pelch (2020), which also confirmed that academic emotions have a direct positive impact on academic performance and student motivation. These results are also supported by the study of Zimmerman & Schunk (2011), which confirmed that academic self-efficacy positively influences learning, depending on the nature of the academic task.

Furthermore, these findings agree with the study by Schraw & Dennison (1994), which focused on the role of metacognitive awareness in improving deep learning strategies, suggesting that this effect is more pronounced among students with higher levels of self-regulation in learning. As well, the results by Arrastia et al. (2016), indicated that metacognitive awareness exhibits a crucial role in enhancing reading and learning strategies, which calls for integrating metacognitive training programs into curricula to improve students' academic performance. Additionally, the study by Biggs & Tang (2011) emphasized that deep learning is influenced by several factors, including academic emotions and metacognitive awareness, highlighting the significance of these variables in enhancing learning quality.

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The results can be interpreted in light of the existing literature that highlights the relationship between positive academic emotions, academic self-efficacy, metacognitive awareness, and deep learning. According to Pekrun et al. (2002), positive academic emotions such as pride and enjoyment enhance students' motivation, which leads them to adopt deep learning strategies focused on deep comprehension of academic content. Zimmerman and Schunk (2011) support this idea by emphasizing that academic self-efficacy, which refers to students' confidence in their abilities, exhibits a crucial role in promoting effective learning strategies and academic success. Students with higher self-confidence tend to adopt more effective learning approaches. Additionally, Schraw and Dennison (1994) suggest that metacognitive awareness enhances students' ability to organize their learning effectively, contributing to the improvement of deep learning strategies. Finally, Biggs and Tang (2011) confirm that deep learning is influenced by several factors, including positive academic emotions and metacognitive awareness. These factors work together to motivate students to develop comprehensive learning strategies that support their academic achievement (Pekrun et al., 2002; Zimmerman & Schunk, 2011; Schraw & Dennison, 1994; Biggs & Tang, 2011).

The results of hypothesis (2) regarding differences in positive academic emotions differ from the study of Al-Qasabi and Amin (2017), which showed statistically significant differences between male and female students in the emotions of hope, pride, and enjoyment, as well as the total score of positive emotions in favor of male students. This suggests that gender may play a role in the expression of positive academic emotions, which could impact academic performance.

Regarding differences in academic self-efficacy, the results are consistent with the study of Baji (2020), which concluded that there were no statistically significant differences in academic self-efficacy between male and female students. However, these results differ from those of Zayed (2024), which showed gender-based differences in favor of female students, indicating that gender may influence academic self-efficacy.

When it comes to metacognitive awareness, there is a divergence in the results. While the study by Nasim et al. (2024) found that male students are less cognitively aware than female students, the study by Al-Yousef (2017) revealed significant differences in metacognitive thinking levels attributed to gender in favor of females. These differences highlight the impact of gender on how students perceive and engage in their cognitive processes.

Regarding deep learning, the current results align with the study by Mansour and Diab (2020), which showed that there were no differences attributed to gender in deep

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learning. However, they differ from the study by Al-Zarfi and Al-Aboudi (2023), which found gender-based differences in deep learning in favor of male students. This indicates the complexity of gender differences in deep learning strategies and their use in educational settings.

The lack of differences between males and females in positive academic emotions, academic self-efficacy, metacognitive awareness, and deep learning may be due to the impact of environmental, social, and educational factors that provide equal learning environments for all students. This can be explained by educational factors that encourage interaction and active participation among genders. Brunstein and Gollwitzer (2019) suggest that educational contexts that encourage interaction and active participation reduce gender differences in positive academic emotions. Additionally, academic self-efficacy can be positively influenced by equal educational experiences, as Zimmerman (2013) found no significant differences in self-efficacy between male and female students in supportive educational environments. Regarding metacognitive awareness, Schraw et al. (2006) found no significant differences between males and females in cognitive skills when equal training on critical thinking strategies was provided. Finally, Entwistle and Ramsden (2013) indicate that students, regardless of gender, show similar abilities to use deep learning strategies when provided with appropriate training in critical thinking and analysis. Based on these studies, equal educational factors can help reduce gender differences in these academic areas.

The results also revealed that metacognitive awareness has a strong positive direct effect on the dependent variable (deep learning), with a coefficient of 0.3968, which was statistically significant ($p = 0.000$). This indicates that an increase in metacognitive awareness directly leads to an increase in deep learning. We identified indirect effects through positive academic emotions and academic self-efficacy, in addition to the direct effect. A strong link was found between metacognitive awareness and deep learning through positive academic emotions. This link had an effect coefficient of 0.1628 and a significant confidence interval that ranged from 0.1215 to 0.1970. Academic self-efficacy also showed an indirect effect, with a coefficient of 0.1494 and a confidence interval range. The results are consistent with Elbyaly and Elfeky (2022) as they showed a relationship between metacognitive awareness and deep learning. Metacognitive awareness significantly influences learning outcomes by organizing perception and understanding cognitive processes in an individual. It also showed that learners with higher levels of metacognitive awareness tend to engage more deeply in the learning

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process, enhancing better understanding, critical thinking, and the ability to link new knowledge to previous knowledge. This confirms that metacognitive awareness demonstrates a crucial role in promoting deep learning strategies and improving academic performance.

The relationship between metacognitive awareness and positive academic emotions reveals that metacognitive awareness accounts for 64.35% of the variance in positive academic emotions. This is a strong relationship, meaning that metacognitive awareness has a significant impact on academic emotions. The p-value of 0.000 indicates the statistical significance of the relationship between them. The fact that more mindful individuals tend to experience more positive academic emotions explains this. Metacognitive awareness may help individuals better regulate their emotions and enhance overall well-being. These results align with Gross (2002), who showed that metacognitive awareness contributes to regulating and interacting with emotions in a positive way, which leads to improved performance, as well as Lischetzke et al. (2024) and Denny (2020), who found that metacognitive awareness is associated with improved well-being through increased ability to regulate emotions.

The correlation between metacognitive awareness and academic self-efficacy has a coefficient of determination of R = 0.6660. This indicates that awareness accounts for 66.60% of the variance in self-efficacy. This is a significant percentage, indicating that awareness plays an important role in shaping academic self-efficacy. p-value = 0.000: Since the p-value is less than 0.05, it indicates that the relationship between metacognitive awareness and academic self-efficacy is statistically significant. The reason for this is that individuals with a high level of metacognitive awareness tend to have a higher sense of academic self-efficacy. This awareness can enhance individuals' appreciation of their abilities and motivate them to work more effectively. This is consistent with Bandura's theory (1997), where he indicated that individuals who have the ability to be aware of their situations and performance can increase their self-efficacy. It is also consistent with Zimmerman (2000), where he indicated that self-awareness enhances individuals' ability to set their goals and evaluate their performance, which contributes to enhancing self-efficacy.

The direct effect of metacognitive awareness on the dependent variable (deep learning) is 0.3968, indicating a direct positive effect of metacognitive awareness on deep learning. The p-value (< 0.05) confirms that this effect is statistically significant.

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Additionally, the indirect effects through positive academic emotions and academic self-efficacy are also significant. Positive academic emotions (0.1628) and academic self-efficacy (0.1494) shifted the effect of metacognitive awareness toward deep learning, highlighting their crucial role in this process. R = 0.8788 indicates that the model accounts for 87.88% of the variance in the dependent variable. This is a high explanatory value, indicating that the factors included in the model (metacognitive awareness, positive academic emotions, and academic self-efficacy) demonstrate a significant role in determining the dependent variable (deep learning). p-value = 0.000: The p-value is less than 0.05, indicating that the overall model is statistically significant. Therefore, we draw the conclusion that these factors strongly collaborate to enhance deep learning, which subsequently impacts academic performance. These findings also support the control value theory, which suggests that positive academic emotions enhance motivation and self-regulation in learning (Pekrun et al., 2002, 2007), as it shows that students who experience positive emotions while learning are more likely to engage in deep learning activities. Pekrun and Stephens (2012) discuss how positive emotions can enhance attention, learning strategies, and persistence, which are critical for deep learning. Pekrun (2006) noted that positive emotions such as joy, pride, and interest are associated with increased student motivation and persistence in the face of academic challenges, leading to the adoption of deep learning strategies. As well, according to the control value theory, as proposed by Pekrun et al. (2002, 2007), it has been confirmed that academic emotions are found to significantly influence deep learning. Furthermore, D'Mello & Craig (2009) suggest that positive emotions help students overcome challenges in complex learning tasks and improve learning outcomes, as they support cognitive processes such as problem solving and creativity, which are essential for deep learning. In addition, Yu et al. (2020) found that the presence of positive academic emotions significantly enhances the quality of deep learning, acting as a mediator between external factors (such as teacher support and peer interactions) and learning outcomes. Furthermore, positive emotions can contribute to building a supportive learning environment that stimulates innovation and active participation in academic activities (Usher & Pajares, 2008).

Bandura's social cognitive theory suggests that individuals with high self-efficacy are more likely to set ambitious objectives, invest time, and persist amidst adversity (Bandura, 1997). Also, the study by Zhen (2017) suggests that academic self-efficacy can predict learning engagement through academic emotions. Academic self-efficacy

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enables students to use deep learning strategies more effectively. They tend to analyze and understand academic concepts in depth rather than just memorizing them superficially, which leads to improved long-term academic performance (Biggs, 1987). According to Pajares (1996), higher self-efficacy is associated with greater use of more complex cognitive strategies, such as elaboration, organization, and self-regulation. These strategies are essential for deep learning, which involves more than just superficial memorization. As well, According to Zimmerman & Schunk (2011), students with high levels of self-efficacy demonstrate higher motivation to adopt effective learning strategies, including deep learning strategies, which enhances their academic performance. Honeck and Broadbent (2016) found that academic self-efficacy was a strong predictor of academic performance and deep learning behaviors across a variety of educational contexts. Robbins et al. (2004) showed that self-efficacy influences students' persistence and success in academic tasks. Additionally, Yokoyama (2019) found that those with higher academic self-efficacy were more likely to engage in deep learning strategies and perform better academically.

Based on the previous discussion, it is clear that the relationship between positive academic emotions, academic self-efficacy, metacognition, and deep learning represents a complex interaction of psychological and cognitive factors that influence academic performance and engagement with the learning environment. Studies show that positive academic emotions, such as motivation and achievement, have a beneficial effect on academic self-efficacy (Schunk, 1991). In turn, academic self-efficacy enhances motivation to learn and increases one's ability to use metacognitive strategies like planning and organizing (Zimmerman, 2000). These factors contribute to deep learning, which involves processing information at a high level of understanding and retention, thereby improving academic performance (Biggs, 2003). Additionally, research indicates that metacognitive awareness acts as a bridge between academic emotions and the capacity to engage with educational materials in a more profound and effective manner (Flavell, 1979). Therefore, the relationship between these variables is dynamic and contributes to improving educational outcomes.

Conclusion

The current results highlight the significant role demonstrated by positive academic emotions, academic self-efficacy, and metacognitive awareness in enhancing deep learning among university students. The findings revealed positive relationships between

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these variables and deep learning, emphasizing their importance in improving students' academic performance. Furthermore, the research found no statistically significant differences between male and female students in these variables, indicating that both genders benefit equally from these academic factors.

Additionally, the results showed that positive academic emotions and academic self-efficacy act as mediator variables in the relationship between metacognitive awareness and deep learning, suggesting that these variables contribute to strengthening the impact of metacognitive awareness on learning. Based on these results, educational institutions should foster learning environments that support the development of students' cognitive and emotional skills, as these factors significantly contribute to enhancing their academic outcomes and overall educational experiences.

Recommendation

1. Develop educational programs that aim to improve metacognitive awareness as it affects learning and academic performance.
2. Universities should design training programs that focus on developing metacognitive awareness and enhancing positive academic emotions, as these can help improve outcomes in psychological and educational domains.
3. Encourage students to practice emotion management techniques.
4. Enhance the academic self-efficacy of university students through the provision of training programs.
5. Conduct future studies to explore how positive academic emotions and academic self-efficacy interact with other educational variables.

Limitations

While this research provides valuable insights into the relationship between metacognitive awareness, positive academic emotions, academic self-efficacy, and deep learning, several limitations should be considered:

1. Cross-sectional Design: The research utilized a cross-sectional design, which limits the ability to draw causal conclusions. Longitudinal studies would be beneficial to better understand the long-term effects and causal relationships between the variables.
2. Sample Size and Generalizability: The sample consisted of 430 students from Kafrelsheikh University, Egypt, which may limit the generalizability of the

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findings to other populations or universities. Future research could explore broader and more diverse samples to improve external validity.

3. Self-reported Data: The data in this research were collected through self-report questionnaires, which may introduce response biases, such as social desirability or inaccurate self-assessment. Future studies could use a combination of self-reports and objective measures to enhance the reliability of the findings.
4. Limited Variables: While the research focused on metacognitive awareness, positive academic emotions, and academic self-efficacy, other factors that could influence deep learning, such as instructional methods or learning environments, were not considered. Expanding the scope of variables in future research could provide a more comprehensive understanding of the factors affecting deep learning.
5. Cultural Context: The research was conducted in Egypt, and cultural factors may exhibit a role in shaping students' academic emotions and self-efficacy. The findings may not fully apply to students in different cultural contexts, so future research could explore these relationships in diverse cultural settings.

Despite these limitations, research offers a valuable contribution to the understanding of the psychological and educational factors that influence deep learning.

Competing interests: The author declares no conflicts of interest.

Funding: No financial support was provided for this research.

Authers's contribution: The author is fully responsible for the conceptualization, design, data collection, analysis, and writing of this manuscript.

Acknowledgements: I sincerely thank the participants who willingly took part in this research and deeply appreciate the time and effort they dedicated to it.

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