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Research article

Metacognitive awareness and academic motivation and their impact on academic achievement of Ajman University students

Rasha M. Abdelrahman [a,b,*]

[a] Psychology Department Ajman University, United Arab Emirates
[b] Researcher at the National Center for Examination and Educational Evaluation (NCEEE), Egypt

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ABSTRACT

Metacognition is the ability of learners to take necessary steps to plan suitable strategies for solving the problems they face, to evaluate consequences and outcomes and to modify the approach as needed, based on the use of their prior knowledge. Metacognition helps learners to successfully achieve a personal goal by choosing the right cognitive tool for this purpose. The study, therefore, aims to explain the relationship and impact of metacognitive awareness and academic motivation on student's academic achievement. This descriptive and correlational study design has included 200 students (60 males) studying sociology in the College of Mass Communication and Humanities at Ajman University, UAE. Academic intrinsic motivations scale and the metacognitive awareness inventory were used as instruments. PLS-SEM was used to examine the relationship between metacognitive awareness and academic motivation, and their impact on academic achievement. Females obtained significantly higher levels than males on the two scales of metacognitive awareness, as shown in metacognitive knowledge. Females reported a higher-level academic extrinsic motivation than males. There is a highly significant correlation between the students' academic achievement and academic motivation; academic achievement and academic intrinsic motivation; academic achievement and academic extrinsic motivation. Metacognitive awareness is a major contributor to success in learning and represents an excellent tool for the measurement of academic performance.

1. Introduction

The quality of education has been positively changed by the rapid development of science (Darling-Hammond et al., 2019). This condition (quality of education) further paved the way to transition from teacher-centered education to student-centered education, completing changing the conventional understanding of education (Kasim and Aini, 2012). Furthermore, the crucial components of student-centered education are among the study procedures, where students use their metacognitive awareness, regulating their own study procedures, and possessing motivation. Metacognitive awareness, metacognitive experiences, metacognitive knowledge, metacognitive beliefs, metacognitive skills, high-level skills, and upper memory are some terms associated with metacognition (Veenman et al., 2006; Yeşilyurt, 2013). The objective of education in the 21st century is not only to provide students with a huge amount of knowledge and information but also to prepare students to become effective and independent learners, who have self-regulatory skills and can achieve academic success as long with life success. Wolters (2003) identified the self-regulated learners as "the persons who have the cognitive, metacognitive abilities as well as motivational beliefs required to understand, monitor, and direct their own learning".

Boekaerts and Corno (2005) have argued that students must be actively engaged in the learning process. Students should be able to plan, monitor, regulate, and control their cognitive procedures with respect to their attitudes and behaviors. Therefore, students need to possess high metacognition skills to engage actively in learning and achieve success. Achieving excellence in academic performance is founded on the student's academic intrinsic motivation, which plays a vital role in the learning process and human's life activities. Learners are not only information recipients from psychologists' viewpoint, but they must be active participants in the process of learning, which requires full engagement and deep involvement of students. Modern statistical investigations proved that optimum learning outcomes are achieved when learners possess the intrinsic motivation and true interest in the subject they learn (Cerasoli et al., 2014; DePasque and Tricomi, 2015; Ryan and Deci, 2000). Learners equipped with intrinsic motivation can face academic

* Corresponding author.
E-mail address: r.abdelrahman@ajman.ac.ae.

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challenges and difficulties with the appropriate flexibility and adaptability.

College-aged students can take advantage of using strategies under metacognition strategies. Moreover, metacognitive skills can be understood by students for enhancing their learning (Fisher et al., 2015; Barenberg and Dutke, 2019). Pintrich claims that students will more likely to use different types of strategies for learning, problem-solving, and thinking. Furthermore, Pintrich (2002) argues that there is a need to teach metacognitive knowledge comprehensively. Two recent studies have presented particular strategies for enhancing metacognition (McGuire, 2015; Medina et al., 2017). The relationship between the metacognitive level of students with their demographic attributes including academic achievement and grade point average (GPA) is also examined (Özsoy and Ataman, 2017; Mokhtari et al., 2018). Higher cognition knowledge was observed among undergraduate students (Erenler and Cetin, 2019), whereas Medina et al. (2017) have found higher knowledge of cognition among graduate students as compared to undergraduates.

The commitment of the teachers is considered as the principal indicator to endorse failure or success, in the education system. Due to minimal commitment of the teachers, students tend to lose the level of self-efficacy. In this way, students switch the deeper strategic approach to learning and move in the direction of surface learning approach, in the first year of education (Güvendir, 2016). Most of the teachers do not assist or develop the motivation of the students appropriately, which reduces the motivation of the students. Therefore, behavior of the teachers is important to increase the motivation of the students. Specifically, behavior of autonomy tends to increase the motivation within the students while the control behavior decreases it (Hallinger et al., 2018). Moreover, the learning atmosphere and environment are important for the motivation of the education rather than teachers' behavior and individual students. Similarly, the practices of the institutes and perception of the class mates are likewise important (Hanus and Fox, 2015). Furthermore, it is observed that the major downside of the extrinsic motivation is its tentative nature. The extrinsic motivation disappears when the reward or prize is achieved (Hofferber et al., 2016).

The study, therefore, aims to explain the relationship and impact of metacognitive awareness and academic motivation on student's academic achievement. Following research questions are constructed to achieve the aim comprehensively;

1. Is there any significant difference in (academic achievement, metacognitive awareness, and academic motivation) related to Gender differences?
2. Is there a relationship between metacognitive awareness (metacognitive knowledge and metacognitive regulation) and academic achievement?
3. Is there a relationship between academic motivation (intrinsic motivation-extrinsic motivation) and academic achievement?
4. Is there a relationship between metacognitive awareness (metacognitive knowledge and metacognitive regulation) and academic motivation (intrinsic motivation and extrinsic motivation)?

The importance of this study is to provide the insights about the factors which impacts upon the academic achievement of the students in Ajman University. Firstly, the exploration of the concepts related to the metacognition will help the literature in the settings of educational institutes. Secondly, this study adds value to the literature on motivation as the concept of intrinsic and extrinsic motivation among the students is also the focus of this study. Thirdly, this study develops the concept about the academic achievement of the students, in the context of Ajman University. Hence, this research work should add value to the lives of university students to increase the level of academic achievement among the students of Ajman. Moreover, the outcomes, implication, and suggestions of the study should provide an advantage to the administrators of the university as well, to develop the strategy to improve the teacher's affective support among the teachers of Ajman.

2. Theory

2.1. Metacognition awareness and academic motivation

Several studies have indicated a strong relationship between metacognition skills and intrinsic motivation. These studies linked the success of academic involvement of students to their intrinsic motivation and application of sound and fruitful metacognition strategies, in comparison to their fellow students who have no intrinsic motives (DePasque and Tricomi, 2015; Efklides, 2011). Pintrich and DeGroot (1990) believed that metacognition strategies are essential for success in the learning process; however, academic success is not only dependent on these strategies. The type of metacognition strategies and intrinsic motivation play a major role in the students' academic achievement. Furthermore, students with intrinsic motivation are capable of engagement in metacognition strategies for continuous planning, assessment, and evaluation of their progress in academic performance. The positive correlation between motivation and self-appeared to be one of the main pillars of the self-learning process.

According to Ibrahim et al. (2017), the metacognitive strategy is further considered as one of the basic pillars of academic performance and learning excellence. This shows that metacognition assists a learner in appropriately planning, regulating, organizing, and calibrating his or her cognitive procedures and intellectual capabilities. Negovan et al. (2015) have classified metacognition into metacognitive regulation and metacognitive knowledge. Metacognition regulation indicates the actual activities of a learner to enhance memory and learning such as evaluating monitoring and planning. Metacognitive knowledge refers to a learner who identifies his or her own cognitive knowledge based on conditional knowledge and declarative process (Young and Fry, 2008). These strategies are strongly associated with intrinsic motivations, learning advancement, the adoption of adequate strategies based on the task demands, learning outcomes and reading comprehension, and developing an association between previous and new knowledge.

Metacognition is also categorized as higher-order thinking that engages active control over the cognitive procedures involved in the learning process (Barnes and Stephens, 2019). It is also an essential strategy associated with academic achievement and problem-solving abilities. The development of modeling strategies of students is influenced by metacognition when the effects of self-checking, cognitive strategy, awareness, and planning are considered (Vettori et al., 2018). Students who carry-out better self-check reflect higher development in their modeling abilities as compared to those who are less skillful in self-checking. The development in modeling competencies is mediated by planning skills and cognitive strategy. Students with increased skills carried out modeling better after some experience is achieved. On the contrary, the metacognitive and cognitive activities did not occur sequentially in the procedure through which planning activities are most common, while prediction activities are least common (Hidiroğlu and Bukova Güzel, 2016).

2.2. Academic achievement and metacognitive awareness

Some researchers have reported the influence of metacognitive on academic achievement (Bogdanović et al., 2017; Abdellah, 2015), while others view that explicit metacognitive training can enhance students' metacognition skills and believed that metacognition skills promote and correlate significantly with students' academic performance or achievement (Nbina, 2012; Nzewi and Ibeneme, 2011). Several studies have illustrated that students demonstrated high metacognitive awareness skills by reaching a high level of academic achievement, while students with poor metacognitive awareness skills have illustrated the lower level of academic success (Narang and Saini, 2013; Kocak and Bayaci, 2011).

Therefore, metacognition can be used as a strong predictor of academic level. Several studies have shown the positive impact of training on students with poor metacognitive strategies. Those students can benefit from training to improve their metacognitive and academic performance (Nbina, 2012; Nzewi and Ibeneme, 2011; Rezvan et al., 2006). Other studies have shown a negative or no relationship between metacognitive awareness and academic achievement (Cubukcu, 2009; Sperling et al., 2004).

Many studies illustrated the positive relationship between intrinsic motivation and academic achievement. These studies pointed out that, intrinsic motivation plays an essential role in the student's performance and academic achievement. These studies have also found that students with high academic intrinsic motivation had achieved academic success easier than others who have the lower academic intrinsic motivation (Lepper et al., 2005; Deci and Ryan, 1998; Gottfried, 1985, 1990).

Metacognition positively influences problem-solving skills, which comes from studies in other domains (García et al., 2016). Differentiations are observed between inaccurate and accurate students in the metacognitive process during solving math problems, even though students spent little time representing or organizing information (García et al., 2016). Accurate students pay substantial attention to time planning so they do not evaluate their results and progress. Astonishingly, metacognitive training is majorly beneficial for low achievers as it enables them to advance and solve a similar number of tasks (Karaali, 2015). Students usually get help with self-reflective and metacognitive activities emphasized learning comprehensively and motivated and engaged within the study (Karaali, 2015). On the contrary, the contribution of metacognition in the problem varies for students with and without learning complexities. Metacognition does not work well with learning complexities even when associated with the mathematics problem (Al Shabibi and Alkharusi, 2018). For instance, students with learning complexities show a much lower mean score to identify the sequence of steps for solving the activities as compared to those regardless of learning complexities (Al Shabibi and Alkharusi, 2018).

2.3. Metacognition awareness, academic achievement, and gender differences

Previous studies on gender differences in self-regulation and metacognition have been generally inconsistent. Jenkins (2018) has reported that male students use more superficial learning tactics as compared to female students, whereas Nunaki et al. (2019) have indicated that female students utilize self-monitoring goal setting and planning as compared to male students. Jenkins (2018) has studied gender differences to evaluate academic metacognition and motivation. The study has used strategies that are used by students to actively change their learning capabilities. Male students show higher scoring in their use of rote-learning strategies as compared to female students and indicate no gender differences in any of the other superficial learning strategies.

Alghamdi et al. (2020) have examined gender differences in self-regulated learning by identifying metacognition of students to several other self-regulated learning strategies, which include time management, elaboration and effort, rehearsal, and organization. In general, female students report higher scores as compared to male students in different strategies of self-regulated learning, which include metacognition. Arum (2017) has claimed that awareness must be owned by students at every step of his thinking for improving metacognition skills. The student will be aware of his thinking procedure and assess him or herself to the outcomes of his thought process so that it will reduce the mistake of a student to solve the problem. Purnomo and Nusantara (2017) have indicated that the concept of metacognition is an estimation of an individual's thinking, including metacognitive skills and metacognitive knowledge. In addition, Trisna et al. (2018) have indicated that metacognition allows a student to be aware of the thinking process by regulating and rechecking the thinking process. Sometimes, there is a concept error on the information acquired by the student in the learning process. The information provided by the lecturer is not like the information that is thought by students. In this instance, metacognition shows the thinking stage of students for reflecting on the way of thinking and the outcomes of thinking. There is an important role of metacognition in the procedure of academic learning, specifically in understanding the concept. A conceptual framework has been constructed to present the relationship between variables discussed aforementioned (Figure 1).

3. Material and methods

Ethical approval

IRB # D-H-F-2020-May-28, Ajman University, United Arab Emirates.

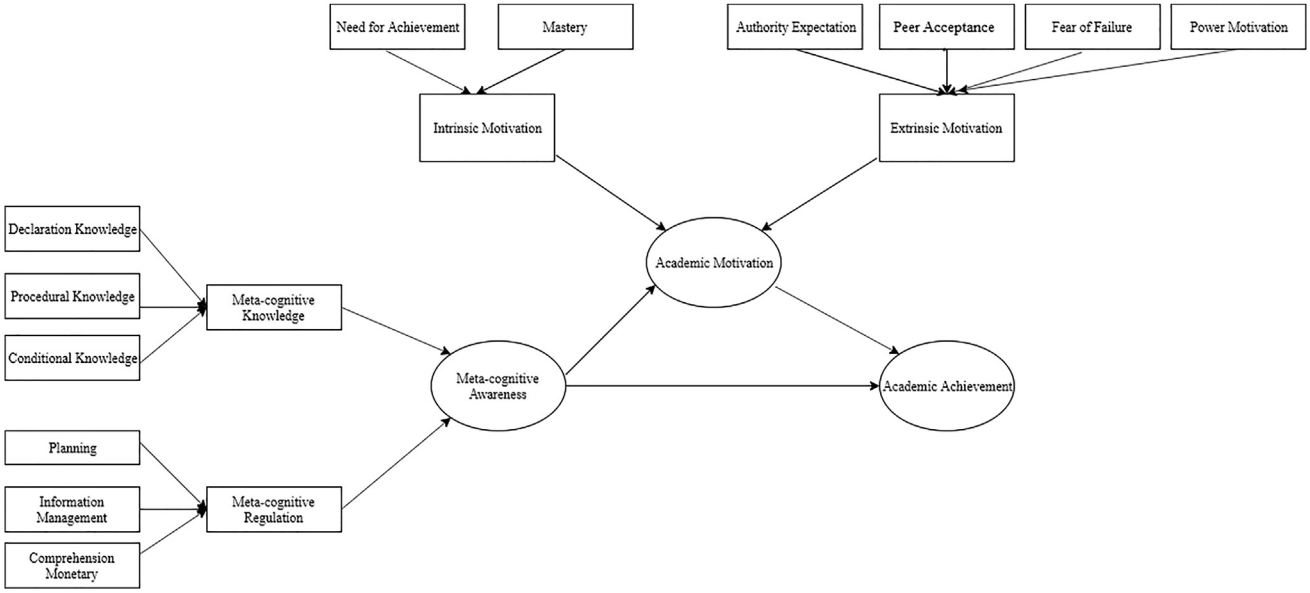

Figure 1. Conceptual framework.

3.1. Study design

The descriptive and correlational study design has been employed to determine the impact of metacognitive awareness, intrinsic motivation, and extrinsic motivation on the student's academic achievement.

3.2. Participants

A purposive sample consisted of 200 students (140 females and 60 males) studying sociology in the College of Mass Communication and Humanities at Ajman University, UAE during the academic year 2015–2016. The range of the age varies between 20 and 29 years, with an average age of 23 years. The survey was conducted between December 2016 and February 2017, covering students studying courses of social psychology and social problems (second, third and fourth years), who responded to the two questionnaires on a voluntary basis. Administration time ranged from 25-40 min. Student's names were not included to ensure confidentiality.

3.3. Instruments

3.3.1. Academic motivation scale

Regina (1998) has proposed this scale based on the results reached in several previous studies. This scale has been translated into Arabic by the researcher to be used in this study and facilitate the students. The scale consists of 56 items graded on a five-point rating scale. It covers six factors: four extrinsic motivation factors including authority expectations, peer acceptance, fear of failure and power motivation, and two intrinsic motivation factors including mastery goals and need for achievement. External motivation drives the intrinsic motivation as compared to undermine it and it has positive influence specifically when students possess low levels of intrinsic motivation in spite of the negative notions on extrinsic motivation.

The scale validation was made by sending the scale to six different arbitrators, who were educational experts specializing in psychology, language, and measurement. Based on the experts' suggestion, eight items were deleted from the original scale. Therefore, the final form of the scale consisted of 48 items, eight items for every factor. Consistency validity was tested by the correlation coefficients ranging from 0.31 to 0.68, which were all statistically significant. The scale reliability was found by using Cronbach alpha, which was: mastery goals (0.73), need for achievement (0.77), authority expectations (0.75), peer acceptance (0.71), fear of failure (0.73) and power motivation (0.72).

3.3.2. The metacognitive awareness inventory (MAI)

Schraw and Dennison (1994) have designed the MAI to determine the adults' metacognition. The MAI consists of 52 statements rated based on the Likert five-point scale, covering two factors of metacognitive: metacognitive knowledge (17 items) and metacognitive regulation (35 items).

3.3.3. The MAI validation and reliability

The MAI validation and reliability were tested and verified by educational experts in Psychology, language, and measurement. A few modifications were made in response to their suggestions. The reliability of the inventory has been found by using Cronbach alpha: The MAI knowledge was (0.78), MAI regulation was (0.8) and MAI total was (0.79).

3.4. Data analysis

The study has used PLS-SEM to analyze the data collected. Structural equation modeling was applied to identify the relationship between metacognitive awareness and academic motivation. Furthermore, this technique was used to examine the impact of metacognitive awareness and academic motivation on academic achievement.

4. Results and discussion

4.1. Gender differences, metacognition, and academic achievement

Table 1 presents the mean and standard deviation of each of the academic achievement as reflected on the students' cumulative grade point average (CGPA), metacognitive awareness (metacognitive knowledge and metacognitive regulation) and academic motivation (academic intrinsic motivation and extrinsic motivation), based on the data of 200 students. The significance levels of t-tests comparing males and females are also provided.

Results showed no significant differences between female and male students in academic achievements, where the academic achievement for female students was 77.1, while the academic achievement for male students was 80.1. Females obtained significantly higher levels than males on the two scales of metacognitive awareness, as shown in metacognitive knowledge ($Female_m = 79.1$, $Male_m = 65.5$, $t_{(98)} = 3.1708$, $p > 0.01$). Also, in metacognitive regulation, females reported a higher score than males ($Female_M = 121.3$, $Male_M = 111.2$, $t_{(98)} = 3.7052$, $p > 0.01$). These results are supported by Roeschl-Heils et al. (2003) and contradicted by Misu and Masi (2017) who attributed the differences in metacognitive awareness to gender differences. The activities related to metacognition allow students to develop an awareness of themselves, care about, and also give instructions (Smith et al., 2017). In a classroom, teachers must be aware of the individual differences in the metacognitive awareness level and must provide the teaching by accounting their individual differences so that their metacognitive ability might improve well in the classrooms (Jaleel, 2016). The importance of metacognitive knowledge is that it encompasses information regarding tactics that work effectively for most students and information of strategies that work for diverse learners. Therefore, at the beginning of the semester, students who receive metacognitive training learn early in the semester how to study for a specific subject, which may include activity or tasks strategies.

Table 1. Gender differences in academic achievement, metacognitive skills and academic motivation.

	Females (N = 140)		Males (N = 60)		T
	Mean	SD	Mean	SD	
Academic Achievement	77.1	15.2	80.1	9.32	0.0553
Metacognitive knowledge	79.1	4.1	65.5	6.8	3.1708**
Metacognitive Regulation	121.3	11.1	111.2	13.7	3.7052**
Academic Intrinsic motivation	94.81	17.87	77.28	13.45	1.506
Academic Extrinsic motivation	156.29	13.60	163.28	15.53	3.6399**

*p > 0.05, **p > 0.01.

Table 2. Reflective Higher-Order Construct (Metacognitive knowledge).

	Estimate	S.D.	T-Stats	Prob.
Metacognitive knowledge → Declaration knowledge	0.72	0.04	16.24	0.00
Metacognitive knowledge → Procedural knowledge	0.88	0.02	39.76	0.00
Metacognitive knowledge → Conditional knowledge	0.87	0.02	44.53	0.00

Table 3. Reflective Higher-Order Construct (Metacognitive regulation).

	Estimate	S.D.	T-Stats	Prob.
Metacognitive regulation → Planning	0.77	0.05	26.42	0.00
Metacognitive regulation → Information management	0.81	0.03	29.67	0.00
Metacognitive regulation → Comprehension Monetary	0.18	0.07	2.79	0.02

There were no significant differences in academic intrinsic motivation between female and male students. This result is consistent with the findings of Cerezo et al. (2004). Interestingly, females also reported a higher academic extrinsic motivation than males ($Female_M = 156.29$, $Male_M = 163.28$, $t_{(98)} = 3.6399$, $p > 0.01$), which differ than the result of Cerezo et al. (2004), who found no difference between males and females in their intrinsic motivation. It should be noted that intrinsic motivation improves innovation, creativity, performance and intellectual ability, resilience and enjoyment, and deep learning process (Fidan and Ozturk, 2015). It has been asserted that academic intrinsic motivation accounted for 19% of the total variance of the study variables. The extent of intrinsic motivation in the academic setting was even better as compared to the extrinsic motivation. However, both intrinsic and extrinsic motivation played a substantial role between academic achievement, metacognitive knowledge, and metacognitive regulation.

With respect to academic intrinsic motivation, no large difference was noticed between male and female students, but females reported a higher-level of academic extrinsic motivation than males. Findings also showed a significant correlation between metacognitive awareness and metacognitive regulation, which is confirmed with the results of Narang and Saini (2013); Kocak and Bayaci (2010); Young and Fry (2008); Coutinho (2007); Nietfeld et al. (2005); and Sperling et al. (2004). These studies confirmed that students with high metacognitive awareness demonstrate perfect academic performance compared to students with poor metacognitive awareness. It was also found that students' learning strategies have more contribution to academic success than their awareness of metacognitive knowledge.

In all stages of the educational process, the implementation of metacognitive strategies will improve the cognitive performance and efforts of all students. Teaching should be rapid, understandable, and focused on all metacognition parameters based on the special and developmental learning children needs (Mastrothanasis et al., 2016). To be precise, a greater amount of variance was explained by metacognition of the recognized regulatory learning style as compared to the other styles, which complement the importance of metacognition in order to achieve autonomy learning behavior and regulatory learning behavior (Rosman et al., 2018).

Tables 2, 3, 4, and 5 present reflective higher-order construct of metacognitive knowledge, metacognition regulation, academic intrinsic motivation, and academic extrinsic motivation. From the findings, it is observed that declarative knowledge (0.72, $p < 0.10$), procedural knowledge (0.88, $p < 0.10$), and conditional knowledge (0.87, $p < 0.10$) are positively and significantly reflected from metacognitive knowledge (Table 2). Similarly, planning (0.77, $p < 0.10$), information management (0.81, $p < 0.10$), and comprehension monetary (0.18, $p < 0.10$) are reflected from metacognition regulation (Table 3). Needs for achievement (0.87, $p < 0.10$) and mastery (0.41, $p < 0.10$) are reflected from intrinsic motivation (Table 4). Authority expectation (0.79, $p < 0.10$), peer acceptance (0.83, $p < 0.10$), fear of failure (0.73, $p < 0.10$), and power motivation (0.39, $p < 0.10$) are significantly and positively reflected from extrinsic motivation (Table 5).

High metacognitive regulation students considered autonomy strategies as more influential and considered to manage their motivation. Autonomous regulatory learning and autonomous style positively affected performance anticipations and performance across the students' achievement (Ibrahim et al., 2017). However, metacognitive knowledge was not an influential indicator of regulatory learning style and; therefore, it reported in school achievement directly. At this specific educational level, it is observed that students perceived the controlling behavior of parents as influential for their objectives to a significant extent.

It has been provided in the above table that metacognitive knowledge (0.13, $p < 0.10$) and metacognitive regulation (0.35, $p < 0.10$) have significant relationship with metacognitive awareness. Metacognitive awareness has a significant and positive relationship with academic motivation (0.29, $p < 0.10$) and academic achievement (0.41, $p < 0.10$). Academic intrinsic motivation (-0.20, $p < 0.10$) and academic extrinsic motivation (0.15, $p < 0.10$) have statistically significant relationship with academic motivation. Furthermore, academic motivation (0.19, $p < 0.10$) has statistically significant and positive impact on academic

Table 4. Reflective Higher-Order Construct (Intrinsic motivation).

	Estimate	S.D.	T-Stats	Prob.
Intrinsic motivation → Needs for achievement	0.87	0.02	37.16	0.00
Intrinsic motivation → Mastery	0.41	0.08	5.08	0.00

Table 5. Reflective higher-order construct (Extrinsic motivation).

	Estimate	S.D.	T-Stats	Prob.
Extrinsic Motivation → Authority expectation	0.79	0.04	24.42	0.00
Extrinsic Motivation → Peer acceptance	0.83	0.02	19.67	0.00
Extrinsic Motivation → Fear of failure	0.73	0.09	3.79	0.02
Extrinsic Motivation → Power motivation	0.39	0.06	23.73	0.03

Table 6. Path analysis.

	Estimate	S.D.	T-Stats	Prob.
Metacognitive knowledge → Metacognitive awareness	0.13	0.07	1.82	0.04
Metacognitive regulation → Metacognitive awareness	0.35	0.05	6.74	0.00
Metacognitive awareness → Academic motivation	0.29	0.04	5.21	0.00
Metacognitive awareness → Academic achievement	0.41	0.03	5.44	0.00
Academic intrinsic motivation → Academic motivation	-0.20	0.07	2.80	0.00
Academic extrinsic motivation → Academic motivation	0.15	0.06	2.38	0.01
Academic motivation → Academic achievement	0.19	0.07	2.56	0.01

achievement. It is essential to develop influential strategies for facilitating the cognitive procedures as learning is a multifaceted process. Furthermore, a learner is represented by his or her accuracy experience, better judgment, significant ways for improving accuracy, and their metacognition and cognitive process (see Table 6).

There is a strong correlation between academic achievement and academic intrinsic motivation (Pintrich, 2002; Ryan and Deci, 2000; Wu, 2003), and a significant correlation between academic achievement and academic extrinsic motivation. Furthermore, findings showed a high correlation between metacognitive knowledge awareness and academic intrinsic motivation, and a high correlation between metacognitive regulation awareness and academic intrinsic motivation, which agree with the studies of (DePasque and Tricomi, 2015; Efklides, 2011; Pintrich and DeGroot, 1990). There is a weak correlation between academic extrinsic motivation and either metacognitive knowledge awareness and metacognitive regulation awareness.

4.2. Practical implications

The study has determined the relationship and impact of metacognitive awareness and academic motivation on student's academic achievement. The findings of the present study showed no significant differences between female and male students in academic achievement. However, there is a significant difference in metacognitive awareness. Female students showed a higher level of metacognitive knowledge and metacognitive regulation. Findings found that intrinsic and extrinsic motivations are essentially independent. However, extrinsic motivation does not suppress intrinsic motivation and both showed little compatibility in male students. In contrast, both motivations are compatible or even collaborative in female students. This result is consistent with the nature of females in Arab culture, which is patriarchal societies, in which men hold primary power and authority. In such a society, the female motivation is strongly influenced by many extrinsic factors including, family and professor expectation, peer acceptance, fear of failure and power motivation, which affect their motivation.

Both intrinsic and extrinsic reasons underlie the students' achievement behavior. In this instance, professors must adopt effective methods of teaching which include; interactive teaching and curiosity-based learning, using interesting materials and enjoyable tasks that promote academic intrinsic and extrinsic motivation. The present study incorporates independent assessments of both intrinsic and extrinsic motivations, based on the reasons why students engage in-class learning and provide a valuable complement to traditional assessment of motivation, such as how much students enjoy certain activities or content domains. To overcome poor academic performance, university professors can enhance students' intrinsic motivation and metacognition skills by helping them to set endurable goals, which facilitate learning acquisition and enhance constructive and meaningful involvement in academic activities.

Students' academic performance and achievement depend on the applied metacognitive strategies with respect to their intrinsic motivation. Therefore, these aspects with respect to students' intrinsic motivation in universities must be developed and promoted. Teaching strategies and techniques adopted by university professors should not be limited to deliver information but must encourage more interaction between professors and students and activate the use of metacognition skills as an effective tool of positive impacts on academic achievement. Supporting and improving students' intrinsic motivation by using different and enjoyable non-academic activities supports students' personalities and motivates them to participate and raise their self-concept. These improvements would raise their intrinsic motivations and give them the energy to face complex and multidimensional learning challenges and reach achievement.

Lastly, for better understanding of the effects of metacognitive awareness, academic intrinsic motivation, and academic extrinsic motivation on the university academic achievement, future studies should focus on their effect on the outcomes of the learning process, such as students' qualifications, achieved knowledge and skills, and development of social responsibility. Academic motivation is an important factor in college success. The motivations behind academic constancy vary through many intrinsic and extrinsic factors. Many university students lack the motivation needed to excel in their academic performance and to achieve their goals. Most of the students are studying majors they have not chosen, but because of their parent's desires, which make them lose motivation to learn and achieve.

The traditional teaching methods used by professors are not appropriate with a cognitive revolution that can influence the students' academic motivation. Therefore, professors have a great responsibility to support students to learn and achieve their academic degrees. Also, they must adopt successful methods of teaching to motivate them to learn as much as they can. Professors should use their experiences to design the context and tasks in an attractive way. This study has concluded that metacognitive awareness is a major contributor to success in learning and represents an excellent tool for the measurement of academic performance. This study has found a correlation between metacognitive awareness and intrinsic academic motivation. The findings have provided important implications with regards to the findings of mediation analysis. Firstly, self-extrinsic motivation, and intrinsic motivation are identified as determinants of academic motivation and related with metacognition in students in Ajman University. In addition, it should be realized that the likelihood of motivation and metacognition of students are possible approaches related with student's academic achievement.

4.3. Limitation and future studies

One of the limitations of this study was the sampled participants which belong to one academic program at Ajman University, UAE. Therefore, the findings of this study cannot be generalized to other locations or populations. This limitation, however, shines some light on how different locations and populations may influence the relationships between metacognition, intrinsic and extrinsic motivation and academic achievement. Future studies should adopt other measurement approaches such as the experimental approach. In addition, other sources of self-reported data may include parents, instructors, and peers. This will provide future research with different perspectives and holistically assesses students' learning activities. Future studies may also identify other key features such as causal relationships among the complex constructs that were not evident in the findings of this study. Therefore,

it is strongly recommended that an experimental design or a mixed-method approach shall be used to gain more knowledge on how optimal learning occurs.

Declarations

Author contribution statement

R. M Abdelrahman: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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