The impact of learning strategies on the academic achievement of university students in Saudi Arabia

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Abstract

Purpose – This study aimed to investigate the learning strategies adopted by Saudi university students and explore the differences in the use of learning strategies due to gender and academic achievement.

Design/methodology/approach – The study utilized a cross-sectional descriptive analytic approach and adopted the brief "ACRA-C" learning strategies scale. The study sample consisted of 365 students enrolled at a Saudi university selected using the random clustering technique.

Findings – The study revealed that microstrategies and study habits are the most preferred strategies by Saudi university students. Statistically significant differences in the use of learning strategies were found between male and female students in favor of the female students. The study also found that learning strategies are a significant predictor of students' academic achievement.

Research limitations/implications – The study was limited to one college in one Saudi university. Future studies should use larger samples from different colleges and universities in Saudi Arabia and incorporate a variety of measures of academic achievement, such as students' grades in specific courses rather than the overall grade average.

Originality/value – While there are a number of studies that investigated the use of learning strategies by students, there is a lack of such research in the higher education context of Saudi Arabia. Hence, the current study contributes to closing this gap in the literature by looking at the use of learning strategies by university students in Saudi Arabia and the relationship between strategy use, gender and academic achievement.

Keywords Learning strategies, Saudi higher education, Academic achievement

Paper type Research paper

Introduction

Traditional rote-learning memorization has been the dominant learning strategy by students in educational institutions in the Kingdom of Saudi Arabia (KSA). This emphasis on rote memorization is responsible to a great degree for Saudi students being passive recipients of information in the classroom (Al-Seghayer, 2021; Pordanjani & Guntur, 2019; Kim & Alghamdi, 2019).

Recently, in KSA, there has been substantial interest in raising students' awareness of learning strategies in an effort to increase the quality of learning in educational institutions and satisfy preestablished global performance standards, such as the KSA national accreditation requirements established by the National Commission of Academic Accreditation and Assessment (NCAAA). The accreditation certificate is a significant

indicator of educational quality, and it assesses four aspects of the educational system: curriculum, instructors, teaching strategies and students. In terms of the student indicators, performance is the first measurement of learning quality (Vermunt & Vermunt, 2017), while learning is measured through attainment or accumulative achievements, such as exam results. Ali, Medhekar and Rattanawiboonsom (2017) argued that student achievement in a higher education institution can be improved through several critical factors namely, the quality of the staff, the inclusion of information technology and appropriate learning strategies. Thus, a number of local studies have investigated the role and impact of instructors in promoting student achievement and learning. For example, Bashir, Lockheed, Ninan and Tan (2018) asserted that pedagogical practice and instructor knowledge play a critical role in increasing student learning. Similarly, Buchori, Setyosari, Dasna, Degeng and Sa'dijah (2017) established that instructors' strategies and techniques determine students' roles, activities and achievement in the learning process and likewise foster students' responsibility for their learning. Other studies investigated learning strategies which can help students acquire information and take an active role in the learning process (e.g. McMullen, 2009; Shehzad, Razzaq, Dahri, & Shah, 2019).

Research on learning strategies has shown that students may adopt more than one learning strategy since the different academic tasks and their nature require different processing strategies, which range from simple to more complex strategies. Some studies established that the learning strategies could be a good predictor of academic achievement (e.g. Pennequin, Sorel, Nanty, & Fontaine, 2010; Muelas & Navarro, 2015; Pinto, Bigozzi, Vettori, & Vezzani, 2018; Tan, 2019), while others found that the relationship between learning strategies and academic achievement was negative such as in Vettori, Vezzani, Bigozzi and Pinto (2020). Furthermore, a few studies did not find any association between learning strategies and student performance (see Tariq *et al.*, 2016). In their study, Chiu, Chow and Mcbride-Chang (2007) found that different contextual factors such as the economic and cultural background of the students may substantially affect the association between learning strategies and academic achievement.

Despite the extended research conducted investigating the relationship between the use of learning strategies and student academic performance, there is lack of evidence on the use of learning strategies by Saudi students. Therefore, this study explores the learning strategies adopted by Saudi university students in the education process in light of the country's efforts to raise the quality of teaching and learning in its educational institutions.

Literature review
Learning strategies are defined as a set of approaches that learners use to acquire information and knowledge, such as taking notes, organizing information, summarizing and coding (Muelas & Navarro, 2015). There is a difference between learning style and learning strategies. Learning style is used to describe the information processing routines associated with students' personalities, whereas learning strategies refer to students' learning approaches in specific learning activities and learning situations (Curry, 1990; Li, Medwell, Wray, Wang, & Xiaojing, 2016).

Effective learning strategies refer to techniques and approaches learners use to achieve the acquisition, storage, retention, recall and adoption of knowledge. Cognitive learning theories consider learners as primary participants in the education process in which their role goes beyond passively acquiring information to being active participants. Consequently, students not only receive information and knowledge but also perform mental activities to process and adopt information effectively (Shi, 2017). Accordingly, learners have a wide range of sources and are free to select their learning strategies, direct their learning process

and control their tendencies and emotions to serve their learning objectives (Díaz, Zapata, Diaz, Arroyo, & Fuentes, 2019).

Academics claim that students are not well prepared to meet higher education requirements, and they face huge challenges in being self-regulated students (Rosário *et al.*, 2015). The study by Tomar and Jindal (2014) described seven effective learning strategies as follows:

(1) Determine the information that is most significant by extracting keywords, ideas and models.

(2) Make notes that are more frequently used within classroom time, which help students to recall the information mentioned by the lecturer.

(3) Retrieve relevant information associated with the constructivist learning approach, which relies on making associations among prior information and newly acquired information.

(4) Organize the content and material using the specific plan and obvious objectives previously formulated by learners.

(5) Elaborate on the content of the material and course sources, extract conclusions and extrapolate the information.

(6) Summarize the information into general ideas and concepts and determine the more important relationships and conceptual definitions.

(7) Monitor their memorization and comprehension periodically to ensure their understanding and their knowledge.

Similarly, the study of Montero and Arizmendiarrieta (2017) explicated 10 learning strategies consisting of elaboration, time and effort, perseverance, organization, classmates' support, metacognition, self-questioning, the study environment, repetition and instructors' help. Furthermore, Juste and López (2010) identified seven learning strategies that include the planning and reinforcement of self-esteem, classification, problem-solving, repetition, cooperation, deduction and inference, and prediction and assessment. Apart from identifying specific strategies, Muelas and Navarro (2015) classified strategies into four main categories (i.e. information acquisition strategies, information coding strategies, information retrieval strategies and processing support strategies), while Vega-Hernández, Patino-Alonso, Cabello, Galindo-Villardón and Fernández-Berrocal (2017) identified three main categories of learning strategies: cognitive and learning control strategies, learning support strategies and study habits.

Further studies have attempted the classification of learning strategies into micro and macrostrategies (Jiménez, García, López-Cepero, & Saavedr, 2017). Planning and self-regulation are the main pillars of macrostrategies while summarizing and highlighting information are related to tasks and situations that are present in microstrategies. According to Nikou and Economides (2019), homework is one of the main examples of a microlearning strategy, and this explains why microstrategies are often used among students. Microlearning delivers learning through small and short units within short, focused activities. In microlearning, students summarize and highlight content to obtain smaller units, such as definitions, formulas and brief paragraphs. Conversely, the concept of macrostrategies is seen as a set of approaches encompassing monitoring, revising, checking and self-assessment. Macrostrategies are more general and developmental, and they cannot be directly defined.

Another classification associated with the use of learning strategies was proposed by Rosário *et al.* (2015) who stated that students have to be self-regulated to control their learning and effectively implement learning strategies. Therefore, students must acquire three types

of knowledge: declarative, procedural and conditional knowledge. Declarative knowledge includes information about various learning strategies. Procedural knowledge includes knowing the appropriate way to apply the different learning strategies. Finally, conditional knowledge identifies the proper context to implement a specific learning strategy.

In addition to identifying and classifying the different learning strategies that students employ, a number of studies were carried out to examine the different preferences among students when adopting learning strategies. Vega-Hernández et al. (2017) explored the differences in learning strategy utilization among students according to gender and age and found that male students preferred learning support strategies and study habits, while female students used cognitive and learning control strategies more frequently. Díaz et al. (2019) also revealed that studying in a group, learning through graphic expression and focusing on information synthesis are most commonly used by university students. In a recent study, Tan (2019) found that students rarely used surface or strategic learning strategies, while they frequently used deep learning strategies, but at a moderate level, thus exhibiting less interest in reading and solving word and numeric problems in math.

The subject area has also been found to have an effect on the use of learning strategies. For example, Muelas and Navarro (2015) investigated student strategy use in three main subject areas: language, math and social sciences. In the language subject, the information coding and information recovery strategies were found to be the most significantly related to higher achievement. The coding strategy was the only strategy that had a significant correlation with higher achievement in math and social science subjects. Muelas and Navarro (2015) argued that teaching learning strategies can be a remedial solution for low student achievement, and they illustrated how to exploit brain competencies through learning strategies to improve academic achievement.

Apart from academic achievement, studies have also looked at other psychological aspects in the context of effective use of learning strategies. For example, Tan (2019) concluded that the use of learning strategies has a moderating effect on the relationship between self-concept and problem-solving skills in students studying mathematics. Similarly, Montero and Arizmendiarrieta (2017) found that remedial interventions in enhancing the use of learning strategies improved student motivation and learning beliefs. Vega-Hernández et al. (2017) also found the use of learning strategies had a positive relationship with perceived emotional intelligence (repair, attention and clarity).

While there are a number of studies that investigated different aspects of the use of learning strategies by university students, there is a lack of such research in the higher education context of Saudi Arabia. Hence, the current study contributes to closing this gap in the literature by looking at the use of learning strategies by Saudi university students and the relationship between strategy use and academic achievement. The research question that guided the present study was: "What is the impact of learning strategies on the academic achievement of Saudi university students?" The study further explored whether gender makes any difference in the selection and use of learning strategies.

Methodology
The study adopted a cross-sectional descriptive analytic approach and applied a quantitative method using a scale as a data collection tool. The study intended to examine the adopted learning strategies among students regardless of whether they had a good basic knowledge of learning strategies (i.e. used the learning strategies intentionally or not).

Participants
The study population comprised all students enrolled in the College of Education at a university in Saudi Arabia. First, the participants of the study were selected using the

clustering technique. Four degree programs were identified: Diploma, Bachelor, Master and Doctorate. Then, the participants from each degree program were selected using the stratified random technique to include a variety of the population in the sample. The study selected students enrolled in the College of Education to avoid differences in the use of learning strategies due to the subject area. Thus, the target population consisted of 2,870 female students and 999 male students according to the admission and registration department of the university. The study sample consisted of 365 students, which means that the results can be generalized to all students enrolling in the College of Education at the target university (see Krejcie & Morgan, 1970). Table 1 shows that the gender distribution of the sample was balanced (49% female and 51% male). The majority of the participants were enrolled in a bachelor's degree program (81.9%). Participants' grade point average (GPA) varied: 44.9% had very good grades, 34.5% had good grades, 18.9% had excellent grades and 1.6% had passing grades. Participants were mainly in their final year (54.8%) and third year (25%).

Data collection instrument
The study adopted the higher education version of the brief "ACRA-C" learning strategies scale by Jiménez *et al.* (2017) (see Appendix 1). The scale assesses the strategies used by students during the learning process in the university. The original ACRA-C scale was adapted to the study context and the scale used in the study comprised 22 items (17 items for learning strategies and 5 items for learning habits). Participants were asked to evaluate each item using a four-point Likert scale according to the knowledge process (from 1 = Never use to 4 = Always use). The knowledge process is anchored mainly on the following strategies: cognitive and learning control strategies, learning support strategies and study habits. The 22 items were further organized into four main categories: microstrategies (Items 1–5), keys of memory and metacognition (Items 6–10), emotional-social support (Items 11–17) and study habits (Items 18–22). Microstrategies are strategies that control leaning (e.g. "I make summaries after underlining"). Keys of memory and metacognition referred to the ability to self-regulate the learning process (e.g. "It helps me if I recall events or anecdotes to remember"). Emotional-social support referred to the personal motivational aspects and learning support from surroundings (e.g. "I study hard to feel proud of myself"). Study habits

Demographic characteristics		Frequency	Percentage
Gender	Female	179	49%
	Male	186	51%
	Total	365	100%
Degree	Diploma	0	0%
	Bachelor	299	81.9%
	Master	63	17.3%
	Doctorate	3	0.8%
	Total	365	100%
Educational year	First year	46	12.6%
	Second year	26	7.1%
	Third year	93	25.5%
	Final year	200	54.8%
	Total	365	100%
Grade point average	Passing	6	1.6%
	Good	126	34.5%
	Very good	164	44.9%
	Excellent	69	18.9%
	Total	365	100%

Table 1.
Demographic characteristics of the participants ($N = 365$)

referred to what students do habitually (e.g. "I try to express what I have learned in my own words, instead of repeating literally what the teacher or the book says"). A sociodemographic section was added to the scale. This section recorded various types of information about the participants such as their degree, gender, college enrollment, GPA and years of study.

The instrument was translated into Arabic prior to distribution to the sample. In order to ensure that the respondents understood the questions, the instrument was presented to a panel of academics in the field to ensure the translated scale was linguistically and culturally valid. Also, the scale was presented to five students who were from the study population but were not included in the study sample to ensure that they comprehended the items fully. Furthermore, the reliability and validity of the scale were measured. The reliability was measured using a split half (Guttman coefficient = 0.657) and Cronbach's alpha for each dimension and the total scale ranged from 0.658 to 0.777, representing an acceptable level of internal consistency (see Table 2). Furthermore, the total score of the instrument was 0.726, indicating good consistency.

To test the validity of the instrument, exploratory factor analysis (EFA) was conducted. According to the Kaiser–Meyer–Olkin (KMO) test, the sample was adequate to run the EFA test (KMO = 0.707; Bartlett's sphericity p = 0.000). The results found that the variance (eigenvalues) of the instrument's items ranged from 1 to 3.39, and the commonalities of all items were higher than 0.4. The results showed that four factors can be retained by eliminating items that are not saturated by any factor (<0.4), as shown in Table 3. The instrument is divided into four main dimensions: microstrategies, keys of memory and metacognition, emotional support and study habits. The EFA results are similar to the results obtained by Jiménez *et al.* (2017). Therefore, the factors were named the same as those in Jiménez *et al.* (2017): microstrategies, keys of memory and metacognitive strategies, social-emotional supports and study habits.

Data analysis
The variance of the learning strategies among participants due to gender and GPA was investigated using covariance tests such as the *t*-test. Then, the combination of bivariate correlation and regression tests was used to investigate the impact of learning strategies on the students' performance.

Results
The central tendency and dispersion of participants' responses were measured for each dimension, as shown in Table 4. Participants reported frequent use of all learning strategies in their learning and a preference for microstrategies and study habits compared to the rest of the learning strategies. The kurtosis values for all dimensions excluding "study habits" were positive, which show peaked distributions, while "study habits" showed a flatter distribution.

Furthermore, to investigate the differences in the participants' responses due to gender, the *t*-test was used, and the results are shown in Table 5. The female participants reported a

Dimension	Cronbach's alpha	Number of items
Microstrategies	0.658	5
Keys of memory and metacognition	0.777	5
Emotional-social support	0.654	7
Study habits	0.673	5
Total	0.726	22

Table 2.
Reliability of the scale

Items*	Microstrategies	Keys of memory and metacognition	Emotional support	Study habits
Item 1	*0.638*	−0.304	0.382	0.037
Item 2	*0.688*	−0.345	0.000	−0.067
Item 3	*0.774*	−0.224	−0.009	0.235
Item 4	*0.521*	−0.210	0.216	−0.094
Item 5	*0.446*	0.176	0.168	0.150
Item 6	0.334	*0.520*	0.287	0.156
Item 7	0.378	*0.503*	−0.213	0.003
Item 8	0.157	*0.582*	−0.261	0.027
Item 9	0.124	*0.620*	−0.266	−0.138
Item 10	0.049	*0.638*	0.156	−0.252
Item 11	0.008	0.017	*0.622*	−0.048
Item 12	0.144	−0.025	*0.450*	−0.180
Item 13	0.181	−0.089	*0.404*	−0.115
Item 14	0.309	−0.010	*0.621*	0.019
Item 15	0.367	0.153	*0.720*	−0.237
Item 16	0.030	−0.024	*0.683*	−0.054
Item 17	0.184	0.353	*0.729*	0.042
Item 18	−0.088	0.383	−0.072	*0.426*
Item 19	−0.122	0.094	−0.621	*0.422*
Item 20	0.059	−0.145	−0.297	*0.575*
Item 21	0.246	0.017	−0.171	*0.647*
Item 22	0.387	0.153	−0.171	*0.451*

Note(s): *Based on the "ACRA-C" learning strategies (Jiménez *et al.*, 2017)
Italic values represent high loading factor of the statement for the fact and higher than 0.4

Table 3.
Exploratory factor analysis of the instrument (four factors)

Dimension	Central tendency (mean)	Dispersion (SD)	Kurtosis	Skewness	Level	Rank
Microstrategies	3.1814	0.504	1.588	−1.145	Often use	1
Keys of memory and metacognition	3.1682	0.399	0.678	−0.580	Often use	3
Emotional-social support	3.1393	0.386	1.948	−0.896	Often use	4
Study habits	3.1688	0.396	−0.062	−0.455	Often use	2
Overall score of learning strategies	3.1621	0.297	0.856	−0.665	Often use	

Ranges of central tendency	Level of frequency
1.00–1.74	Not use
1.74–2.49	Rarely use
2.50–3.24	Often use
3.25–4.00	Always use

Table 4.
Central tendency and dispersion of participants' responses for each dimension of learning strategies ($N = 365$)

significantly higher level of use overall ($M = 3.24$; $t(363) = 5.689$, $p = 0.000$) and also for each category of strategies: microstrategies ($M = 3.28$, SD = 0.504; $t(363) = 3.79$, $p = 0.000$), keys of memory and metacognition ($M = 3.26$; $t(363) = 4.65$, $p = 0.000$), emotional and social support ($M = 3.21$; $t(363) = 3.75$, $p = 0.000$), study habits ($M = 3.24$; $t(363) = 3.75$, $p = 0.000$), when compared to the male participants.

Furthermore, the study investigated the differences in the use of learning strategies using academic achievement and gender as the predictors. The results are shown in Table 6. There was no difference in the learning strategies among students who achieved "passing" grades.

Dimension	Gender	Central tendency (mean)	Dispersion (SD)	T	df	Sig
Microstrategies	Female	3.2816	0.50151	3.791	363	0.000**
	Male	3.0849	0.48933			
Keys of memory and metacognition	Female	3.2648	0.36015	4.654	363	0.000**
	Male	3.0753	0.41477			
Emotional-social support	Female	3.2155	0.39556	3.754	363	0.000**
	Male	3.0661	0.36478			
Study habits	Female	3.2469	0.38046	3.759	363	0.000**
	Male	3.0935	0.39846			
Overall score of learning strategies	Female	3.2489	0.29254	5.689	363	0.000**
	Male	3.0787	0.27889			
Note(s): **Significant at <0.000 level						

However, in students with "good," "very good" or "excellent" grades, there were significant differences found in the use of learning strategies in favor of the female students.

According to Table 6, female students who achieved "very good" grades showed higher overall use of learning strategies than males with the exception of "emotional-social support." However, females who achieved "excellent" grades surpassed the males even in "emotional-social support" along with "study habits" and the overall use of learning strategies, while there was no difference between the genders in "microstrategies" and "keys of memory and metacognition" in this GPA group.

Table 7 shows the results of the linear regression test seeking to discover the impact of learning strategies on student achievement. According to the results, there is a positive relationship between the use of learning strategies and student achievement, where learning strategies can explain 8% of the variance in student achievement. In addition, the learning strategies were statistically significant in predicting student achievement (F (1, 363) = 34.816, $p < 0.05$).

Moreover, a multiple regression test was conducted to investigate the source of the impact of various learning strategies on students' achievement. To conduct a multiple linear regression, multicollinearity has to be checked first. In this study, all variance inflation factors (VIFs) were less than 3, which means that there was no multicollinearity between the learning strategy dimensions, while linearity between the learning strategy dimensions and students' achievement was diagnosed. Another assumption that had to be examined before conducting a multiple linear regression was the normality of the residuals using the Q-Q plot, as shown in Figure 1 in which all data points are so close to the diagonal line; thus, they are normally distributed.

As can be seen in Table 8, the overall model (microstrategies, keys of memory and metacognition, emotional-social support and study habits) was a significant predictor of student achievement ($F(4, 360) = 10.167$, $p < 0.01$), where the model explained 10% of the variance in academic achievement and had an appositive mild correlation ($R = 0.31$). The significant contributors of the model were microstrategies ($\beta = 0.138$, $p = 0.013 < 0.05$) and keys of memory and metacognition ($\beta = 0.196$, $p = 0.001 < 0.01$). These two categories were the main sources of the effects on student achievement.

Discussion

The present study utilized a scale to examine Saudi students' use of learning strategies and the extent to which strategy use is related to academic achievement and gender. The results presented a high preference for microstrategies by students. This can be explained by the fact

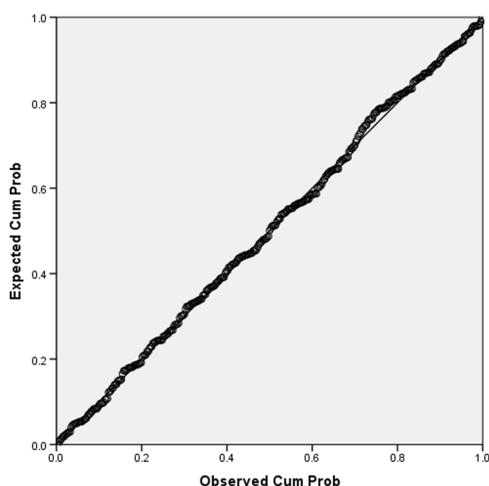| Academic achievement	Dimension	Gender	Central tendency (mean)	Dispersion (SD)	t	Sig
Passing (N = 2 female, 4 male)	Microstrategies	Female	2.4000	0.56569	0.000	1.000
		Male	2.4000	0.71181		
	Keys of memory and metacognition	Female	2.8000	0.56569	0.459	0.670
		Male	2.5000	0.80829		
	Emotional-social support	Female	2.5714	0.20203	−2.25	0.097
		Male	3.0714	0.34007		
	Study habits	Female	2.5000	0.14142	−1.49	0.209
		Male	3.1000	0.52915		
	Overall score of learning strategies	Female	2.5682	0.09642	−0.65	0.549
		Male	2.7955	0.45982		
Good (N = 54 female, 72 male)	Microstrategies	Female	3.2222	0.35749	3.005	0.003**
		Male	3.0056	0.42983		
	Keys of memory and metacognition	Female	3.1963	0.31680	2.596	0.011*
		Male	3.0222	0.40913		
	Emotional-social support	Female	3.1799	0.31050	2.199	0.030*
		Male	3.0437	0.36727		
	Study habits	Female	3.2037	0.32387	2.144	0.034*
		Male	3.0639	0.38832		
	Overall score of learning strategies	Female	3.1987	0.23014	3.517	0.001**
		Male	3.0347	0.27848		
Very good (N = 86 female, 78 male)	Microstrategies	Female	3.3023	0.50943	2.293	0.023*
		Male	3.1231	0.48908		
	Keys of memory and metacognition	Female	3.2674	0.36119	3.140	0.002**
		Male	3.0769	0.41558		
	Emotional-social support	Female	3.1711	0.42425	1.586	0.115
		Male	3.0696	0.39190		
	Study habits	Female	3.2326	0.39747	2.506	0.013*
		Male	3.0718	0.42393		
	Overall score of learning strategies	Female	3.2368	0.28349	3.439	0.001*
		Male	3.0839	0.28524		
Excellent (N = 37 female, 32 male)	Microstrategies	Female	3.3676	0.61376	0.816	0.418
		Male	3.2563	0.50350		
	Keys of memory and metacognition	Female	3.3838	0.37824	1.534	0.130
		Male	3.2625	0.25621		
	Emotional-social support	Female	3.4054	0.37270	3.627	0.001**
		Male	3.1071	0.29922		
	Study habits	Female	3.3838	0.36630	2.020	0.047
		Male	3.2125	0.33288		
	Overall score of learning strategies	Female	3.3870	0.32507	2.873	0.005**
		Male	3.2003	0.18395		

Note(s): *Significant at <0.05 level; **Significant at <0.01 level

Table 6.
Results of the mean comparison t-test for academic achievement according to gender (N = 365)

Statistics	Learning strategies
β	0.296
T	5.90
Sig. (two-tail) of t	0.000**
F	34.816
Sig. (two-tail) of F	0.000**
Correlation coefficient R	0.29
Coefficient of determination R^2	0.088

Note(s): **Significant at <0.000 level

Table 7.
Results of linear regression test on academic achievement (N = 365)

Statistics	Microstrategies	Keys of memory and metacognition	Emotional-social support	Study habits
β	0.138	0.196	0.034	0.079
T	2.503	3.44	0.034	0.059
Sig. (2-tail) of t	0.013*	0.001**	0.556	0.305
VIF	1.22	1.29	1.35	1.32
F	10.167			
Sig. (2-tail) of F	0.000**			
Correlation coefficient R	0.319			
Coefficient of determination R^2	0.101			
Note(s): *Significant at <0.05 level; **Significant at <0.01 level				

Table 8.
Results of the linear
regression test on
academic
achievement ($N = 365$)

that in Saudi universities, students are encouraged to use microstrategies like summarizing and highlighting information rather than macrostrategies such as self-regulated learning and planning for learning (see Alhaisoni, 2012; Al-Otaibi, 2004). In the majority of the lectures delivered in Saudi universities, students are only passive recipients of information, summarizing and highlighting what the instructor disclosed during the lecture, using a specific textbook for reference (Al-Seghayer, 2021; Pordanjani & Guntur, 2019; Kim & Alghamdi, 2019). This contradicts the results for university students in Lima in Díaz *et al.* (2019) where students preferred metacognitive strategies and information processing strategies. Study habits which ranked second in this study explained the high level of self-regulation that Saudi students have to control their learning, and this is aligned with the higher education norms in Saudi Arabia, which use mostly a student-centered curriculum. Therefore, students have to assume responsibility for their learning. Accordingly, students always seek summaries and short focus activities to help them acquire information. Nevertheless, the descriptive data also referred to a lack of emotional-social support to students. This could be attributed to the poor educational content, which does not meet students' interests or their educational needs (Alenezi, 2020; Khan, 2019).

The results of the study further revealed differences in the frequency of using the various learning strategies, and the overall academic achievement, with female Saudi students

showing a higher use of learning strategies. Previous studies in other parts of the world have also shown that female students have a higher level of competence and willingness to perform better in their academic programs (DiPrete & Buchmann, 2013; Tariq *et al.*, 2016; Quadlin, 2018). This result is also in agreement with the results obtained by Vega-Hernández *et al.* (2017). Furthermore, female students with "good," "very good" or "excellent" grades showed significant differences in their use of learning strategies compared to male students. However, this was not the case when comparing male and female students with low grade achievement. This makes sense since these students are not successful learners and they therefore do not use learning strategies that much regardless of their gender. In the case of the highest GPA students, there was no difference in all learning strategies except in the emotional-social support category with female students outperforming the male students. These students are highly motivated and competitive with females being extra determined to prove themselves in a patriarchal and male dominated society making the emotional-social support strategies all the more important. These results taken together show that learning strategies have a significant effect on students' academic achievement and they have clear implications for faculty in Saudi universities who have to use numerous and various teaching strategies to induce students' use of appropriate learning strategies especially among the weaker students. Ali *et al.* (2017) reported that both the quality of the staff and appropriate teaching and learning methods are factors that affect student learning at university. The findings of the current study contribute valuable insight into how faculty in Saudi universities may help develop students' use of appropriate learning strategies.

Finding differences in the use of learning strategies between male and female students of varying GPA levels encourages further investigation of the association between learning strategies use and students' academic performance. In this study, learning strategies explained 8% of the variance in student achievement. The microstrategies and keys of memory and metacognition were the main sources of the effects on student achievement, which means that only these two main strategies statistically significantly predicted the achievement. In addition, the overall model used in this study (microstrategies, keys of memory and metacognition, emotional-social support and study habits) was a significant predictor of student achievement, in which the model explained 10% of the variance in academic achievement. This is in agreement with other empirical studies that support the positive relationship between the use of learning strategies and academic achievement (Pennequin *et al.*, 2010; Pinto *et al.*, 2018). Furthermore, the evidence presented in this study contradicts studies that refuted any association between learning strategies and student achievement or performance (such as Tariq *et al.*, 2016).

Succinctly, the results revealed that there is a positive relationship between learning strategies and student achievement with the frequency of use of learning strategies significantly predicting the academic achievement of students. Furthermore, Saudi female students were found more eager to use learning strategies than male students, especially in higher GPA levels.

Conclusion
The study assessed the impact of Saudi university students' use of learning strategies on their academic achievement. The study adopted the higher education version of the brief "ACRA-C" learning strategies developed by Jiménez *et al.* (2017) and divided learning strategies into four main categories: microstrategies, keys of memory and metacognition, emotional-social support and study habits. A total of 365 female and male university students at a College of Education participated in the study. Results showed statistically significant differences in the use of learning strategies due to gender in favor of the female students, which implies that male students have to improve their use of learning strategies and study

habits. The study also found that the use of learning strategies significantly predicted student achievement, particularly the microstrategies and keys of memory and metacognition. This implies that students have to pay more attention to the use of these learning strategies if they are to enhance their academic performance.

Based on the study results, it is recommended that training programs on learning strategies be introduced to enrich Saudi students' knowledge and utilization of learning strategies. Also, the training program has to consider the students' gender and their academic level. Furthermore, students have to grasp the significance of the learning strategies as a facilitating tool to increase their academic achievement.

While the study made a valuable contribution, it was limited to one college in one Saudi university. Future studies should use larger samples from different colleges and universities in Saudi Arabia and incorporate a variety of measures of academic achievement, such as students' grades in specific courses rather than the overall grade average.

Despite its limitations, the current study contributed to the field of learning strategy use and filled a gap in the literature by shedding light on the Saudi Arabian context. By examining the relationship between strategy use, academic achievement and gender, it makes an important contribution to Saudi higher education and provides a map to help improve the quality of higher education and student achievement in university.

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Further reading

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Appendix 1
The adopted higher education version of the brief "ACRA-C" learning strategies developed by Jiménez *et al.* (2017)

Effective learning strategies
Use the correct point in the scale (4. Always use, 3. Often use, 2. Rarely use and 1. Never use) to show how often you use the following strategies.

No	Statement	Frequency of use			
		Always use	Often use	Rarely use	Never use
Microstrategies					
	1. I make summaries after underlining				
	2. I make summaries after the end of each topic				
	3. I summarize after each topic, lesson or write down the most important things				
	4. I draw diagrams from underlined material and summaries				
	5. I memorize summaries, diagrams, conceptual maps, etc.				
Keys of memory and metacognition					
	6. I use signs and drawings to highlight important information				

(*continued*)

No	Statement	Frequency of use Always use	Often use	Rarely use	Never use
	7. I am aware of the importance of using elaboration strategies				
	8. I recognize the role of learning strategies for memorizing				
	9. It helps me if I recall events or anecdotes to remember				
	10. I recall drawing, images, metaphors to elaborate information				
Emotional-social support					
	11. I study hard to feel proud of myself				
	12. I avoid distractions when I study				
	13. I sort out family problems to concentrate on studying				
	14. I solve conflicts with fellow students, lecturers or family				
	15. I talk to fellow students, lecturers or family to clarify study doubts				
	16. It gives me satisfaction when others value my work positively				
	17. I encourage and help my fellow students to be academically successful				
Study habits					
	18. I try to express what I have learned in my own words, instead of repeating literally what the teacher or the book says				
	19. I try to learn the topics in my own words instead of memorizing them literally				
	20. When I study I try to mentally summarize what is most important				
	21. When beginning to study a lesson, I first skim over the whole thing				
	22. When I study a lesson, in order to improve comprehension, I take a break and afterward review it in order to learn it better				

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