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Students' academic adjustment and science learning motivation at the university level

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ABSTRACT
This study aimed to investigate the relationship between students' adjustment to the academic learning process (academic adjustment) and motivation for learning science. The study was conducted with the participation of university students enrolled in science-related programs. A correlational research design was utilized in which data was collected through the Academic Adjustment Subscale (AAS) and the Students Motivation towards Science Learning (SMTSL) scale. Both scales were piloted before administering to data collection. The research sample comprised of 526 students selected using a simple random sampling technique, with participants providing informed consent prior to their involvement in the study. The collected data was analyzed using Pearson's r correlation and independent sample t-tests after checking normal distribution of data. Results showed a small positive correlation between students' academic adjustment and motivation for learning science. Statistically, no significant mean differences were found between male and female students, as well as between the 17-22 years and 23-27 years old student groups. These findings suggest that academic adjustment plays an important role in motivating students to learn science and vice versa. Given that the study did not find significant differences based on gender and age groups, educational institutes should provide need based individualized support and guidance to all students regardless of their gender or age.

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Introduction

Science education at the university level is critical for producing a scientifically literate and informed citizenry (Howell & Brossard, 2021). However, many students struggle to succeed in science courses (Jumini et al., 2022 Wiyarsi et al., 2020; Freeman et al., 2014). Academic adjustment and motivation to learn are two key factors that can impact students' success in science courses at the university level (van Rooij et al., 2018; Raza et al., 2020). Academic adjustment refers to the degree to which students can adapt to the academic demands of their university, which depends on four separate aspects: motivation to learn and having clear academic goals; applying oneself to academic

work; exerting effort to meet academic demands; and being satisfied with the academic environment (Zhao, et al., 2022; Baker & Siryk, 1999; Baker & Siryk, 1984a). It is one of six adjustment areas that first-year university students experience, along with cultural, emotional, financial, intellectual and social adjustments (Hazard & Carter, 2018). Motivation refers to the psychological processes that initiate, direct and sustain goal-oriented behavior (Nevid, 2013; Cook & Artino, 2016). It can be intrinsic, reflecting a desire for internal gratification, or extrinsic, reflecting a desire for external rewards (Tranquillo & Stecker, 2016).

Several research studies have highlighted the importance of academic adjustment and motivation for learning in predicting students' academic performance in science related courses (Thomas et al., 2009; Clark et al., 2014; Willems et al., 2021; Wang et al., 2021). For instance, students who can successfully adjust to the academic demands of their university tend to perform better in their science related courses (Baker & Siryk, 1999; Obrentz, 2012; Raza et al., 2020; Willems et al., 2021). Likewise, students who are highly motivated to learn science tend to have higher academic performance (Wang & Guthrie, 2004; Glynn & Koballa, 2006; Kusurkar et al., 2013; Juliana et al., 2014; Rana et al., 2015; Llbao et al., 2016). Recent research has also shed light on the connection between academic adjustment and motivation for learning science in this context. A study by Chen et al. (2021) found that academic adjustment predicted science motivation among Chinese college students. Another study by Vansteenkiste et al. (2020) found that students' academic adjustment was positively related to their intrinsic motivation for learning science.

Overall, the literature reveals that academic adjustment and motivation for learning science are crucial elements that influence students' success in university-level science courses (van Rooij et al., 2018; Petrie et al., 2018; Steinmayr et al., 2019). However, the relationship between these two factors remains unclear (Clark et al., 2014; Yarin et al., 2022). Some studies have found that motivation for learning science positively influences academic adjustment (Raza et al., 2020; Wang et al., 2021). Other studies have found that academic adjustment is a mediator of the effects of several learning strategies and motivational variables on academic achievement (Kusurkar et al., 2013; van Rooij et al., 2018; Willems et al., 2021). Academic adjustment and motivation for learning science may have a bidirectional relationship, with academic adjustment impacting motivation and motivation influencing academic adjustment. Therefore, there is a need for further research to clarify the relationship and determine the direction of the association between academic adjustment and motivation for learning science.

Despite previous research, the relationship between academic adjustment and motivation for learning science remains unclear. This study aims to address this research gap by investigating the association between university freshmen's motivation for learning science and their academic adjustment. By examining this association and shedding light on the direction of the relationship, the study seeks to contribute to the existing body of knowledge in the field of science education.

Literature Review

The literature review indicates that academic adjustment involves adapting to the academic environment, including academic demands, social integration, and personal development. On the other hand, motivation for learning refers to the drive and willingness to engage in academic activities and achieve academic goals. Research has shown that academic adjustment and motivation for learning are interrelated, with unclear evidence either academic adjustment influencing motivation or motivation for learning influence academic adjustment. Thus, this literature review aims to explore the empirical evidence about academic adjustment, motivation for learning science, gender differences as well age differences in the relationship between academic adjustment and motivation for learning.

Academic Adjustment

Academic adjustment is multifaceted, reflecting in addition to students' learning capacity their motivation, how they conceptualize their academic goals, the strategies they apply to achieve them, their satisfaction with the academic environment, and so on (Hazard & Carter, 2018; Baker & Siryk, 1984a). A number of research studies have pointed towards a positive relationship between academic adjustment and academic performance, indicating that students who are well adjusted academically achieve higher academic performance (e.g., Baker & Siryk, 1984a; Napoli & Wortman, 1998; Wintre & Yaffe, 2000; Sennett et al., 2003). Besides, students who fail to adjust to university are more likely to be less motivated to participate in science learning activities e.g., taking part in scientific exhibitions, discussions, and scientific research (Gerdes & Mallinckrodt, 1994; Tinto, 2006; Raza et al., 2020; Willems et al., 2021). For example, Kantanis (2000) argues that students will face extreme difficulties at university if they do not adjust to the social and academic demands of university life. Poor student adjustment to the demands and requirements of university life may also impact on the psychological health of students (Jdaitawi et al., 2020; Aspinwall & Taylor, 1992; van Rooijen, 1986).

Gender Differences and Academic Adjustment. In the realm of gender differences, Halamandaris and Power (1999) conducted a study involving 183 first year undergraduate students, elucidating that, with regard to academic adjustment, female students exhibited superior adaptation to university life compared to their male counterparts. This observation was corroborated by Leong et al. (1997), who, employing the Student Adaptation to College Questionnaire (SACQ) in a study of 161 first year students, identified statistically significant gender differences within the sub-scales of adjustment. Notably, a discernible trend emerged wherein female students demonstrated superior adjustment both academically and socially in comparison to their male counterparts.
Conversely, divergent perspectives exist within the body of research, with some studies suggesting that male students fare better in university adjustment (Abdullah et al., 2009; Enochs & Roland, 2006; Wintre & Yaffe, 2000). Simultaneously, conflicting findings have been reported, indicating no discernible gender differences in academic and social adjustment to university (e.g., Ishak et al., 2011). Given the variegated outcomes observed in prior research, refraining from making definitive predictions regarding the superior adjustment of either female or male students to university is prudent.

Age Group Differences and Academic Adjustment. Concerning age differences, Graham and Donaldson (1999) revealed that younger college students exhibited a predominant association with peers of similar age both on campus and in activities of a peer-related nature. In contrast, older college students demonstrated reduced engagement in campus activities and allocated more time toward familial commitments. Consequently, it is plausible that older students may manifest comparatively diminished (academic) adjustment to university life. However, it is noteworthy that their current level of adjustment might be perceived as more favorable when evaluated on the scale applicable to their earlier years. However, Ramos and Nichols (2007) reported no significant difference between young and older students‟ level of adjustment to university in their sample of 280 first-year undergraduate students at an Australian university. Additionally, no differences in students‟ academic adjustment to university were reported amongst a sample of 289 first-year students in North Jordan (Ishak et al., 2011). Contrary to the findings mentioned above, Clifton et al. (2008) reported that older students were better adjusted to university than younger students in their sample of 854 undergraduate students at a Canadian university.

Motivation for Learning Science

Motivation for learning science refers to the drive and willingness to engage in science-related activities and achieve science-related goals. It involves a desire to understand the natural world,

explore scientific concepts, and apply scientific knowledge to real-world problems (Zhu et al., 2021). Reading additional books not prescribed for a course out of interest to learn more because a student is enjoying the subject or attending extra-curricular lectures because students find them interesting or stimulating are examples of academic intrinsic motivated behavior. Students are expected to demonstrate intrinsic motivation and genuine active engagement in class throughout the teaching-learning process. To accomplish this, it is necessary to first assess students' motivation levels and then plan activities that will improve their motivation for learning science (Mujasam et al., 2018). Extrinsic motivation refers to behavior that is directed outwards (Tranquillo & Stecker, 2016). Here the motivation is not internal or for self-determination goals but a means to an end (Vallerand & Bissonnette, 1992) to achieve an external reward (e.g., praise, acceptance, attending university to attain a high paying job, etc.) or to avoid undesirable events (e.g., disappointing parents or family members, avoiding criticism, etc.). Research indicates that high intrinsic motivation is related to a deeper approach to learning (Ames & Archer, 1988; Jdaitawi et al., 2020), higher self-esteem (Deci & Ryan, 1985) and lower self-perceived stress (Baker, 2004). Students when they are intrinsically motivated are less likely to procrastinate, are confident and in control of their academic tasks, use self-initiated exploratory strategies and are likely to display autonomy (Pintrich et al., 1991; Seifert & O‟Keefe, 2001; Senecal et al., 1995). Intrinsic motivation and the more self-determined type of extrinsic motivation (identified regulation) have also been found to be related to lower drop out and higher academic adjustment of students.

Previous research findings have cleared about gender differences related to academic adjustment. For example, Nunn (1994) found that women are more academically adjusted than men and Vallerand et al. (1992) also reported that female students were well adjusted academically than male students.

Gender and Age Group Differences in Motivation for Learning Science. Likewise, previous research indicates that older students are more likely to attend university because of being internally motivated or (more likely) they are less likely to drop out as younger students (Klein, 1990; Nunn, 1994), whereas younger students are more likely to display external motivations (Jacobson, 2000). In a study with 566 undergraduate students Isiksal (2010) reported that older students were more intrinsically motivated than younger students. Similarly, Jeffrey et al. (2009) studied 1 811 students in New Zeeland and found that older students were more intrinsically motivated than younger students. Studies by Justice and Dornan (2001) and Bye et al. (2007) however, reported that younger and older age college students did not differ in their motivations to learn at university. It is thus hypothesised that older students will display higher levels of intrinsic motivation whereas younger students will display higher levels of extrinsic motivation. Moreover, Vermeir and Van Kenhove (2008), Roxas and Stoneback (2004) and Jeffrey et al. (2009) also reported that males are more externally motivated and females more internally motivated. Similarly, a study with 123 undergraduate students at the University of Cape Town conducted by Muller and Louw (2004) in South Africa found significant gender differences in motivation. Female students displayed higher levels of intrinsic motivation and lower levels of external motivation compared to male students. Therefore, it is hypothesised that female students display higher levels of intrinsic motivation, whereas male students are hypothesised to display higher levels of extrinsic motivation.

Relationship between Academic Adjustment and Motivation for Learning

Previous research indicated that motivation for learning significantly predicts students‟ adjustment and academic performance at university (Allen & Robbins, 2010; Aspinwall & Taylor, 1992; Baker, 2004; Conti, 2000; Davy et al., 2009; Deci & Ryan, 1985; Garcia & Pintrich, 1994; Jones et al., 2008; Petersen et al., 2009; Prus et al., 1995; Richardson et al., 2012; Robbins et al., 2004; Robbins et al., 2006; Sikhwari, 2007; Struthers et al., 2000; Vallerand & Bissonnette, 1992). For example, a study conducted by Baker (2004) which assessed psychological well-being and adjustment to university of

92 second year undergraduate psychology students. The results showed a positive relationship between intrinsic motivation and adjustment ($r = .28$, $p < .01$), and no relationship between extrinsic motivation and adjustment; indicating that higher intrinsic motivation was associated with better (Baker, 2004, p. 195). In general, these findings are equally appliable for all academic disciplines including science.

Theoretical Underpinnings and Research Questions

Theoretical Underpinnings. The present study is grounded in the principles of self-determination theory (SDT; Deci & Ryan, 1985, 2002), a conceptual framework widely utilized across diverse disciplines to elucidate individual motivation. SDT posits that an individual's regulation of behavior during a task can be categorized as intrinsically motivated, extrinsically motivated, or non-motivated. The motivational regulations experienced by individuals can fluctuate based on the degree of self-determination (autonomy) they possess. According to SDT, individuals' engagement in various activities, their exertion of effort, and their perseverance in tasks can be positioned along a continuum of self-determination (Deci & Ryan, 2000, 2002). At one end of this continuum lies intrinsic motivation, which represents behaviors driven by pure enjoyment or pleasure or anticipation of a future reward. Conversely, at the opposite end, we find non-motivated, which denotes a complete absence of motivation (Ryan & Deci, 2017).

In accordance with SDT, recent research has pointed out the significance of self-determined motivation in students' learning processes (e.g., Thøgersen-Ntoumani & Ntoumanis, 2006). The various types of motivational regulation have the potential to directly or indirectly account for a broad range of behavioral, cognitive and affective outcomes (Vallerand, 1997). Within the existing body of literature on self-determined motivation, scholars have explored the correlation between students' motivation and academic achievement (e.g., Burton et al., 2006; Joe et al., 2017). Investigations have demonstrated that students' self-determined motivation is positively associated with desirable learning outcomes, including engagement, self-regulation, improved performance, and perseverance (Burton et al., 2006; Chirkov et al., 2007; Noels et al., 2000; Thøgersen-Ntoumani & Ntoumanis, 2006; Vallerand, 1997). When students manifest self-determined motivation in classroom tasks, they exhibit a greater propensity to actively participate in tasks and engage in various classroom activities (Ryan & Deci, 2017).

Although SDT principles have been applied in various contexts, there is still a research gap pertaining to students' motivation for learning science and their adjustment during the transition to university. In the realm of academic adjustment and motivation for learning science, SDT proposes that students who perceive a certain degree of control over their learning process possess a sense of competence in mastering the subject matter and establish connections with their teachers and peers are more likely to experience academic adjustment and attain academic success (Guo, 2018; Wood, 2019).

Research Questions. The two research questions provided pertain to the relationship between academic adjustment and motivation for learning science among university students, with the second question specifically considering the impact of demographic factors.

The first research question likely emerged from a desire to explore the overall relationship between academic adjustment and motivation for learning science among university students. The second research question likely arose from an interest in understanding how demographic factors may influence this relationship, as previous research has shown that factors such as gender and age differences can impact students' academic motivation and adjustment (Greene & Miller, 1996; Wang & Eccles, 2012).

RQ 1: What is the relationship between academic adjustment and motivation for learning science among university students?
RQ 2: How does the academic adjustment and motivation for learning science differ with respect to gender and age differences at university level?

Methods

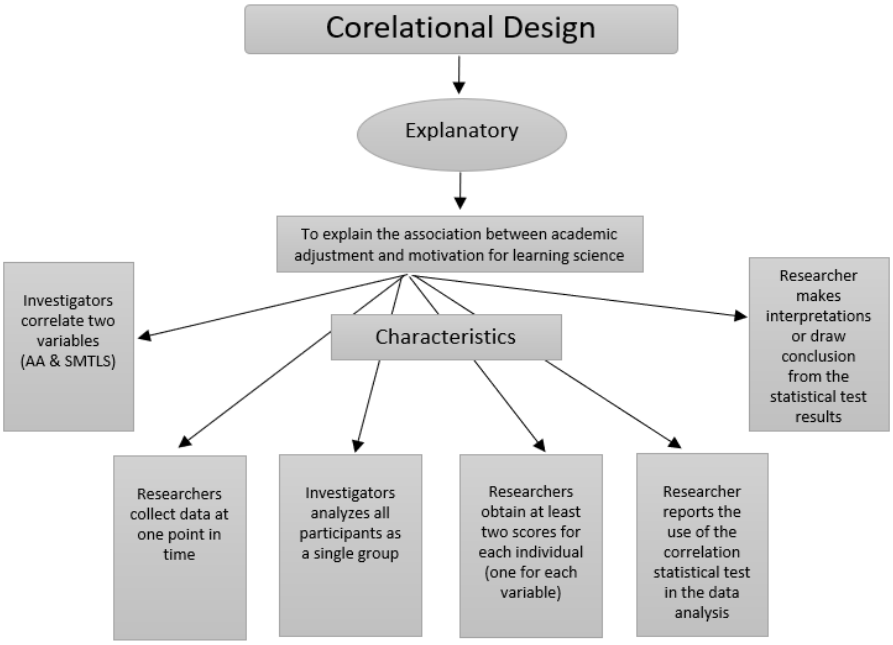
The research methodology for investigating the relationship between students' academic adjustment and motivation for learning science involved a correlational design. The sample consisted of 526 undergraduate students from a science-based university in Pakistan. The test instruments used were the Academic Adjustment Subscale (AAS) and the Students Motivation towards Science Learning (SMTSL). Data collected through a self-report questionnaire administered in a single session. The data analysis was conducted using correlation, linear regression, and independent sample t test to determine the significant relationship between academic adjustment and motivation for learning science as well the differences with respect to demographics.

Study Design

A correlational research design is well-suited for investigating the relationship between students' academic adjustment and motivation for learning science. This design involves measuring two or more variables and examining the strength and direction of their relationship (Wang et al., 2021). In the context of studying academic adjustment and motivation for learning science, a correlation research design can help identify whether there is a positive or negative relationship between these variables (Akyol & Boyaci, 2020). Overall, correlational research design is an effective way of identifying the relationship between variables, which can inform educational interventions and educators aimed at improving students' learning experiences. The explanatory carried design of study is mentioned in the Figure 1.

Figure 1

Conceptual Map for Correlation Design



Sample

The participants for this study were first year university students who were enrolled in science programs. A representative sample of students from various departments and faculties within the university was recruited to ensure a diverse and representative sample. Participants were selected with simple random sampling and of course the informed consents were taken from all the participants before taking part in current study. The total sample consisted of 526 first-year university students from different research-intensive universities in Pakistan, who completed the questionnaire approximately 3 months after the start of their program i.e., they were in effect a self-selected sample. Many different degree programs were represented in the sample, but a large majority of the students were pursuing a natural sciences degree (77%), e.g., Chemistry, Environmental Science, Mathematics. Physics, Zoology etc. and a smaller number of students were in the material sciences (4%) and engineering (19%). Women were overrepresented in this study (66%). Students' average age was 19.13 years (SD 1.57), ranging from 17 to 27 years, hence the sample can be seen as a sample of traditional students. Furthermore, 54% of students can be classified as first-generation university students, students of whom neither of their parents had attended higher education. The representation of selected sample is presented in Table 1.

Table 1

Sample Representation

	Gender			Age Differences		
	Male	Female	Total	17-22 Years	23-27 Years	Total
Frequency	178	348	526	351	175	526
Percentage	33.8	66.2	100	66.7	33.3	100

Test Instruments

The Academic Adjustment subscale was applicable to this study because it measures each student's adjustment or coping to the educational demands of university (Baker & Siryk, 1999). The Academic Adjustment subscale consists of 24 items; a nine-point scale used for participants to self-report their perception of academic adjustment to university (Baker & Siryk, 1999). Each of the 24 items is scored from one to nine (Baker & Siryk, 1999). The responses range from "applies very closely to me" beginning at one point and "doesn't apply to me at all" at nine points or less adaptive to more adaptive, respectively (Baker & Siryk, 1999). A few example items from academic adjustment subscale are represented in Table 2. In addition, Table 3 shows the descriptive statistics and reliability coefficients for total scale.

Table 2

Example Items for Academic Adjustment Questionnaire

Sr. No.	Example Items
1	I have been keeping up to date on my academic work.
2	I am finding academic work at college difficult.
3	I am satisfied with the level at which I am performing academically.
4	My academic goals and purposes are well defined.
5	I really have not had much motivation for studying lately.
6	I am satisfied with the number and variety of courses available at colleges.
7	I am not doing well enough academically for work I put in.
8	I am having a lot of trouble getting started on homework assignment.
9	I am quite satisfied with my academic situation at college.

Table 3

Descriptive Statistics and Cronbach's Alpha for Academic Adjustment Subscale

Variable	No. of Items	Mean	SD	Cronbach Alpha
Academic adjustment - questionnaire	24	145.91	22.092	0.854

Students' Motivation towards Science Learning Scale (SMTSL) developed by Tuan et al. (2005) was used to collect data about student motivation for science learning. This Likert type scale is comprised of 35 statements. This instrument was classified by the original authors into six factors. These were self-efficacy (7 statements); active learning strategies (8 statements); science learning values (5 statements); performance goal (4 statements); achievement goals (5 statements) and learning environment situation (6 statements). A few example items with respect to their constructs in shown in Table 4. The Cronbach Alpha reliability coefficient for the scale and its sub-scales were calculated. Moreover, Table 5. shows the descriptive statistics and reliability coefficients for total scale and its sub-scales.

Table 4

Example Items for Motivation towards Science Learning Scale

Factors/Constructs	No. of Items	Example Items
Self-efficacy	7	Whether the science content is difficult or easy, I am sure that I can understand it.
		No matter how much effort I put in, I cannot learn science. (-)
Active learning strategies	8	When learning new science concepts, I attempt to understand them.
		When I make a mistake, I try to find out way.
Science learning values	5	In science, I think that is the important to learn to solve problems.
		I think that learning science is important because I can use it in my daily life.
Performance goal	4	I participate in science courses to get a good grade. (-)
		I participate in science courses so that other students think that I'm smart. (-)
Achievement goals	5	During a science course, I feel most fulfilled when the teacher accepts my ideas.
		During a science course, I feel most fulfilled when I attain a good score in a test.
Learning environment situation	6	I am willing to participate in this science course because it is challenging.
		I am willing to participate in this science course because the teacher uses a variety of teaching method.

Note. (-) represent reverse items.

Table 5

Descriptive Statistics and Reliability Coefficient for Motivation Scale

Variable	Mean	SD	Cronbach Alpha
Motivation for learning science - Scale	134.62	18.754	.887

Both instruments, the Academic Adjustment Subscale (AAS) and the Students Motivation towards Science Learning (SMTSL), were carefully piloted before being administered for data collection. To establish the construct validity of the academic adjustment scale, a confirmatory factor analysis was conducted. The results were found consistent with the findings of a previous research

study by Baker and Siryk (1999). Additionally, an exploratory factor analysis was performed on the students' motivation towards science learning scale (SMTSL). The results of the factor loading analysis for SMTSL were found to be consistent with the findings of a previous study by Tuan et al. (2005).

Data Collection Procedure

The Ethics Committee of the universities had given approval of the study. All participants received printed consent forms to participate in the study. Seventy-one percent of participants received these questionnaires, composed by the researchers, via a coordinator of their program who was interested in having the first-year students of his or her program participate in the study and the other 29% received the printed questionnaires directly from the researchers. The front page explained the research purpose and asked the student to complete both questionnaires; participation was voluntary. Incentives were allotted among participants who had completed the questionnaire. The response rate was 52%.

Data Analysis

The data obtained were analyzed using SPSS 28.0. Shapiro-Wilk test was implemented to check the nature of distribution of the data, because the number of participants were greater than 50. It was observed that for both the continuous variables, academic adjustment ($p > .05$) and the motivation for learning science ($p > .05$) data were normally distributed. Parametric tests were chosen and applied after checking the normality of data.

We implemented the Pearson rank correlation test for exploring the strength and direction of relationship between students' academic adjustment and motivation for learning science for research question 1. Furthermore, an independent sample t test was carried out for comparing first year's students' motivation for learning science and academic adjustment with respect to their gender and age differences in research question 2.

Results

Research Question 1

Pearson rank correlation test was applied to find out like, what is the strength and direction of relationship between academic adjustment and motivation for learning science among university students? For this purpose, the authors corelate both continuous computed total academic adjustment subscale and motivation for learning science variables. Table 6 presents the findings of conducted test and Table 7 presents the linear regression analysis findings of motivation for learning science to predict academic adjustment for first year's university students.

Table 6

Relationship between University Students' Academic Adjustment & Motivation for Learning Science

Variables	Academic Adjustment	Motivation for Learning Science
Academic Adjustment	.	. 184**
Motivation for Learning Science	.184**	.

Note. ** Correlation is significant at the .00 level (two-tailed).

There was a small, positive correlation between the two variables, $r = 0.184$, $n = 526$, $p < .001$ with low level of academic adjustment associated with lower level of motivation for learning science. The scatterplot of relationship is also shown in Figure 2.

Figure 2

Scatterplot of Correlation between Academic Adjustment and Motivation for Learning Science

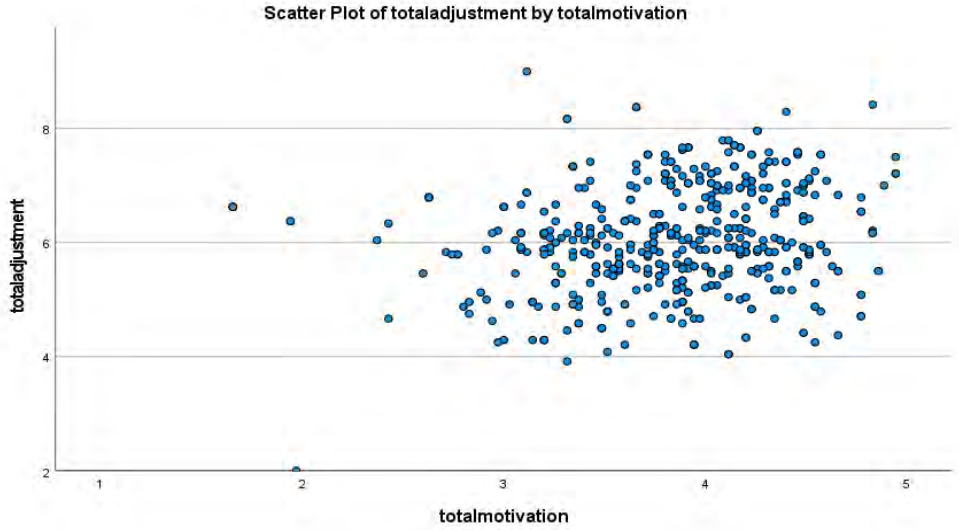


Table 7

Motivation for Learning Science Predict Academic Adjustment

Predictor	R^2	R^2 Change	F-Change	*df*	ß	Sig.
Motivation for learning science	.034	.032	18.338	524	.184	.000

Linear regression analysis test was applied to investigate the effect of motivation for learning science as a predictor of academic adjustment at university level. Table 7 presented the associated results. It is evident that motivation for learning science predict students' academic adjustment at university level, $R^2 = .034$, $F(1, 524) = 18.338$, $p = .000$.

Research Question 2

Table 8 and Table 9 presents "how does the academic adjustment and motivation for learning science differ with respect to gender and age differences at university level?". An independent sample t test was conducted for both demographics gender and age to find out the difference if any exist related to academic adjustment and motivation for learning science.

Table 8

Comparing Male & Female Responses for Academic Adjustment & Motivation for Learning Science

Variables	Demographic Variables	N	Mean	*df*	t-value	Sig.
Academic Adjustment	Male	178	6.09	524	.191	.848
	Female	348	6.07			
Motivation for Learning Science	Male	178	3.78	524	-1.98	.048
	Female	348	3.88			

There existed no significant mean difference in 'academic adjustment' for both male (M = 6.09, SD = .854) and female (M = 6.07, SD = .954; t (524) = .191, p = .848, two-tailed) university students. The magnitude of the differences in the means (mean difference = .016, 95% *CI*: -.151 to .183) was almost same with very low effect size = 0.018. It means male and females were equally adjusted to their academic activities and there is no any difference in their responses. In addition, there existed no significant mean difference in 'motivation for learning science' for both male (M = 3.78, SD = .553) and female (M = 3.88, SD = .525; t (524) = 1.984, p = .048, two-tailed) university students. The magnitude of

the differences in the means (mean difference = -.098, 95% *CI*: -.194 to -.001) was almost same with very low effect size = 0.007. It means male and females were equally motivated to learn science at university as there is no any difference in their responses.

Table 9

Comparing Academic Adjustment Subscale & Motivation for Learning Science with Age Differences

Variables	Demographic Variables	N	Mean	df	t-value	Sig.
Academic Adjustment	17-22 Years	351	6.06	524	-.744	.457
	23-27 Years	175	6.12			
Motivation for Learning Science	17-22 Years	351	3.87	524	1.184	.237
	23-27 Years	175	3.81			

Table 9 indicates, there existed no significant mean difference in 'academic adjustment' for both age groups like 17-22 years (M = 6.06, SD = .961) and 22-27 years (M = 6.12, SD = .834; t (524) = -.744, p = .457, two-tailed) university students. The magnitude of the differences in the means (mean difference = -.063, 95% *CI*: -.231 to .104) was almost same with very low effect size = 0.001. It means both age groups were equally adjusted to their academic activities and there was not any difference in their responses. It is also clear from the results there existed no significant mean difference in 'motivation for learning science' for both age groups like 17-22 years (M = 3.87, SD = .514) and 23-27 years (M = 3.81, SD = .577; t (524) = 1.184, p = .237, two-tailed) university students. The magnitude of the differences in the means (mean difference = .059, 95% *CI*: -.039 to .156) was almost same with very low effect size = 0.00. It means both age groups were equally motivated to learn science at university as there is no any difference in their responses.

Discussion & Limitations of Study

The primary objective of this study was to investigate the strength and relationship between students' academic adjustment and motivation for learning science at university level. As a result, the two research questions mentioned earlier were developed for investigation. These research questions were addressed with correlational explanatory research design and the collected data were analyzed with Pearson rank coefficient test and independent sample t test. The findings after analysis were presented in above section with the help of graphical explanation. In the next part we argue over to which extent the results of addressed research questions are associated with previous studies and vice versa. In the later section limitation of study, comprehensive conclusion and further research recommendations of the study were discussed.

Association between Academic Adjustment & Motivation for Learning Science – RQ 1

The first research question aimed to investigate the correlation between students' academic adjustment and their motivation to learn science at the university level. The study found that these variables are positively related, with a small yet significant correlation coefficient of r = .184**. This indicates that students who are academically well-adjusted are more likely to have a corresponding level of motivation to learn science. In other words, an increase in one variable is likely to lead to an increase in the other.

These findings are consistent with the research conducted by Baker (2004), who examined the psychological well-being and adjustment of undergraduate psychology students. Baker found a positive correlation between intrinsic motivation and adjustment (r = .28, p < .01), while no relationship was found between extrinsic motivation and adjustment.

Moreover, the study revealed that motivation for learning science is a significant predictor of students' academic adjustment (R2 = .034, F (1, 524) = 18.338, p = .000). This result is consistent with

previous studies by Allen & Robbins (2010), Aspinwall & Taylor (1992), Conti (2000), Davy et al. (2009), Deci & Ryan (1985), Garcia & Pintrich (1996), Jones et al. (2008), Petersen et al. (2009), Prus et al. (1995), Richardson et al. (2012), Robbins et al. (2004), Robbins et al. (2006), Sikhwari (2007), Struthers et al. (2000), and Vallerand & Bissonnette (1992). The study suggests that students who are motivated to learn science are more likely to be academically adjusted and perform better in their science courses.

In summary, the study found a positive correlation between students' academic adjustment and their motivation to learn science. This relationship was found to be a significant predictor of students' academic success in science courses at the university level. These findings suggest that promoting students' motivation to learn science may be an effective way to enhance their academic adjustment and ultimately improve their performance in science courses.

Gender and age differences – RQ 2

The aim of the second research question was to examine the differences in academic adjustment and motivation for learning science among university students based on demographic factors such as gender and age. The results indicated no significant mean difference in academic adjustment for both male (M = 6.09, SD = .854) and female (M = 6.07, SD = .954; t (524) = .191, p = .848, two-tailed) students. This finding contrasts with previous studies conducted by Nunn (1994), Halamandaris and Power (1999), and Leong et al. (1997), which suggested that women tend to be more academically adjusted than men. However, other research studies, including Abdullah et al. (2009), Enochs and Roland (2006), and Wintre and Jaffe (2000), supported the notion that male students are better adjusted to university than female students. The current study's findings align with recent research indicating that male students are better adjusted to university than female students (Abdullah et al., 2009; Enochs & Roland, 2006; Wintre & Jaffe, 2000).

The study found no significant mean difference in motivation for learning science for both male (M = 3.78, SD = .553) and female (M = 3.88, SD = .525; t (524) = 1.984, p = .048, two-tailed) students. This result contrasts with Vallerand et al. (1992), who reported that female students have a higher self-determined motivational profile than male students. However, other studies, including Vermeir and Van Kenhove (2008), Roxas and Stoneback (2004), and Jeffrey et al. (2009), suggested that males are more externally motivated, while females are more internally motivated.

Regarding age differences, the results showed no significant mean difference in academic adjustment for both age groups, 17-22 years (M = 6.06, SD = .961) and 22-27 years (M = 6.12, SD = .834; t (524) = -.744, p = .457, two-tailed) students. This finding contrasts with Graham and Donaldson (1999) and Clifton et al. (2008), who reported that older students were better adjusted to university than younger students. However, the results are similar to Ramsay et al. (2007), who reported no significant difference in academic adjustment between young and older students at an Australian university. Jdaitawi et al. (2011) also reported no differences in academic adjustment among a sample of 289 first-year students in North Jordan.

Similarly, the study found no significant mean difference in motivation for learning science for both age groups, 17-22 years (M = 3.87, SD = .514) and 23-27 years (M = 3.81, SD = .577; t (524) = 1.184, p = .237, two-tailed) students. This result contradicts studies conducted by Klein (1990), Nunn (1994), and Jacobson (2000), who suggested that younger students are more motivated than older ones in motivation for learning science. However, Isiksal (2010) reported that older students are more intrinsically motivated than younger students. The current study's findings align with Justice and Dornan (2001) and Bye et al. (2007).

Limitations of Study

As with all studies, there were limitations that affect the generalizability of the results. The four main limitations where causality cannot be established, lack of control of confounding variables, timing, and science was not compared with other disciplines.

Causality cannot be Established

In correlation studies can only establish a relationship between two variables; they cannot establish causality. Therefore, it is possible that other factors could be influencing both academic adjustment and motivation for learning science, rather than one causing the other.

Timing

The study may only assess academic adjustment and motivation at a single point in time, potentially missing changes in these constructs over time that could impact the relationship between them.

Lack of Control for Confounding Variables

There may be other variables, such as family background, socio-economic status, or prior academic achievement, that could be influencing both academic adjustment and motivation for learning science. Failing to control for these variables can lead to inaccurate conclusions about the relationship between academic adjustment and motivation.

Interdisciplinary Comparison

Another, great limitation of the study is that science discipline was not compared with other disciplines.

Conclusion, Implications of Study & Further Research

Based on the results of the study, it appears that there is a small positive relationship between students' academic adjustment and motivation for learning science. This suggests that as students' academic adjustment increases, so does their motivation for learning science, and vice versa. However, it is important to note that the strength of this relationship is small, indicating that other factors beyond academic adjustment may also be contributing to students' motivation for learning science. Furthermore, the study found no significant mean differences in academic adjustment and motivation for learning science between male and female students, as well as between students aged 17-22 years and those aged 23-27 years old. This suggests that regardless of gender or age group, students' academic adjustment and motivation for learning science are similar.

In conclusion, the study indicates that academic adjustment and motivation for learning science are positively related, albeit weakly, and that this relationship is consistent across gender and age groups. These findings could have implications for educators, who may need to focus on supporting students' academic adjustment to help improve their motivation for learning science.

Implications of Study

The results of this study have important practical implications for educational practices and offer valuable insights for future research in the field of science education. The findings indicate a small positive correlation between students' academic adjustment and their motivation for learning science. Moreover, no significant mean differences were observed between male and female students, as well as between different age groups, regarding academic adjustment and motivation for learning science. These findings contribute to our understanding of the relationship between academic

adjustment and motivation, and their impact on science learning in university settings. The practical implications derived from this study are as follows:

Educational institutions can focus on promoting academic adjustment among students enrolled in science-related programs. This may involve providing support services and resources that help students effectively adapt to the academic demands of science courses. Examples of such services may include academic advising, study skills workshops, mentoring programs, and creating a supportive and inclusive learning environment that encourages student engagement.

Educators can design instructional strategies that foster students' motivation for learning science. By incorporating hands-on experiments, real-world applications, and interactive discussions into the curriculum, instructors can help students develop intrinsic motivation and a genuine interest in scientific concepts. Additionally, highlighting the relevance and practical implications of scientific knowledge can further enhance students' motivation to engage in science learning.

Further Research

Based on the results and limitations of the study, there are several possible recommendations for further research on the relationship between students' academic adjustment and motivation for learning science. These include:

Longitudinal Studies

Conducting longitudinal studies that track changes in academic adjustment and motivation for learning science over time could provide a more comprehensive understanding of the relationship between these constructs.

Qualitative Research

Conducting qualitative research, such as focus groups or interviews, could help to provide a more in-depth understanding of the factors that contribute to academic adjustment and motivation for learning science, particularly from the perspective of students themselves.

Multivariate Analysis

Conducting multivariate analyses that control for other factors that could be influencing academic adjustment and motivation for learning science, such as socio-economic status or prior academic achievement, could help to establish a clearer relationship between these constructs.

Interventions

Conducting interventions that focus on improving academic adjustment, such as providing academic support or reducing stress, and measuring the impact of these interventions on students' motivation for learning science could help to establish a causal relationship between these constructs.

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