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College Majors and their Harmony with Students' Multiple Intelligences

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تناغم التخصص العلمي مع ذكاءات الطلبة المتعددة

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ABSTRACT

This study aims to explore the harmonisation of scientific specialisation for undergraduate science students using multiple intelligences (MI), their relationship to academic achievement (GPA) and the students' attitudes towards science. The sample consists of 198 male and female students chosen randomly from different year groups in the departments of physics and chemistry at Al-Qunfudah College at Umm Al-Qura University in Saudi Arabia. The study used a tool to survey MI and a questionnaire to measure the sample's attitudes towards science. The researcher obtained the students' GPAs from the college administration department. The results showed that the ranking of intelligences for the sample, respectively, was existential, logical, interpersonal, kinaesthetic, naturalistic, visual, intrapersonal, linguistic and musical. There was consistency between the levels of students' MI with their science specialisation. There was no significant correlation between the levels of study, GPA variables and attitudes towards science. There was a significant and positive increasing correlation between GPA and each of the following MI: logical, intrapersonal and existential. There was a significant difference between attitudes towards science in favour of chemistry, a significant difference between the medians of existential intelligence in females and a significant and positive increasing correlation between the attitudes towards science and existential intelligence.

الملخص

تهدف هذه الدراسة إلى معرفة مدى تناغم التخصص العلمي لطلبة البكالوريوس في العلوم التطبيقية بجامعة أم القرى مع ذكاءاتهم المتعددة، وعلاقته بتحصيلهم الأكاديمي (المعدل التراكمي)، واتجاهم نحو العلوم. تكونت عينة الدراسة من (198) طالباً وطالبة تم اختيارهم عشوائيًا من جميع المستويات الدراسية، في أقسام الفيزياء والكيمياء في كلية القنفذة فرع جامعة أم القرى بالمملكة العربية السعودية، واستخدمت الدراسة أداة لمسح الذكاءات المتعددة، وكذلك استبياناً لقياس اتجاهات العينة نحو العلوم. ومن خلال التحليل أظهرت النتائج أن ترتيب الذكاءات للعينة كان جاريًا وفق النسق التالي: الوجودي، ثم المنطقي، ثم الذاتي، ثم الحركي، ثم الطبيعي، ثم البصري، ثم الاجتماعي، ثم اللغوي، ثم الموسيقي في المرتبة الأخيرة. يمكن القول أن هناك تناغمًا وانسجامًا بين مستويات ذكاء أفراد العينة وتخصصهم العلمي، كما لا توجد علاقة ارتباطية بين مستويات الدراسة والمعدل التراكمي والاتجاه نحو العلوم. ومن النتائج المحصّلة أيضًا وجود ارتباط إيجابي بين المعدل التراكمي وكل من الذكاءات التالية: المنطقي، والذاتي، والوجودي، مع وجود فرق مهم بين الاتجاهات نحو العلوم لصالح تخصص الكيمياء. ناهيك عن وجود فرق مهم بين متوسطات الذكاء الوجودي تجاه الإناث. مع قيام ارتباط إيجابي بين الاتجاه نحو العلوم والذكاء الوجودي.

1. Introduction

How do students choose their university specialisation? There is an interaction between a group of motivations, such as academic achievement in secondary school, testing abilities at university, the desire to find a suitable job after graduation, the love and enjoyment of studying the specialisation, opinions of parents and friends and the intelligence and ability of the students themselves. These are perhaps the most important motives that affect them and, in turn, influence scientific achievement at university, their attitude towards science and their enjoyment of the subject. The more relative the individual's intelligence and ability are to the requirements of the specialisation, the higher the proportion of adaptation and positivity towards science leading to a more enjoyable learning experience and the ability to excel (Alumran, 2006).

Gardner (1983) proposed a view of intelligence that differed from the traditional view of IQ in that it recognised multiple mental differences and intelligences. He called this the theory of multiple intelligences (MI). His definition of intelligence encompassed two basic parts. The first was human competence, which emerges in problem-solving skills. The second was the ability to create an effective product, thereby, laying the groundwork for new knowledge. The theory of MI represents a new concept that is based on the existence of nine types of intelligence. This theory has been adopted by many schools across the world.

This study attempts to identify the levels of MI in science students (male and female) at Umm Al-Qura University and their relationship with academic specialisation, scientific achievement and attitudes towards science. Are students' specialities compatible with their MI? Is the right student in the appropriate specialisation? Do these intelligences affect their attitude towards science?

2. Related Literature Review

Many Arabic and international studies have been conducted on this subject due to its importance. Ibrahim and Alsaeed (2017: 149) aimed to identify MI's relationship with the academic achievement of primary school pupils at the Mahalla Elementary School in Howtat Bani Tamim during 2016. The MI theory was applied to an experimental group of 10 sixth-grade students, and the results showed statistically significant differences at α=0.01 in favour of educational achievement in post-tests in remembering, understanding, problem-solving and overall achievement.

Ismaeel (2016: 162) designed a teaching model integrating MI and learning styles and investigated the effect of suggested MI on enquiry, thinking skills and attitudes towards science education. Fifty-two sixth and seventh-year students were divided into an experimental and control group in the science department at the Faculty of Education, Sirte University, Libya in 2012. The results showed statistically significant differences at α=0.05 between the mean scores of the experimental group and the control group

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students in the enquiry and thinking skills test. In some skills, the results were in favour of the experimental group. The results showed no correlation between enquiry, thinking skills and attitudes towards science teaching.

Alfrayhat (2015: 67) investigated MI levels in 450 male and female students at Ajloun University College in Jordan, according to instructional level (bachelor and intermediate diploma), gender and their relationship to achievement. A scale of 54 items distributed across nine MI was used, and the results revealed that MI were ranked, in order, as personal, social, linguistic, mathematical, physical, natural, existential, spatial, physical, kinetic and musical. The results also showed statistically significant differences in the levels of MI in favour of bachelor degree students and no significant statistical differences in the levels of MI attributed to gender. Finally, there was a correlation between the levels of MI and student achievement.

Abu Alula (2012: 451) tried to predict academic achievement using learning styles and MI. The study sample consisted of 242 fourth-year students in the Faculty of Education at Benha University in Egypt. After applying the learning styles and MI scale, the results showed that 1) The students' academic achievement could be predicted by reflective, sensing, verbal and sequential learning styles; 2) The students' academic achievement could be predicted by linguistic, logical and intrapersonal intelligences; 3) There was a positive correlational relationship at α=0.01 between students' degrees and reflective, verbal, visual, sequential learning styles and intrapersonal, linguistic, spatial and logical intelligences, respectively.

Balawy (2010: 136) attempted to identify the MI of students at Qassim University in Saudi Arabia in 2008 and explored the relationship between these intelligences with specific variables. A sample of 704 male and female students was selected in a random cluster manner representing different levels of education and colleges. An MI scale was used, and the results indicated that the most dominant intelligence among the students was social intelligence (52%), then personal, linguistic, existential, kinetic, spatial, natural, logical and musical, respectively. There were statistically significant differences in some types of intelligence due to gender variables, scientific achievements, specialisation, academic level and place of residence. Males outperformed females in four types: logical, existential, social and kinetic, while females outperformed in linguistic and spatial intelligence.

From the literature outlined above, the following has been noted.

- Previous studies have dealt with the theory of MI from several aspects, such as using MI strategies in teaching and studying their impact on students' achievement, learning style and motivation.
- Most of these studies showed the positive impact of this teaching strategy, such as raising the level of academic achievement and demonstrating a positive attitude towards the material, but some studies showed no relationship between MI and the level of academic achievement in students.
- Some studies built teaching models according to this strategy. Other studies looked at the relationship between scientific specialisation and MI.
- This study is a continuation of previous studies, specifically from the University of Umm Al-Qura in Saudi Arabia, which seeks to develop and improve the teaching process by guiding students towards the disciplines best suited to them.

3. Statement of the Problem

Saudi universities seek to develop and achieve the best outcomes compared to international universities. According to Gardner (1993, 1983), most people behave and perform tasks according to a special combination of intelligences (intelligence fingerprint) to solve the problems they face in life. If an individual has a low level of intelligence, they are not inclined to use the intelligence footprint, and if a task is performed that requires this type of intelligence, the individual performs it with less confidence and the achievement of the task does not meet the level of ambition. However, if an individual has a high level of intelligence, they will enjoy these types of tasks and, thus, can be creative or distinguished in the achievement of these tasks.

This study aims to reveal the relationship between scientific specialisation and intelligence. When a university student is distinguished in their specialisation and enjoys it, they will enjoy performing specialisation-specific tasks; they will make more effort, have more patience and demonstrate perseverance in achieving excellence and creativity. This requires consistency and harmony between the specialisation and the student's abilities and intelligences.

Hence, this study will explore the compatibility of university specialisation with the abilities of science students and their MI. In particular, it will investigate if the intelligences affect students' academic achievement and attitudes towards science and if academic achievement and the tendency towards science increase if there is greater harmony between MI and university specialisation.

4. Purpose and Research Questions

The levels of MI among a sample of science students at Umm Al-Qura University will be examined along with how the level of these intelligences affects scientific specialisation, academic achievement and attitudes towards science. The study attempts to answer the following questions:

4.1. Descriptive Questions:

- Q1: What are the levels of MI (logical, verbal, visual, physical, musical, interpersonal, intrapersonal, naturalistic and existential) in a sample of science students at Umm Al Qura University in Saudi Arabia?
- Q2: Is there harmony or consistency between the sample's scientific specialisations and the level of MI?
- Q3: What is the general attitude of students towards science?

4.2. Inferential Questions for MI:

- Q4: Is there a significant relationship (at a significance level of 0.05) between attitudes towards science and the MI of the students?
- Q5: Is there a significant difference (at α=0.05) between the mean of MI and the gender variant?
- Q6: Is there a significant difference (at α=0.05) between the mean of MI and the specialisation variant?

4.3. Inferential Questions for Attitude towards Science:

- Q7: Is there a significant difference (at α=0.05) between the mean of attitudes towards science and the gender and specialisation variables?
- Q8: Is there a significant relationship (at α=0.05) between MI, study level (year group) and GPA variables?
- Q9: Is there a significant relationship (at α=0.05) between attitudes towards science, each MI level and GPA variables?

5. Limitations

This study is limited to the nine MI included in the multiple intelligence survey tool: logical, verbal, visual, physical, musical, interpersonal, intrapersonal, naturalistic and existential intelligence. It is also limited to students of chemistry and physics at the Al-Qunfudah College, Umm Al-Qura University because the biology and geology departments are located in different colleges. This study was conducted in the first semester of the academic year 2019–2020.

6. Significance

The Saudi Ministry of Education has asked for development and improvement in the education process at schools and universities across Saudi Arabia. This research was conducted in response to that request, and the study of MI and its application in science education is expected to provide information that may help teachers develop and enhance these intelligences in their students.

The research can contribute to predicting the most appropriate scientific specialisation for individual students by using information about their abilities and intelligences. This will result in student excellence and creativity in their specialisation and outstanding academic achievement.

This study may help teachers and university admissions departments guide students towards disciplines that are compatible with their abilities and MI, attracting students who have scientific and logical intelligence and positive attitudes towards science to study scientific disciplines. Thus, this study, together with other studies, may contribute to the development of new tools used in the university admissions system.

7. Hypotheses

The following hypotheses will be tested on the sample:

- There is no statistically significant relationship between the nine intelligences and the students' academic achievement (GPA).
- There is no statistically significant relationship between MI and the students' attitudes towards science.
- There are no statistically significant differences in the level of MI attributed to the gender variable.
- There are no statistically significant differences in GPA attributed to the gender variable.
- There are no statistically significant differences in the average attitudes towards science attributed to the gender variable.

8. Operational Definitions

Multiple intelligences: Mental abilities defined in light of the concept of MI proposed by Gardner (1983).

Attitudes towards science: A positive or negative feeling borne by experience that influences us to prefer or not prefer some things or actions. In this study, it is measured by an attitude scale of science that is designed for this purpose.

Harmonisation of the level of intelligence within the specialisation: The extent of homogeneity and the compatibility of intelligence with students' scientific specialisation at the university. It is measured by analysing the requirements of the science specialisation that are then linked to the abilities and intelligence required by the specialisation.

Academic achievement: The extent to which students achieve the required goals in their courses. It is measured by the cumulative GPA across all courses at the college.

9. Methodology

9.1. Population and Sample:

The study population consists of 753 chemistry students and 170 physics students at Umm Al-Qura University during the first semester of the academic year 2019–2020. Al-Qunfudah College was chosen because it is one of the largest colleges in the university and includes the department of chemistry and physics; the researcher also works in the department, which makes the study feasible.

The study sample comprises 198 male and female students who were selected using the stratified random method representing all levels and different specialities (chemistry and physics). Table 1 shows the distribution of the study sample according to its variables.

Table 1: Distribution of the study sample according to its variables

Variable	Category	Frequency	Percentage %
Gender	Male	118	59.6
	Female	80	40.4
	Total	198	100.0
Specialisation	Chemistry	158	79.8
	Physics	40	20.2
	Total	198	100.0
Levels (year groups)	1st year	46	23.2
	2nd year	56	28.3
	3rd year	70	35.4
	4th year	26	13.1
	Total	198	100.0
GPA	Mean	2.4053	
	Standard deviation	0.80510	
	Minimum	0.87	
	Maximum	4.98	
	Skewness	0.265	
	Kurtosis	-0.674	

9.2. Tools:

The researcher used different tools to survey MI and measure attitudes towards science. The GPA and the sample's specialities were obtained from the Department of Admission and Registration at the college. The following is an explanation of how the tools were set up.

9.2.1. Multiple Intelligence Survey Tool

The researcher developed a tool to scan nine MI. The tool was based on work by Alumran (2006: 34), which is characterised by good validity and reliability coefficients and is suitable for university students. The nine MI include musical-rhythmic, visual-spatial, verbal-linguistic, logical-mathematical, bodily-kinaesthetic, intrapersonal, interpersonal, naturalistic and existential intelligence. Each type of intelligence included a set of 10 paragraphs describing the behaviour associated with it. Each paragraph had a 10-point scale for each student to determine to what extent it applied and to score themselves. The maximum score for each intelligence was 100, and the minimum score was 10.

The tool was applied to a survey sample, and the average time of the first five students and the last five students was calculated; 30 minutes was considered an appropriate time to complete the survey.

The tool was examined by eight specialists in educational psychology and evaluation from different universities to verify the validity of the questions and their appropriateness to measure the desired goal. Some items were modified according to the reviewers' feedback. Instructions for answering the questions were explained to the sample before they started the survey.

The researcher investigated the reliability coefficient by using the tool with an exploratory sample using the Cronbach Alpha formula. The reliability values of internal consistency coefficients of each intelligence ranged from 0.76–0.87: logical-mathematical (0.76), linguistic (0.81), visual-spatial (0.77), bodily-kinaesthetic (0.82), naturalistic (0.83), interpersonal (0.80), intrapersonal (0.79), musical (0.84) and existential (0.87).

9.2.2. Attitude towards Science

The researcher developed a tool to measure the students' attitudes towards science after reviewing studies from Koksal and Yel (2007: 237) and Hillman et al. (2016: 211).

The dimensions of the scale and its fields were determined in three dimensions: interests and tendencies, science and its difficulties and the social implications of science. From these dimensions, the researcher developed 22 paragraphs within the scale. The paragraphs were developed along the lines of a Likert scale (strongly agree, agree, unsure, disagree and strongly disagree) and were ranked from 5–1, respectively.

The tool was applied to a survey sample, and the average time of the

first five students and the last five students was calculated; 20 minutes was considered an appropriate time to complete the survey.

The tool was examined by nine specialists in science teaching methods and educational evaluation from different universities to verify the validity of the tool items. The notes were reviewed and adjustments were made.

In terms of reliability, the internal consistency of the Cronbach Alpha coefficient for the dimensions of scale were scientific interests (0.78), the difficulty of science (0.76), the social implications of science (0.80) and total scale (0.83).

10. Results and Discussion

The researcher divided the analysis into two parts: descriptive and inferential.

10.1. Descriptive Analysis:

Table 1 shows that the student sample was nearly 60% male and just over 40% female; just under 80% were chemists and just over 20% studied physics. The majority of students were in third year (36%), followed by second-year students (28%), first-year students (23%) and fourth-year students (13%). The mean GPA was 2.41 with a standard variation (SD) of 0.81, with skewness (SK) at 0.27 and kurtosis (KU) at -0.67, which means that the distribution of the GPA variable was normalised around the mean value.

The researcher answered the enquiry questions about each dependent variable separately using descriptive statistical procedures, which are the mean and SD.

10.1.1. Q1: What are the levels of students' MI?

Table 2: The mean and SD of the students' multiple intelligences

MI	Mean	SD	SK	KU	Normality	Rank
Linguistic	28.9697	9.39862	-0.265	-0.342	Yes	8
Logical	35.7172	8.00766	-0.838	1.130	Yes	2
Visual	32.6566	13.31627	3.081	27.462	No	6
Bodily	34.3535	9.72079	-0.328	-0.363	Yes	4
Musical	28.0859	11.24655	-0.179	-0.811	Yes	9
Interpersonal	34.7879	9.51117	-0.656	0.052	Yes	3
Intrapersonal	31.1061	10.20321	-0.136	-0.764	Yes	7
Naturalistic	33.1869	10.74440	-0.567	-0.409	Yes	5
Existential	46.5051	44.12209	9.305	89.201	No	1

Table 2 demonstrates that all of the intelligences had a mean of less than 50% with a large SD, which means that the students had low scores in intelligences with non-homogeneity among students.

The maximum score was in existential intelligence with a mean of 46.51/100 and SD 44.12. Logical intelligence was ranked second with a mean of 35.7172 and SD 8.00766. Interpersonal intelligence was ranked third with a mean of 34.7879 and SD 9.51117. Bodily-kinaesthetic intelligence was fourth with a mean of 34.3535 and SD 9.72079. This was followed by naturalistic intelligence (mean: 33.1869; SD: 10.74440), visual-spatial (mean: 32.6566; SD: 13.31627), intrapersonal (mean: 31.1061; SD: 10.20321), linguistic (mean: 28.9697; SD 9.39862) and finally, musical (mean: 28.0859; SD: 11.24655).

10.1.2. Q2: Is there harmony or consistency between the sample's scientific specialisations and the level of MI?

This was measured by analysing the requirements of the science specialisation and linking them to the abilities and intelligence required by the specialisation. Science specialisation requires a high level of logical intelligence, and as it was ranked second (Table 2), we can surmise that there is harmony, or consistency, between the levels of students' intelligences with their science specialisation. Furthermore, the mean of the MIs were all less than 50% with an abnormal distribution of visual-spatial and existential intelligence (according to the kurtosis and skewness values), which is demonstrated in Figure 1.

Figure 1: Histogram and normal curve of multiple intelligences

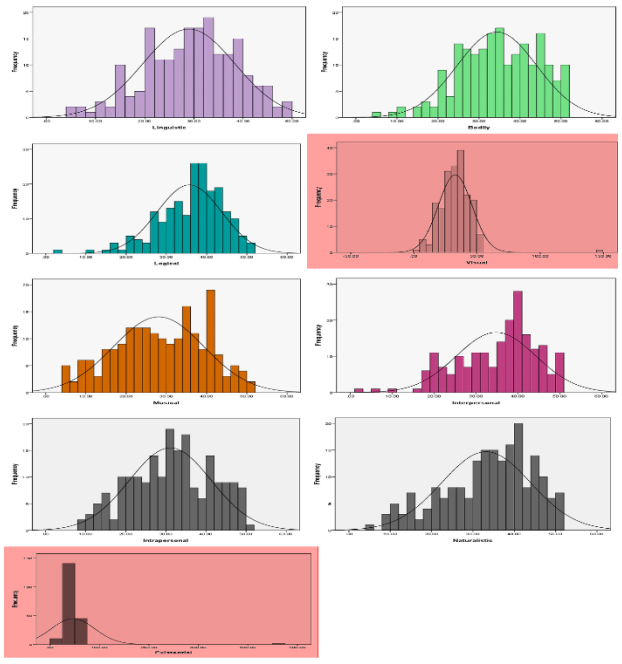

Figure 1 shows that the mean distributions of all MI were normal, except for visual and existential intelligence. This means that we can use parametric statistical procedures when connecting them with demographic variables (for all MI, including the two that were not since the sample size was more than 30).

10.1.3. Q3: What is the general attitude of students towards science?

The researcher used the interpretation rule that related to the fifth Likert scale, where strongly disagree had a mean value of 1.00–1.80, disagree had a mean value of 1.81–2.60, neutral had a mean value of 2.61–3.40, agree had a mean value of 3.41–4.20 and strongly agree had a mean value of 4.21–6.00. Table 3 shows the mean and SD of the students' responses to the items on the scale.

Table 3: Mean and standard deviation of responses to students' attitudes towards science

Item number	Mean	Standard deviation	Rank	Interpretation
1	3.6313	0.90707	10	Agree
2	2.7980	1.26635	17	Neutral
3	3.6313	1.44279	11	Agree
4	3.4545	1.16874	13	Agree
5	3.8131	1.20086	7	Agree
6	4.2121	0.99003	3	Strongly agree
7	3.7071	1.19008	8	Agree
8	4.0354	1.00444	6	Agree
9	2.4899	1.14767	20	Disagree
10	4.0505	0.91656	5	Agree
11	4.1818	0.85927	4	Agree
12	4.2525	0.90507	2	Strongly agree
13	2.5253	1.29304	19	Disagree
14	2.1616	1.07776	22	Disagree
15	4.2626	0.88514	1	Strongly agree
16	3.4091	1.07549	14	Agree
17	2.5404	1.47600	18	Disagree
18	2.8384	1.15065	16	Neutral
19	3.6566	1.20204	9	Agree
20	2.4798	1.26535	21	Disagree
21	3.0202	1.23798	15	Neutral
22	3.6010	1.29717	12	Neutral
All items	3.4000	0.27232		Agree
	Sk =0.255	KU = .557		

Table 3 shows that the general attitudes of students towards science was good to a large degree as the total mean of all responses to items on the attitude scale was 3.40 with an SD of 0.27. This indicates that the students agreed on all items since the SD value was less than 1. In terms of the skewness and kurtosis values, the distribution of responses about attitudes towards science was normalised (SK was less than 1 and KU was less than 3).

The fifteenth paragraph was ranked highest; this statement suggested that science contributes to creating better opportunities for future generations. Paragraph 12 was ranked second, were

students thought that science made lives healthier. Third was paragraph 16, which indicated that students would eventually like a job related to science; this reflects students' positive views about the subject.

Figure 2: Histogram and normal curve of the total mean of all items about attitudes towards science

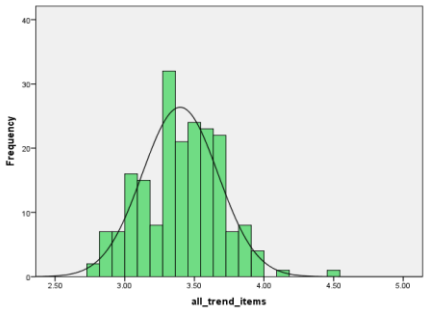

Figure 2 shows that the distribution of all responses to the items on the scale was normalised, which means that we can use parametric statistical procedures when connecting them with demographic variables.

10.2. Inferential Analysis for MI:

The researcher used inferential statistical procedures in this section (parametric statistical procedures) by connecting the MI variable with demographic variables using the answers to questions on differences and correlations.

10.2.1. Q4: Is there a significant relationship (at α=0.05) between attitude towards science and the MI of the students?

The researcher used the Pearson correlation coefficient as a parametrical statistical test to determine the relationship between each of MI and attitudes towards science. The Spearman correlation coefficient was used as a non-parametric statistical procedure to measure attitudes towards science and visual and existential intelligences as their distribution was not normal.

Table 4: Pearson and Spearman correlation coefficients between attitudes towards science and study levels, GPA and multiple intelligences

Variables			Person correlation	Spearman correlation
Study levels (Year group)	Intelligence	Linguistic	0.078	
		Logical	0.034	
		Visual		-0.096
		Bodily	-0.047	
		Musical	-0.049	
		Interpersonal	-0.043	
		Intrapersonal	-0.025	
		Naturalistic	-0.020	
		Existential	0.078	-0.015
	Attitude towards science		-0.001	
GPA	Intelligence	Linguistic	-0.060	
		Logical	0.225**	
		Visual		-0.039
		Bodily	0.058	
		Musical	-0.086	
		Interpersonal	-0.048	
		Intrapersonal	0.178*	
		Naturalistic	0.068	
		Existential		0.201**
	Attitude towards science		-0.086	
Attitude towards science	Intelligence	Linguistic	0.119	
		Logical	-0.128	
		Visual		0.094
		Bodily	-0.054	
		Musical	-0.011	
		Interpersonal	0.024	
		Intrapersonal	0.092	
		Naturalistic	0.095	
		Existential		0.150*

* Correlation is significant at level 0.05 (2-tailed) ** Correlation is significant at level 0.01 (2-tailed)

Table (4) demonstrates that there was no significant correlation at level 0.05 between attitudes towards science and linguistic, logical, visual, bodily, musical, interpersonal, intrapersonal and naturalistic intelligences. However, there was a significant and positive increasing correlation between attitudes towards science and existential intelligence with a value of 0.15.

The interpretation could be that the entire sample was Muslim because the highest-ranked intelligence was existential (from Table 4). There is a relationship between Islam and science: science calls for thinking, and Islam calls for knowledge, research, thinking and inference to the creator.

10.2.2. Q5: Is there a significant difference (at α=0.05) between the mean of MI and the gender variant?

The researcher used t-tests for independent samples as a parametrical statistical test for linguistic, logical, bodily, musical, interpersonal, intrapersonal and naturalistic intelligences.

Table 5: T-test for independent samples to determine the differences between the mean of MI and attitudes towards science regarding gender and specialisation variables

Variables			Mean	t-value	Degrees of freedom	Sig
Attitude towards science	Gender	Male	3.3910	-0.429	196	0.668
		Female	3.4080			
Linguistic		Male	28.0932	-1.600	196	0.111
		Female	30.2625			
Logical		Male	36.7458	2.217	196	0.028
		Female	34.2000			
Bodily		Male	33.5424	-1.430	196	0.154
		Female	35.5500			
Musical		Male	27.1610	-1.409	196	0.160
		Female	29.4500			
Interpersonal		Male	33.7797	-1.822	196	0.070
		Female	36.2750			
Intrapersonal		Male	30.4068	-1.172	196	0.242
		Female	32.1375			
Naturalistic		Male	33.9407	1.200	196	0.231
		Female	32.0750			
Linguistic	Specialization	Chemistry	29.8544	2.673	196	0.008
		Physics	25.4750			
Logical		Chemistry	35.1709	-1.921	196	0.056
		Physics	37.8750			
Bodily		Chemistry	34.1392	-.616	196	0.539
		Physics	35.2000			
Musical		Chemistry	28.6582	1.427	196	0.155
		Physics	25.8250			
Interpersonal		Chemistry	34.9304	.418	196	0.676
		Physics	34.2250			
Intrapersonal		Chemistry	31.5000	1.080	196	0.281
		Physics	29.5500			
Naturalistic		Chemistry	32.7152	-1.229	196	0.220
		Physics	35.0500			
Attitude towards science		Chemistry	3.4197	2.272	196	0.024
		Physics	3.3114			

Table 5 shows no significant differences between the mean of linguistic, bodily, musical, interpersonal, intrapersonal and naturalistic intelligences regarding the specialisation variable as the significant values of t-tests were greater than 0.05. However, there was a significant difference in the mean of logical intelligence as the significant value of the t-test was less than 0.05 towards males. This means that male students had significantly more logical intelligence than female students.

As the distribution of visual and existential intelligences was not normalised, a Mann-Whitney test was used as a non-parametric test.

Table 6: Result of the Mann-Whitney tests to determine the differences between the medians of visual and existential intelligence regarding specialisation and gender variables

MI	Variables		Mean Rank	Z-value	Sig
Visual	Gender	Male	84.15	-4.581	0.0001
		Female	122.14		
Existential		Male	98.74	-0.228	0.820
		Female	100.62		
Visual	Specialization	Chemistry	104.20	-2.293	0.022
		Physics	80.95		
Existential		Chemistry	98.39	-0.547	0.584
		Physics	103.90		

Table 6 shows no significant difference in the medians of existential intelligence as the significant value in the Mann-Whitney test was greater than 0.05. However, there was a significant difference in the medians of visual intelligence for females because the significant value in the Mann-Whitney test was less than 0.05. This indicates that female students have significantly more existential intelligence than male students.

From these results, it could be interpreted that intelligence by gender is a subject of discussion in educational literature. Some studies have seen differences in intelligence by gender (Voyer and Voyer, 2014), while others have found no difference (Nisbet et al., 2012). There does not seem to be a consensus on it. This study found that there was a difference in intelligence by gender, and this is probably attributed to tendencies, interest and practice.

10.2.3. Q6: Is there a significant difference (at α=0.05) between the mean of MI and specialization variable?

Table 5 shows no significant differences in the mean of logical, bodily, musical, interpersonal, intrapersonal and naturalistic intelligences regarding the specialisation variable as the significant t-test values were greater than 0.05. However, there was a significant difference in the mean of linguistic intelligence as the significant t-test value was less than 0.05 for chemistry. This indicates that the students studying chemistry have significantly more linguistic intelligence than those studying physics.

The distribution of visual and existential intelligence was not normalised, so the Mann-Whitney test was used as a non-parametrical test. Table 6 shows no significant difference in the medians of existential intelligence as the significant value of the Mann-Whitney test was greater than 0.05. However, there was a significant difference in the medians of visual intelligence as the significant value was less than 0.05 for chemistry students.

This means that the students whose speciality is chemistry have significantly more existential intelligence than those whose speciality is physics.

10.3. Inferential Analysis for Attitude towards Science:

The researcher used inferential statistical procedures in this section (parametric statistical procedures) by connecting the attitudes towards science variable with demographic variables using the answers to difference and correlation questions.

10.3.1. Q7: Is there a significant difference (at α=0.05) between the mean of attitude towards science and the gender and specialization variables?

Table 5 shows no significant differences between the mean of attitudes towards science regarding the gender variant as the significant t-test value was greater than 0.05. This means that male and female students have the same attitude towards science. There is a significant difference between the mean of attitudes towards science for chemistry students as the significant t-test values are less than 0.05. This means that students studying chemistry have a significantly more positive attitude towards science than physics students.

The differences in existential and linguistic intelligence in favour of chemistry students and their attitudes towards science could be because chemistry students have a higher high school GPA than physics students. This can be explained by the fact that the chemistry syllabus includes more practical courses than physics. Studying and working in a chemistry lab, performing experiments and observing interactions increase motivation and enjoyment of the subject. Furthermore, perhaps the nature of information in physics is more abstract and difficult. The researcher observed, by supervising student clubs and scientific exhibitions at the college, that chemistry students participated in these activities more than physics students.

10.3.2. Q8: Is there a significant relationship (at α=0.05) between MI, study levels and GPA variables?

This was examined using the Pearson correlation coefficient between each of the MI, study levels and GPA variables and using the Spearman correlation coefficient for visual and existential intelligence as their distribution was not normal.

Table 4 shows no significant correlation at 0.05 between study level and each of the following MI: linguistic, logical, visual, bodily, musical, interpersonal, intrapersonal, naturalistic and existential. There was no significant correlation between the GPA variable and linguistic, visual, bodily, musical, interpersonal and naturalistic intelligences. However, there was a significant and positive increasing correlation between the GPA variable and logical, intrapersonal and existential intelligences. This indicates that as the students' GPA increased, their logical, intrapersonal and existential intelligence also increased, and vice versa.

These results could be interpreted as whoever has a high level of logical intelligence would have no problem studying science as it would help with numbers, formulae and objects. Those with high intrapersonal intelligence know exactly what they need and can think and plan how to study. Existential intelligence could be the most important and central to all intelligence as it becomes a source of guidance for others (Covey, 2004). It increases students' self-awareness and motivates them to work in-depth and organise their study patterns.

10.3.3. Q9: Is there a significant relationship (at α=0.05) between attitude towards science, study levels and GPA variables?

Table 4 shows no significant correlation at the level of significance (0.05) between study level, GPA variables and attitudes towards science.

11. Conclusion and Recommendations

The results show that there is consistency between the levels of students' intelligences with their science specialisation, and in the light of the results of this study, the researcher recommends the following: Conduct other studies in other colleges in different disciplines. And use a MI tool to detect and predict students' abilities. Also, work on developing the university admission system using MI tests.

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