



INTEREST AND ATTITUDE OF UNDERGRADUATE BIOLOGY STUDENTS TOWARDS COURSES WITH MATHEMATICAL CONTENTS IN PUBLIC UNIVERSITIES OF OSUN STATE

Akanbi Adekemi O¹, Osuala Rita O²

¹akanbi.adekemi@gmail.com, ²ogechirita2015@gmail.com

Department of Science, Technology and Mathematics Education,
University of Ilesa, Nigeria

ARTICLE INFO

Article History

Accepted on July, 2025

Keywords: Interest, Attitude, Mathematics courses (MC), Biology education, Undergraduate, Public Universities

ABSTRACT

The study investigated the interest and attitude of Undergraduate Biology Education (UBES) students towards courses with mathematical content (MC) in public universities of Osun State. It assessed the level of interest shown towards courses with MC, and the attitude of students towards courses with MC was also determined, among others. The population comprised 312 UBES from 200-400 levels, and a total of 90 were sampled through stratified random sampling. An analytic descriptive survey method guided by four research questions was employed. Data was collected with a well-validated self-designed questionnaire titled "BESAMQ" on a 4-point Likert scale. The reliability coefficient through Cronbach's alpha was found to be 0.76. Data was analysed using appropriate descriptive and inferential statistics. It was revealed that adequate and effective support and classroom instructional approach from lecturers spur students' interest in learning mathematics. The interactive teaching method motivated their interest in the study of mathematics. Students' previous achievement in math significantly contributed to UBES' interest in courses with MC. UBES' attitude towards courses with MC (B coefficient 0.156, t-value=2.106, p-value=0.038. The difference in attitude of students according to gender is not significant enough (t=1.404, df=88, P-value >0.05). It was concluded that adequate and effective support and classroom instructional approach from lecturers motivated the students in studying courses with MC, among others. It was therefore recommended that teachers must always use more interactive and innovative strategies in teaching mathematics at the secondary school level to sustain students' interest and positive attitude towards the subject.

Introduction

Mathematics is a subject that has applications in virtually all fields of study. This is one of the core subjects for all students at all levels, and a foundation of all scientific processes. Alechenu (2012) describes mathematics as the “queen” of the sciences, without which it would be difficult for people to study other sciences like physics, chemistry, biology and computer science/information technology. According to Iji (2008), mathematics is described as a model of thinking which helps the learner to observe, report and reason logically about a problem and to communicate ideas, which makes it a vital tool in science. Adeneye and Abisola (2020) from their observation state that mathematics not only enhances problem-solving and analytical skills of students but also promotes their logical, functional and aesthetic skills. Mathematics helps in modelling. Mathematics can construct models of the solution processes. With the construction of such models, predictions can be made, and certain processes can be optimised. Mathematics is used in biology for basic, raw data gathering that is useful in tracking changes over time. Biostatistics uses statistical analyses to form conclusions about biological phenomena, such as drawing comparisons or correlations between biological variables. The subject also allows biologists to describe how molecules move in and out of cells, how bacteria shuttle through blood vessels, how drugs get broken down in the body and many other physiological processes. Even though adequate knowledge of mathematics is necessary in producing versatile and resourceful graduates needed for national transformation, it appears from a cursory look at the situation that students outside of the core mathematics department, but with some mathematics content, have a deep-seated fear of mathematics, otherwise known as a phobia. This fear is also exhibited by students who opt to study biology and biology-related courses in tertiary institutions. This category of students only makes concerted efforts to make a credit pass in mathematics, knowing that mathematics is an entry requirement, but with the hope that when they enter the University, they will not be required to take mathematics courses. These students fail to realise that some knowledge of mathematics is required for proper understanding of certain concepts in Biology. Studies over the past decade show that approximately 50% of life science students lack confidence in their mathematical abilities, and as a result, students often adopt a rigid attitude to learning mathematics. Olaniyan and Salmon (2015) pointed out that mathematics phobia is regarded as a mathematics weakness in students that deals with the psychological dimension of learning. A prolonged feeling of mathematics phobia impacts negatively on the interest of students in the subject.

Lack of interest in mathematics has direct implications for students' involvement in areas that require a strong mathematics background, including science, technology, engineering and mathematics (STEM) disciplines and careers, particularly for females. Lower interest is closely related to lower performance on mathematics-related achievement tests and lower grades in mathematics (Betz, 2010), less interest in taking challenging mathematics curricula before enrolling in College (Nosek, 2002), and less interest in pursuing a career in STEM Disciplines (Usher, 2009). Usher further states that females express less interest in mathematics than their male peers, and some studies link that lower interest to fewer females pursuing careers in STEM fields. The study of Ouek, et.al (2018) on relationships between affective factors, classroom instructional approach, interest, and motivation in mathematics among primary school students showed that positive affective factors, engaging instructional approaches, and intrinsic motivation were significantly related to increased interest and motivation in mathematics.

Attitudes of students towards learning are important factors in the learners' levels of goal setting, problem-solving abilities, their beliefs towards learning, their inner and external motivations in the process of learning and all the academic performances they perform. Being a successful learner starts with having a positive attitude towards learning. A positive attitude allows the students to relax, remember, focus and absorb information as they learn. Scholars have viewed attitude in several ways. For instance, Ngogo (2014) defines attitude as the accumulation of information about an object, person, situation or experience which forms an individual's opinion about or predisposition towards that thing. Achieng (2012) sees attitude as the way one thinks and feels about an act towards an objective and ideas. Fishbein and Ajzen (2010) further describe attitude as an inner feeling expressed by an individual that indicates a positive or negative willingness of the individual towards an object.

On the matter of attitude of students towards mathematics learning, Hashim et.al (2021), among other researchers, state that students' factors, attitude, are the key contributors to academic performance in mathematics. A study by Xu et al. (2016) investigated the relationship between students' interest and attitude in learning mathematics. Results showed that interest affected students' attitudes toward the subject. It also revealed that students' interest in learning the mathematics subject influenced students' attitude toward learning mathematics courses. Thus lack of interest and negative attitude towards learning mathematics was attributed to a large extent to low achievement in the subject.

Tubunemi and Ibiene (2020) carried out a study to determine the attitude of undergraduate biology education students of Ignatius Ajuru University of Education towards

mathematics and also to ascertain whether gender influences their attitude towards mathematics. Results indicated that there was no significant difference between male and female biology education students and their attitude towards mathematics. The study of Adeyemi & Ogunniyi (2020) on the relationship between interest and attitude towards learning mathematics among high school students revealed that significant positive correlation between interest and attitude towards learning mathematics, Interest in mathematics significantly predicted attitude towards learning mathematics, and that students' perceived difficulty and enjoyment of mathematics influenced their interest and attitude. Likewise, the study of Adeyemo & Oluwatobi (2023) on the relationship between attitude, interest, and achievement in mathematics among secondary school students showed a significant positive correlation between interest and achievement, a moderate positive correlation between attitude and achievement and interest was a stronger predictor of achievement than attitude. On gender differences, Oludipe & Owolabi (2022) investigated gender differences in interest and attitude towards mathematics among secondary school students in Nigeria. findings showed a significant gender difference in interest towards mathematics, no significant gender difference in attitude towards mathematics and that both males and females showed a positive interest and attitude towards mathematics. Following the background, this study is, therefore, designed to assess gender influence and factors affecting undergraduate biology education students' (UBES) interest and attitudes towards courses with mathematical content at Universities in Osun State.

The objectives of the study are to:

1. assess the level of interest undergraduate biology education students show towards courses with mathematical content at Universities in Osun State.
2. assess the attitude undergraduate biology education students have towards courses with mathematical content at Universities in Osun State.
3. determine the factors that contribute to undergraduate biology education students developing such interest and attitude towards courses with mathematical content at Universities in Osun State.
4. determine the influence of gender on undergraduate biology education students' attitude towards courses with mathematical content at Universities in Osun State.

The study was guided by the following research questions:

1. What is the level of interest undergraduate biology education students show towards courses with mathematical content at Universities in Osun State?
2. What attitude do undergraduate biology education students have towards courses with mathematical content at Universities in Osun State?
3. What factors contribute to undergraduate biology education students having such interest and attitude towards courses with mathematical content at Universities in Osun State?
4. What is the influence of gender on undergraduate biology education students' attitude towards courses with mathematical content at Universities in Osun State?

Statement of the problem

Over the years, informal observations have shown that undergraduates offering courses outside of core mathematics have mathophobia. This is not different from students who specialise in biology education. This issue stems from a complex interplay of factors, including a pervasive fear of mathematics during secondary education, which in turn results in a negative attitude towards the subject (Eze & Maduekwe, 2021; Okafor & Nwosu, 2022; Adebayo & Ede, 2021). The dread associated with mathematics and the resultant negative attitude exhibited by students can impede their active engagement in class. This lack of interest can detrimentally affect their comprehension of mathematical concepts. Subsequently, students' understanding of certain facets of biology that necessitate mathematical proficiency can be negatively affected. Consequently, a lack of mathematical proficiency and a negative attitude towards mathematics among students may hinder their comprehension of biological concepts that heavily rely on mathematical foundations (Pitt, 2020). From previous research, including that conducted by Adeyemo & Oluwatobi (2023), and Adeyemi & Ogunniyi (2020), consistently emphasise a strong connection between attitude and students' academic achievement. Against this background, the present study embarks on the tasks of assessing gender influence and factors affecting undergraduate biology education students' interest and attitudes towards courses with mathematical content at Universities in Osun State.

Methodology

The study adopted an analytic descriptive survey. The population of the study comprised level 2 (116), level 3 (75) and level 4(121) undergraduate Biology Education of Universities in Osun State, totalling 312 students. The researchers sampled 15 students, each from levels 2, 3 and 4, which gave a total of 90. The techniques used were stratified random sampling and simple

random sampling. The instrument used was named the Biology Education Students' Attitude to Mathematics Questionnaire (BESAMQ). The questionnaire has two sections, A and B. Section A elicited bio-data, while Section B has 20 items adapted from 4 positive Likert scales of strongly agree (SA), agree (A), strongly disagree (SD), and disagree (D) on attitude towards mathematics. The validity of the Instrument was determined by two experts in the Faculty of Education. The reliability coefficient of the instrument was $r = 0.76$ obtained through coefficient alpha by Cronbach as a measure of its internal Consistency. Data were analysed using frequency counts, mean and standard deviation, while regression analysis and t-test statistics were used for the hypotheses.

Results

Objective 1: To assess the level of interest undergraduate Biology education students show towards courses with mathematical content at the University in Osun State

Table 4.0: Distribution of the level of interest undergraduate Biology education students show towards courses with mathematical content at universities in Osun State

<u>Level of Interest</u>	Strongly Disagree	Disagree	Agree	Strongly Agree	mean	Std Deviation
	N(%)	N(%)	N(%)	N(%)		
I perform better in Mathematics	7(7.8)	16(17.8)	41(45.6)	26(28.9)	2.95	±0.88
Learning Mathematics theory is of interest	13(14.4)	19(21.1)	41(45.6)	17(18.9)	2.68	±0.94
The task involved in recalling maths concepts does not impede my interest	8(8.9)	14(15.6)	54(60.0)	14(15.6)	2.82	±0.80
In learning the subject						
Adequate affective support and classroom instructional approach from lecturers spur my interest in learning mathematics	3(3.3)	6(6.7)	64(71.1)	17(18.9)	3.05	±0.62

Interactive teaching methods 8(8.9) 4(4.4) 57(63.3) 21(23.3) 3.01 ± 0.80
 motivate my interest in the study of mathematics.

In interest, Table 4.0 above reveals that the majority of the undergraduate Biology education students, 71.1% (64) agreed that adequate affective support and classroom instructional approach from lecturers spur their interest in learning Mathematics. One of the factors that boosted students' interest, as shown in the table, is the interactive teaching methods, in which 63.3%(57) agreed that interactive teaching motivated their interest in the study of mathematics. The table also reveals that 35.5%(32) undergraduate biology students either disagreed or strongly disagreed that learning mathematical theory was a task of interest to them.

Objective 2: To assess the attitude undergraduate Biology education students have toward courses with mathematical content at the University in Osun State

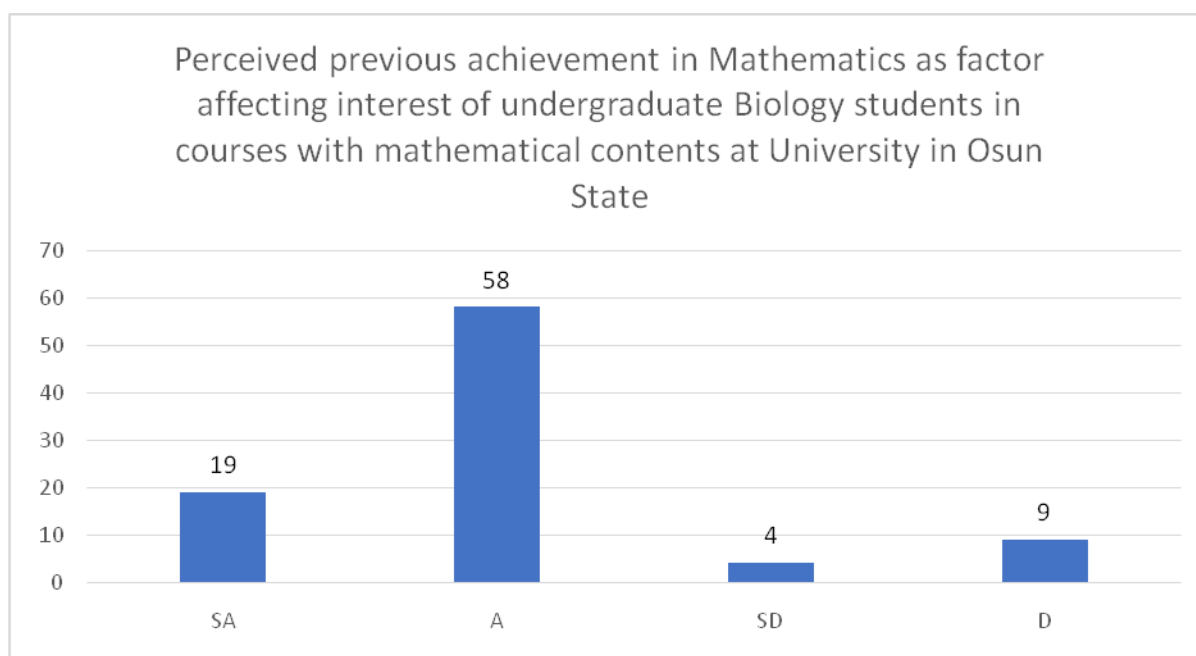
Table 4.1: Distribution of attitudes of undergraduate Biology education students towards courses with mathematical content at universities in Osun State

<u>Attitudes</u>	Strongly Disagree	Disagree	Agree	Strongly Agree	mean	Std Deviation
	N(%)	N(%)	N(%)	N(%)		
Mathematics is relevant to the study of Biology	10(11.1)	21(23.30)	50(55.6)	9(10.0)	2.64	± 0.81
The application of mathematical skills makes learning Biology easier	7(7.8)	30(33.3)	46(51.1)	7(7.8)	2.58	± 0.74
I am not often overwhelmed by complex mathematics problems in my study of Biology	7(7.8)	24(26.7)	42(46.7)	17(18.9)	2.76	± 0.84
Applying mathematics in Biology develops one's reasoning ability.	9(10.0)	15(16.7)	53(58.9)	13(14.4)	2.77	± 0.81
Application of mathematics does not give me fear and anxiety in my study of Biology	11(12.2)	12(13.3)	51(56.7)	16(17.8)	2.80	± 0.87

On attitude, Table 4.1 above shows that 23.3%(21) of respondents disagree, and 11.1%(10) of respondents strongly disagree that mathematics is relevant to the study of biology. The table reveals that 33.3%(30) of respondents disagree, and 7.8%(7) of respondents strongly disagree that the application of mathematical skill makes learning biology easier.

Objective 3: To determine the factors that contribute to undergraduate Biology education students developing such interest and attitude towards courses with mathematical content at the University in Osun State

Figure 1: Perceived previous achievement in Mathematics as a factor affecting interest of undergraduate Biology students in courses with mathematical content at University in Osun State (using frequency, percentages, mean and standard deviation)

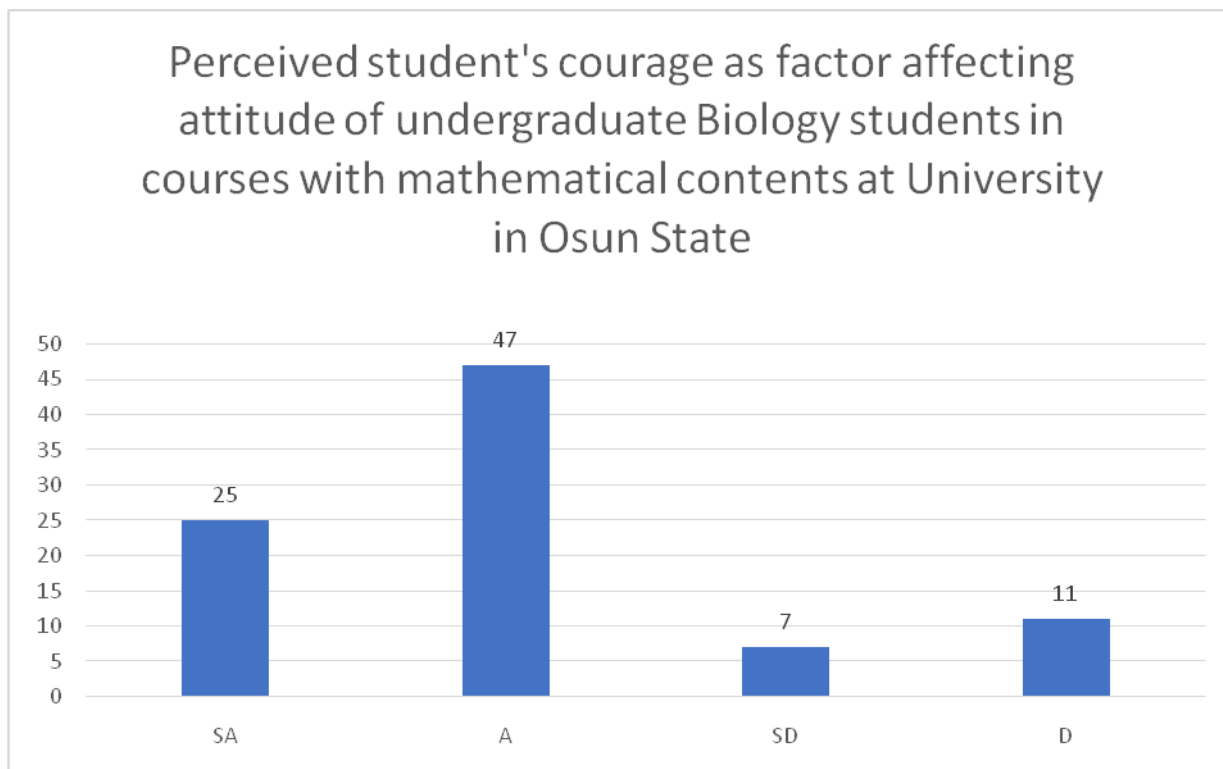


SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree

The figure above reveals the students perception on whether the previous achievement in mathematics affects their interest in courses with mathematical contents. Their response were coded and scored, strongly agree coded as 4 and strong disagree coded as 1, such that the higher the score the higher the interest. The mean interest were found as follows, Strongly Disagree (interest in maths =2.20, std dev= ± 0.58). Disagree(interest in maths =3.02, std dev= ± 0.57) Agree (interest in maths = 2.86, std dev= ± 0.50) Strongly Agree (interest in maths = 3.12, std dev = ± 0.60) . Interest of the students that strongly disagree were significantly lower to

the interest of those that strongly agree, with a statistical F ratio =3.644, df=(3,86) and p-value= 0.016

Figure 2: *Perceived student's courage as factor affecting attitude of undergraduate Biology students in courses with mathematical contents at University in Osun State (using frequency, percentages, mean and standard deviation)*



SA=Strongly Agree A=Agree D=Disagree SD=Strongly Disagree

Strongly Disagree (attitude toward math =2.08, std dev=±0.39). Disagree(attitude toward math =2.54, std dev=±0.42). Agree(attitude toward math = 2.65, std dev=±0.49) Strongly Agree(attitude toward maths = 3.08, std dev = ±0.51) . The attitude of the students that strongly agree were significantly different from those that just disagree, agree or strongly agree. Also attitude of those that either just disagree or agree were significantly different from those that strongly agree with a statistical F ratio=9.369, df=(3,86) and p-value= 0.001

Table 4.2: Factors contributing to undergraduate Biology education students' interest in courses with mathematical contents at University in Osun State(Using regression analysis)

	Interest in courses with mathematical contents				
	Unstandardized Coefficients		Standardized Coefficients	Significant level index	
	B Coefficient	Std Error	Beta	t-value	p-value
(Constant)	1.592	0.330	0.000	4.824	0.00
Interest and attitudes of students can be affected by their previous achievement in mathematics	0.165	0.078	0.208	2.114	0.038
Coping with nature of Mathematics is complex	-0.016	0.069	-0.025	0.234	0.816
Student's interest is jeopardized when they find the sequential procedures difficult.	0.001	0.074	0.002	0.014	0.989
Concentration on difficult keywords in Mathematics makes it complex.	-0.081	0.074	-0.119	-1.097	0.276
Teachers' quality and competence can affect students' interest and attitudes to learning Mathematics.	0.040	0.080	0.055	0.499	0.619
I am enthusiastic about offering Mathematics	0.195	0.078	0.315	2.494	0.015
I am not discouraged from courses having mathematical content.	0.184	0.072	0.279	2.558	0.012
Asking questions in Mathematics classes	-0.089	0.081	-0.142	-1.089	0.280

is exciting.

Mathematics-related courses are gender friendly.	0.199	0.075	0.292	2.663	0.009
Gender differences affect Mathematics courses	-0.163	0.067	-0.272	-2.422	0.018

Table 4.2 above revealed that the factors that significantly contributed to Biology education students' interest in courses with mathematical contents at the University in Osun State are: The previous achievement in mathematics, the students' enthusiasm, the students being courageous and some perceive gender related opinion.

Table 4.2 shows the regression analysis for finding the factors that contribute to undergraduate biology education students' interest in courses with mathematical content at universities in Osun State. Table 4.2 reveals that the students' previous achievement in mathematics significantly contributes to undergraduate biology education students' interest in courses with mathematical content at universities in Osun State, with a regression statistical index (B coefficient 0.165, t-value=2.114, p-value=0.038). It shows that the students' interest in courses with mathematical content will increase 0.165 times for every unit rise in perceived previous achievement in mathematics. Other factors that significantly contributed to undergraduate biology education students' interest in courses with mathematical content at universities in Osun State were: Students enthusiastic in offering mathematics (B coeff= 0.195, t-value=2.494, p-value significant=0.015), not being discouraged from having mathematical content (B coeff=0.184, t-value=2.558, p-value significant=0.012)

Table 4.3: Factors contributing to undergraduate Biology education students' attitude toward courses with mathematical content at the University in Osun State(Using regression analysis)

Attitude toward courses with mathematical content				
Unstandardized Coefficients		Standardized Coefficients	Significant level index	
B Coefficient	Std Error	Beta	t-value	p-value

(Constant)	1.155	0.340	0.000	3.401	0.001
Interest and attitudes of students can be affected by their previous achievement in mathematics	0.102	0.080	0.129	1.270	0.208
Coping with the nature of Mathematics is complex	-0.076	0.071	-0.120	-1.075	0.285
Students' interest is jeopardised when they find the sequential procedures difficult.	-0.021	0.076	-0.031	-0.277	0.783
Concentration on difficult keywords in Mathematics makes it complex.	-0.069	0.076	-0.102	-0.907	0.367
Teachers' quality and competence can affect students' interest and attitudes to learning Mathematics.	0.097	0.083	0.135	1.176	0.243
I am enthusiastic about offering Mathematics	0.114	0.081	0.185	1.414	0.161
I am not discouraged from courses having mathematical content.	0.156	0.074	0.238	2.106	0.038
Asking questions in Mathematics classes is exciting.	0.045	0.084	0.072	0.536	0.593
Mathematics-related courses are gender friendly.	0.123	0.077	0.182	1.599	0.114
Gender differences affect Mathematics courses	0.076	0.069	0.128	1.098	0.275

Table 4.3 above showed that the courage of the students contributed significantly to undergraduate Biology education students' attitude toward courses with mathematical content at the University in Osun, with a regression statistical index (B coeff=0.156, t-value=2.106, p-value significant=0.038). it implies that the students' attitude toward courses with mathematical content at the University in Osun will significantly increase 0.156 times, for every unit rise in students' courage, at $p < 0.05$

Objective 4: To determine the influence of gender on undergraduate Biology education students' attitudes towards courses with mathematical content at universities in Osun State.

Table 4.4: Descriptive statistics of undergraduate Biology education students' attitude towards courses with mathematical content at universities in Osun State by gender.

		Attitudes towards Mathematical Content			Interest in Mathematical content		
		N	Mean	Std Deviation	N	Mean	Std Deviation
Gender	Male	30	2.60	±0.57	30	2.81	±0.58
	Female	60	2.77	±0.54	60	2.95	±0.54

Table 4.5: Inferential of undergraduate Biology education students' attitude towards courses with mathematical content at universities in Osun State by gender.

Gender influence							
	t-value	df	Significant (2-tailed)	Mean Difference	Std Error Difference	Lower	Upper
Attitude	-1.404	88	0.164	-0.173	0.123	-0.418	0.072
Interest	-1.122	88	0.265	-0.140	0.124	-0.387	0.107

Table 4.4 above shows that the attitude of undergraduate Biology students by gender, the attitude of female students is high a bit than that of male students; however, the difference in attitude of students according to their gender is not significant enough, with a statistical t-test index ($t = -1.404$, $df = 88$) at $p\text{-value} > 0.05$.

Table 4.6: The Distribution of respondents' socio-demographic characteristics

		Frequency (N=90)	Percentage (%=100)
Gender	Male	30	33.3
	Female	60	66.7
Field of study	Biology	90	100.0
Department	Science & Tech Education	45	50.0
	STME	45	50.0
Institution	Obafemi Awolowo University	45	50.0
	Osun State University	45	50.0

Discussion of findings

The results of the study revealed that affective support and classroom instructional approach motivated the interests of the Undergraduates in courses with MC. It has been observed that teachers play a great role in motivating and sustaining the interest of students. When the approach to a subject is faulty, students' interests and participation in such subject (s) will be reduced. This is in line with the findings of Betz (2010), who discovered that lower interest in students is related to previous poor performance in mathematics. Findings from Quek et.al (2018) relayed that positive affective factors engaging instructional approach and intrinsic motivation were significantly related to interest and motivation in mathematics.

On the attitude of UBES towards courses with mathematical content, it was revealed by the findings of the study that the students did not agree that Mathematics is relevant to their study, thereby leading to a negative attitude towards any mathematics-related concepts. The study also reveals that the students did not believe in any way that mathematics skills are relevant to their studies. The study on the relationship between interest and attitude by Hashim et.al (2021) revealed a strong connectivity between interest and attitude of students towards learning. Also, the study of Adeyemi and Ogunniyi (2020) on the relationship between interest and attitude of high school students towards mathematics learning revealed that a significant positive correlation existed between interest and attitude towards learning math. It also revealed that interest in math significantly predicted attitude towards math and that perceived difficulty and enjoyment of

maths influenced students' interest and attitude. The study also revealed that students with strong courage have better sustained interest and a positive attitude towards mathematics.

It was revealed by the study that female Undergraduates possess a more positive attitude towards the course with MC. The study of Oludipe and Owolabi (2022) revealed that there was no significant gender difference in the attitude of students towards mathematics.

Conclusion

Based on the findings of the study, it was concluded that adequate and effective support and classroom instructional approach from Lecturers motivated the students in studying courses with mathematical content. The use of interactive teaching methods was a strong predictor of students' interest. The study further concluded that the previous performance of the UBES student in mathematics strongly affected the interest attitude towards the course with MC, and also developed their courage towards the course with MC. Previous achievement in math significantly contributed to UBES' interest in courses with MC. It also concluded that the courage of the students contributed significantly to UBES' attitude towards the course with MC. Statistically, gender has no significant influence on the UBES attitude towards Courses in MC.

Based on the conclusion, the study made the following recommendations:

1. Teachers should use more interactive and innovative strategies in teaching mathematics at the secondary school level to sustain students' interest and positive attitude towards the subject.
2. The teacher should also build students' confidence and courage in mathematics abilities through positive reinforcement, encouragement and motivation.

Reference

- Adebayo, O. O. & Ede, P. N. (2020). Mathematics Anxiety and Chemistry Achievement among Nigerian University Students. *Journal of Science Education*, 11(1), 1-10.
- Adeneye O. A. & Abisola O. L. (2020). Increasing mathematics achievement of senior secondary school students through differentiated instruction. *Journal of Educational Sciences* 4 (1), 1-19
- Adeyemi, T. & Oguniyi, M. B. (2020). Exploring the Relationship Between Interest and Attitude towards Learning Mathematics among High School Students. *Journal of Mathematics Education*, 13(2), 1-15.
- Adeyemo, S. A., & Oluwatobi, P. (2023). Exploring the Relationship Between Attitude, Interest, and Achievement in Mathematics Among Secondary School Students. *Journal of Mathematics Education*, 16(2), 1-15. Doi: 10.1177/00220507221143551.

- Alechenu, S. O. (2012). Gender item functioning in mathematics multiple-choice test items set and administered by the National Examination Council. *Journal of Mathematical Science Education*. Abuja: Federal Capital Territory, Nigeria, 4(1), 12-25.
- Eze, S. O. & Maduekwe, C. C. (2021). Mathematics Anxiety and Environmental Science Attitude among Nigerian University Students. *Journal of Environmental Education*, 10(2), 1-12
- Hashim, S; Masek, Mahthir B.N.S.M; Rashid A.H.A; and Nincarean D. (2021). Association of interest, attitude and learning habits in mathematics learning towards enhancing students' achievement. *Indonesian Journal of Science & Technology*, 6 (1), 113 -122.
- Iji, C.O (2008). Refocusing the school mathematics curriculum in line with Global challenges. *Proceedings of the Science Teachers Association of Nigeria*, 49, 226-230.
- Ngogo, J. L. (2014). Assessment of attitudes of secondary school students towards vocational education and Training in Tanzania: Case study of Mpwapwa District. Master's dissertation, Sokoine University of Agriculture.
- Nosek, C. (2002). A Social-cognitive approach to motivation and personality. *Psychological Review*, 95 (2), 256-273.
- Okafor, C. E., & Nwosu, A. C. (2022). Mathematics Phobia and Computer Science Interest among Nigerian Undergraduates. *Journal of Computer Science Education*, 12(1), 1-15
- Olaniyan, O., & Salmon, S. (2015). Mathematics Phobia among Secondary School Students in Nigeria: Causes and Consequences. *Journal of Education and Practice*, 6(20), 145-155.
- Oludipe, D. O. & Owolabi, O. O. (2022). Gender Differences in Interest and Attitude towards Mathematics among Secondary School Students in Nigeria. *Journal of Education and Gender*, 12(1), 1-12.
- Tubunemi, E. E. & Ibiene, A. B. (2020). Attitude of Undergraduate Biology Education Students towards Mathematics in Ignatius Ajuru University of Education, Port Harcourt, Nigeria. *Journal of Education and Human Development*, 9(2), 1-9
- Usher, S. (2009). *Self-theories: their role in motivation, personality, and development (Essays In social psychology)*. Philadelphia, PA: Psychology Press.
- Quek, H. F; Yeo, S. M, & Tay, E. G. (2018). The Relationship between affective factors, classroom instructional approach, and Interest and Motivation in Mathematics. *Journal of Mathematics Education*, 11(2), 147-162.
- Xu, J; Yuan, R; Xu, B; and Xu, M. (2016). Modelling students' interest in mathematics homework. *The Journal of Educational Research*, 109(2), 148-158.