Evaluating student satisfaction with blended learning styles in the post-COVID-19 era at Umm Alqura University

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ABSTRACT

This research aims to assess student satisfaction with blended learning styles in the post-COVID-19 era at Umm Alqura University, taking into consideration the variables of gender, study level, and academic major. The study utilizes a descriptive analysis methodology to evaluate student satisfaction, employing a sample of 248 students enrolled at Umm Alqura University during the 2021–2022 academic year. A satisfaction questionnaire was developed and administered to collect the necessary data from the participants, ensuring the validity and reliability of the questionnaire. The research findings indicate a high level of satisfaction among university students towards the various blended learning styles, namely the Rotation Model, Lab Rotation, Flipped Classroom, and Individual Rotation. Statistical analysis reveals no significant differences in the mean scores of student satisfaction across different study groups, indicating a consistent level of satisfaction with the blended learning styles, including individual rotation, flipped classroom, lab rotation, and rotation model. Furthermore, there are no statistically significant differences in satisfaction levels between male and female students. Similarly, no significant differences are observed in satisfaction levels between bachelor and postgraduate students. However, a statistically significant difference is found between scientific specialization students and literary specialization students, favoring the literary specialization students' approval of the blended learning style. These research findings contribute to the understanding of the blended learning environment and its associated styles. Moreover, the results highlight the need for further investigation into the effectiveness of blended learning and its various patterns in promoting diverse learning outcomes.

1. Introduction

The Corona pandemic that swept the world had many adverse effects on various sectors of society. The education sector is one of the most negatively affected sectors by this pandemic. David et al. (2020) reported that the Corona pandemic had pushed more than 180 countries worldwide to close their schools and universities by March 2020. Due to that pandemic, many changes and transformations in the education system occurred. The most important one is keeping students in their homes and dealing only with e-learning to enable hundreds of millions of students to learn after they lose their opportunity to go to their educational institutions (Yulia, 2020).

E-Learning refers to a mode of learning or training delivered online through a computer or any other digital device. Generally, it has many advantages, such as solving the problem of crowded lecture halls and classrooms. It provides an interactive learning environment allowing the learner to study from any place and time. Furthermore, it offers an opportunity for each learner to proceed in the study according to his abilities and capabilities. Moreover, it allows a private learning atmosphere, spreading learners' information and communication technology culture (Ismail, 2009; Basak et al., 2018). However, major obstacles appear through e-learning, including the weakness of human interaction leading to boredom from using technology. Weakening the role of the educational institution as a social system plays a

crucial role in socialization and weakness in self-discipline and time management (Ismail, 2009; Basak et al., 2018). David et al. (2020) and Hoofman and Secord (2021) added that many challenges have emerged during the Corona pandemic, including the inability of all students to use this system effectively in light of the pressure of use and the overload on network capacity. Many studies referred that blended learning may be the solution to overcoming the obstacles of e-learning. Bonk and Graham (2004) emphasized that blended learning is based on integrating face-to-face learning experiences in the classroom with learning experiences through communication networks and the Internet. Thus, it allows active independent learning and the development of personal relationships and encourages learners to exchange ideas, information, and experiences. Blended learning enables learners to have the opportunity to interact with their teacher and colleagues face-to-face through electronic and traditional means of interaction, helping strengthen human and social relations and attitudes of learners during education. Hence, it achieves a high level of satisfaction with the educational system besides achieving greater credibility in the evaluation process (Milheim, 2006; Chandra et al., 2022).

The emergence of the COVID-19 epidemic has accelerated the application of blended education in the 2019–2020 academic year as an integrated system based on a mixture of traditional education and e-learning in its various forms in the classroom. As it is an emerging system facing many problems and challenges, it requires thinking and reflection to address them differently. Then, the focus should be on the analysis and planning for the development of this system (Verde and Valero, 2021). Diabat (2013) mentioned that the study of blended learning and the identification of its methods, components, and design had become a crucial trend. Instructors can modify the style of education and become effective in improving learning outcomes. Many blended learning styles attempt to merge e-learning and traditional learning activities, such as rotation, Flex, Online lab, and Flipped Classroom. These styles differ in the roles of instructors, delivery method, spatial space, and study schedules (Han and Ellis, 2021; Horn and Staker, 2011; PERC, 2014; Tkachuk, 2017). Many studies have compared the effectiveness of these styles to reach the most effective blended learning styles and then adopted them. Kuzmina and Golechkova (2012) showed that the blended learning environments were based on face-to-face learning and some educational platforms (Pbworks and Wetpaint; BI HSE IELTS Class; LMS-HSE LMS eFront) at the National Research University Higher School of Economics improved students' academic achievement, making them more satisfied. No difference between the two blended learning styles (flexible/flipped class) exists to provide production skills of audio programs to students at the College of Education (Holm et al., 2022).

Suleiman and Al-Sayed (2016) studied the effectiveness of three blended learning styles (e-learning /traditional learning, traditional learning /e-learning, and synchronous) in developing achievement and electronic interaction skills among educational technology students, with a statistically significant difference favoring the third style. A study by Ismail et al. (2017) confirmed the effectiveness of each blended learning style (Flipped/flexible) in developing cognitive achievement and performance skills using some tools of Web 3.0 with statistically significant differences favoring the flipped learning group. Larsari et al. (2023) presented the station rotation model of blended learning as a generative technology in education. It covers applications and results of retrospective research on students' learning and performance at school. The study reviews previous studies and demonstrates that the station rotation model has a major influence on students' learning. It suggests the prospect of additional research employing this model of blended learning. The findings of this research could be useful for further exploration and implementation of the station rotation model.

Kintu et al. (2017) investigated the effectiveness of blended learning environments by analyzing the relationship between student characteristics/background, design features, and learning outcomes. While it doesn't specifically compare flipped learning and rotation learning styles, it provides insights into the predictors of blended learning effectiveness and the significance of design features and student characteristics in achieving positive learning outcomes.

However, discrepancies, especially among studies researching the most optimal blended learning styles. Perianto and Nur (2021) have suggested that blended learning will be the most used learning method in introducing learning after the COVID-19 pandemic. Moreover, Sancho et al. (2006) and Suleiman and Al-Sayed (2016) accentuated that the ideal mechanism for merging e-learning tools and traditional learning or synchronization between them has not been accurately determined until now.

The main objective of this research is to evaluate the students' satisfaction with the applied blended learning styles in the post-COVID-19 era at Umm Alqura University. It also aims to discover the most appropriate blended learning style that may raise the efficiency of the instructional system at Umm Alqura University in the post-COVID-19 era. Hence, it is proposed to be adopted as a prevalent pattern for providing university education. Also, it is based on the vitality of evaluating e-learning systems to identify the strength and weaknesses indicators and then help those in charge of decision-making prepare plans for the development of these systems to achieve the desired goals. Evaluating e-learning systems and blended learning approaches is vitally necessary to ensure effective use and positive effect on learners. The evaluation based on feedback from students, peers, and instructional designers can be used for blended course improvement. Knowing students' opinions and their satisfaction levels towards e-learning systems is one of the most

critical indicators invoked in the process of evaluating these systems (Palloff and Pratt, 2007; Savoie-Roskos et al., 2018; Al-Fraihat et al., 2020).

The study attempts to answer the following questions:

1. What is the level of student satisfaction with the blended learning styles (Rotation model: Lab rotation: Flipped classroom: Individual rotation) at Umm Alqura University?
2. Is there a difference in the student's satisfaction with the blended learning styles (Rotation model: Lab rotation: Flipped classroom: Individual rotation) at Umm Alqura University?
3. Does the student's satisfaction with the blended learning at Umm Alqura University differ according to gender (Male/Female)?
4. Does the student's satisfaction with the blended learning at Umm Alqura University differ according to the study level (Bachelor's/Postgraduate)?
5. Does the student's satisfaction with the blended learning at Umm Alqura University differ according to the academic major (Practical/Theoretical)?

2. Theoretical framework

2.1. Blended learning definition

Blended learning refers to the deliberate combination between face-to-face and online instructional activities to stimulate and support learning outcomes (Boelens et al., 2015).

Blended learning combines contact teaching with the instructor and has a self-contained setting using online learning (Hubackova and Semradova, 2016).

Bowyer and Chambers (2017) defined blended learning as a mixture of face-to-face and online learning. Cleveland-Innes and Wilton (2018) mentioned that the simplest blended learning definition is the deliberate usage of traditional classroom teaching methods and online learning tools for learners studying the same content in the same course. Therefore, blended learning in this research can be defined as a planned and deliberate integration between face-to-face and online instructional activities to create an effective learning environment that supports the easy achievement of desired learning outcomes for learners who are studying the same content in the same course.

2.2. Advantages of blended learning

We review what was mentioned by Suleiman and Al-Sayed (2016), Szadziewska and Kujawski (2017), and Chandra et al. (2022). The advantages of blended learning can be summarized as follows. 1) learners' skills development in manipulating data and information, 2) easier access to the learning materials, 3) enhancing social interaction among learners and instructors, 4) faster and better communication, 5) increasing the self-learning efficiency, 6) better attention during lectures, 7) increasing the motivation and positive trends towards learning community, 8) effective usage of lecture time, 9) achieving integration between the educational experiences gained from in-class learning and the experiences gained from online learning to enhance the academic achievement, 10) skills performance and attitudes towards learning, 11) better prepare for exams, 12) beneficial for self-development, 13) facilitating knowledge and skills acquisition 14) motivation for self-study of additional tasks.

2.3. Blended learning challenges

Many challenges face blended learning employment. Blended learning needs a new teaching culture, focusing on digital technologies as methodological tools, different theoretical perspectives, objectives, and personal points of view about blended courses. The cost of preparing ICT infrastructure, training and support of faculty members in using digital tools, and employing new instructional strategies are additional factors. The time and effort to re-design blended learning courses, student readiness for this approach, students' restricted access to technological resources, and a lack of innovative teaching strategies to address the digital generation of students are also critical. Teachers do not feel comfortable teaching within the blended learning program in the case of many students (Ghorab et al., 2013; PERC, 2014; Vaughan et al., 2017; Al-Agami, 2018).

2.4. Blended learning styles

There are several patterns for blended learning, mainly based on the merging strategy for e-learning and traditional activities. Han and Ellis (2021) referred that there are three patterns for blended learning as follows:

1. The first style: The Instructor explains the introduction to the lesson as a first step. Then, the learners continue studying the class through software or a website. The final step is the evaluation process, whether paper or electronic.
2. The second style: Learners acquire data and information at the beginning of the lesson through software or a website. After that, learners interact with the instructor face-to-face to complete the class inside the classroom. Then, paper or electronic evaluation follows.
3. The third style: The exchange occurs between online and face-to-face instruction. The learners move alternately between online activities and face-to-face activities until the completion of the lesson. Then a paper or electronic evaluation pursues.

Horn and Staker (2011) classified the blended learning patterns into five main groups:

1. Face-to-face driver: The instructor delivers most of the students' content directly through online teaching and inside the classroom.
2. Rotation: The students have a defined schedule of self-paced online and face-to-face learning in the classroom with the instructor.
3. Flex: The content is delivered through online platforms. The instructor provides online teaching and may provide direct support through small group sessions.
4. Online lab: Students have traditional study schedules. In addition, online lab platforms are employed to deliver the content to the students within the instructional institute.
5. Online driver: Students work remotely through the platforms and face-to-face, but face-to-face interaction is optional as needed.

PERC (2014) added that there are many styles for blended learning as follows:

1. Rotation model: Alternating traditional and online learning activities according to the directions and opinions of the faculty member.
2. Lab rotation: Alternating between face-to-face and online learning in technical laboratories located on campus.
3. Flipped classroom: Studying content remotely (online) and then attending classrooms to discuss and apply what has been studied online.
4. Individual rotation: Alternating traditional learning and online learning activities according to students' individual needs.

The authors indicated that blended learning styles in educational institutions could be classified according to many variables, such as the roles of instructors, delivery method, spatial space, and study schedules. However, Chaeruman (2011), in his study about how to implement blended learning in higher education, revealed that students prefer face-to-face instead of online instruction in the case of introduction. Students prefer online instruction for discussion activities through the discussion board, sharing, and reflecting through blogging with immediate feedback from the instructor. The instructor should pose the problem online on the discussion forum board before discussing it more deeply in the classroom through lectures or group presentations. Students prefer online activities for assignments but opt for face-to-face evaluations and tests. Students prefer online searching, reading, and assignments deemed as self-paced learning.

2.5. Blended learning evaluation

The Success of blended Learning depends on many factors, including the quality of the course and the virtual environment. It also depends on students' ability to make themselves organized in the e-learning environment and use all the tools offered by the LMS (Hubackova and Semradova, 2016).

Additionally, two things are essential for the success of blended learning programs. They are a comprehensive teacher or tutor training and ongoing evaluation (Bowyer and Chambers, 2017). Reed (2014) found that a lack of staff support/training and a lack of skills are the most crucial barriers to implementing blended learning programs at their institution. Pombo and Moreira (2012) suggested that ongoing evaluation during task development, rather than solely at the end of the program, gives a good evaluation process to judge the quality of the course.

Bowyer and Chambers (2017) mentioned that the evaluation process includes a combination of data about course outcomes (retention, attendance, and students' marks) and student engagement and satisfaction measures. Many researchers have created rubric-based frameworks for evaluating blended learning environments.

Fabbri et al. (2021) mentioned that the used rubrics should cover a broader range of factors, such as instructional design, the technology used, and students' program experiences.

There have been many attempts to introduce rubrics that can be used in blended learning evaluation (ION, 2008; Mirriahi et al., 2015; Bowyer and Chambers, 2017).

In addition, student evaluation is the most common method of course evaluation in higher education. Dziuban and Moskal (2011) mentioned that this type of evaluation could assist instructors in improving overall course effectiveness and determining whether course objectives were met.

Many studies aim to evaluate the effectiveness of blended learning, especially from the student's viewpoint.

The evaluation report of blended learning courses in the Faculty of Liberal Arts and Professional Studies and the Faculty of Health at York University in the Winter of 2012 revealed that 72% of students are satisfied with their blended learning courses (Owston et al., 2013).

Ghorab et al. (2013) concluded that teachers and students evaluated the blended learning program at the College of Applied Sciences in Gaza and stated that the requirements for blended learning classrooms are insufficient. The laboratories are not available for use all the time. The program has achieved its objectives of developing student's practical skills and increasing students' motivation to search for knowledge. Teachers did not feel comfortable teaching within the blended learning program due to the increased number of students.

Dos (2014) concluded that students' overall satisfaction was high after studying a blended course at Zirve University in Turkey.

Hubackova and Semradova (2016) showed that blended learning is acceptable and favored by students. Blended learning combines contact teaching with some constructivist principles and an

electronic teaching format. It is a suitable and required path for foreign language learning.

Al-Agami (2018) reported the obstacles of blended learning application in the secondary stage in Mubarak Al-Kabeer Governorate in Kuwait: The large amount of technical and administrative work is entrusted to the teacher. The length of time and effort spent planning and preparing the blended learning is cumbersome. There is a negative impact of Internet use on the attitudes and beliefs of female students. Moreover, a lack of self-learning skills for students exists. Then, evaluating and measuring the level of female students during the application of blended learning is difficult. Additionally, enough promotional incentives for female teachers to apply blended learning are lacking. On top of that, the lack of infrastructure supporting blended learning in the classroom is evident.

Fortin et al. (2019) concluded the ease of using blended learning and students' positive attitude towards using blended learning in accounting courses. Tong et al. (2022) explored the effectiveness of the flex model of blended learning in teaching the mathematics subtopic of coordinates in the plane. The research investigates the impact of blended learning on students' academic achievement, self-study skills, and learning attitudes. The study involves a quasi-experiment with a control class (using traditional methods) and an experimental group (using the blended learning model). Data analysis includes pre- and post-test results, observations, and a student opinion survey.

The findings of the study confirm that blended learning positively influences students' academic achievement, as evidenced by the post-test results (Sig (2-tailed) = 0.001 and SMD = 0.6717). Additionally, observations and student opinion survey results indicate that blended learning enhances student interactions with teachers and improves academic achievement, self-study abilities, and learning attitudes.

The study concludes by recommending further research to enhance the effectiveness of teaching and learning within different blended learning models, broaden the scope of research on the influence of blended learning in other subjects, and increase the sample size for a better representation of the population.

Zhang and Wang (2020) studied the evaluation of blended learning for basketball courses at Tsinghua University from three aspects: knowledge, skill, and attitude. The proposed evaluation questionnaire of blended learning in this study has good reliability and validity. Blended learning positively affects basketball courses in knowledge, skill, and attitude.

A study by Al-Agami (2021) concluded that the students' attitudes towards blended learning were high during the study of students' attitudes of Arab Open University students in the Kingdom of Saudi Arabia towards blended learning and the difficulties facing its application from their viewpoint.

The researchers benefited from the above in preparing the research tool, represented in a questionnaire to evaluate the proposed design of blended learning offered at Umm Alqura University from students' viewpoint.

3. Methodology

3.1. Research methodology

Descriptive and analytical approaches were used. They aim to study scientific phenomena and problems by describing them realistically and analyzing them scientifically. Moreover, they answer research questions about evaluating student satisfaction with the blended learning style at Umm Alqura University in light of the blended learning style variable, gender, academic stage, and academic specialization.

3.2. Research community

The research community consisted of students of Umm Alqura University in the Kingdom of Saudi Arabia for the academic year 2021–2022.

3.3. Research sample

The field research sample consisted of 248 male and female students at Umm Alqura University. Table 1 shows the distribution of the sample members according to the research variables.

Table 1: Description of the research sample (n= 248)

The Variable	Variable categories	Frequency	Percent
Gender	Males	94	37.9 %
	Females	154	62.1 %
Educational level	Bachelor	209	84.3 %
	Postgraduate	39	15.7 %
Academic specialization	Scientific	134	54.0 %
	Literary	114	46.0 %
Blended learning styles	Individual rotation	23	9.2 %
	Flipped classroom	28	11.3 %
	Lab rotation	26	10.5 %
	Rotation model	171	69.0 %

3.4. Research tool

The research tool is represented in a questionnaire to identify the students' satisfaction with the blended learning styles. The questionnaire consisted in its initial form of 14 items. The five-point Likert gradient relied on answering the questionnaire's axes so that the grades were assigned to them upon correction (5/4/3/2/1).

The following steps were followed to verify the validity and reliability of the questionnaire.

- Questionnaire validity: The validity of the questionnaire was verified in two ways:

▪ The validity of the arbitrators: The questionnaire items were presented in their initial form to seven

specialized arbitrators. It is to judge the appropriateness of the questionnaire axes, the items' clarity, their linguistic formulation appropriateness, and the items' appropriateness to the measured axis. In light of the arbitrators' directives, the wording of some of the questionnaire items was modified, and the arbitrators' agreement on the questionnaire's items was 100%. Therefore, no item was deleted.

- Internal consistency: The correlation coefficient between the degree of each item of the questionnaire and the total degree of the questionnaire was calculated on a sample of 88 male and female students at Umm Alqura University. The results are in Table 2.

Table 2: The values of the correlation coefficients of each item degree with the total degree of the questionnaire

Item	Correlation coefficient	Item	Correlation coefficient	Item	Correlation coefficient
1	0.760**	6	0.862**	11	0.847**
2	0.792**	7	0.874**	12	0.738**
3	0.854**	8	0.900**	13	0.848**
4	0.842**	9	0.839**	14	0.799**
5	0.822**	10	0.887**		

**: Significant at 0.01

It is evident from Table 2 that the correlation coefficients are statistically significant at 0.01 level. The values of the correlation coefficients ranged from 0.738** to 0.900**, and the internal consistency did not result in deleting any items.

- Questionnaire reliability: The reliability was calculated using Cronbach's Alpha method. The questionnaire Cronbach's alpha coefficient was determined before and after deleting the item on a sample consisting of 88 male and female students at Umm Alqura University. The reliability coefficient value was 0.963, an acceptable reliability value. When deleting the item degree, the reliability coefficient values ranged from 0.959 to 0.962, meaning that Cronbach's alpha values, obtained when deleting the items, reduce the reliability coefficient of the questionnaire.

It is clear from the preceding discussion that the research tool has validity and reliability. Its final form consists of 14 items to identify students' satisfaction with the blended learning styles.

3.5. The research procedures

The research procedures included the following steps:

1. Reviewing studies and literature related to the research topic.
2. Preparing the search tool (Satisfaction questionnaire) and calculating its validity and reliability.
3. Applying the questionnaire after calculating its validity and reliability on the research sample.

4. Statistical processing of data obtained from the application of the questionnaire.
5. Discussing the research results.
6. Providing recommendations and suggestions.

4. Research results

4.1. Results of the first question

The first question states, 'What is the level of student satisfaction with the blended learning styles (Individual Rotation-Flipped Classroom-Lab Rotation-Rotation Model) at Umm Alqura University?' The questionnaire was applied between 15/03/2022 and 24/03/2022 to answer this question. The frequency, percentage, average, and standard deviation of the sample members' responses to each questionnaire item were calculated. Based on the fact that for each item, a degree extending from 1 to 5, the range of degrees is 4, and the length of the category is 0.8. Therefore, if the average value is 1 to less than 1.8, the level will be very low, (1.8 to less than 2.6) the level will be low, (2.6 to less than 3.4) the level will be medium, (3.4 to less than 4.2) the level will be high, and (4.2 to 5) the level will be very high. The results are in Table 3.

It is evident from Table 3 that there is a high and a very high level of satisfaction from university students towards the blended learning styles in all items, except for item 12, where the level of satisfaction is medium for all blended learning styles. The individual rotation style students are more satisfied than the other three styles in items 1-2-3-5-6-7-8. The students of the flipped classroom style are more satisfied with item 11 compared to the other three styles and more satisfied with item 2 compared to the two styles of lab rotation and rotation model. Moreover, the average value of the whole axis divided by the number of items for the four styles of individual rotation flipped class, lab rotation, and rotation model are 4.03, 3.82, 3.78, and 3.75, respectively. It indicates a high level of satisfaction for the axis of satisfaction with blended learning among students of the four styles.

The high level of student satisfaction with blended learning and its patterns can be explained according to the features characterizing blended learning, mainly including social interaction among learners and their instructors besides online interactions. The integration between the educational experiences gained from in-class learning and the experiences gained from online learning is discernible.

These results are consistent with the results of many studies emphasizing the positive trends towards blended learning and its styles, such as Owston et al. (2013), Dos (2014), Hubackova and Semradova (2016), Fortin et al. (2019), Tong et al. (2022), Zhang and Wang (2020), and Al-Agami (2021).

Table 3: Frequencies, percentages, averages, and standard deviations of the items of student satisfaction with the blended learning style

Item No.	Blended learning style		Responses					Mean	Std. deviation	Satisfaction level
			aa	bb	cc	dd	ee			
1	Individual Rotation	Frequency	2	0	2	3	16	4.35	1.22	Very High
		Percent	8.7	0	8.7	13.0	69.6			
	Flipped Classroom	Frequency	5	0	3	0	20	4.07	1.58	High
		Percent	17.9	0	10.7	0	71.4			
	Lab Rotation	Frequency	4	1	2	2	17	4.04	1.53	High
		Percent	15.4	3.8	7.7	7.7	65.4			
	Rotation Model	Frequency	20	10	25	23	93	3.93	1.40	High
		Percent	11.7	5.8	14.6	13.5	54.4			
2	Individual Rotation	Frequency	2	0	2	2	17	4.39	1.23	Very High
		Percent	8.7	0	8.7	8.7	73.9			
	Flipped Classroom	Frequency	2	0	5	2	19	4.29	1.21	Very High
		Percent	7.1	0	17.9	7.1	67.9			
	Lab Rotation	Frequency	4	1	1	2	18	4.12	1.53	High
		Percent	15.4	3.8	3.8	7.7	69.2			
	Rotation Model	Frequency	15	8	23	21	104	4.12	1.31	High
		Percent	8.8	4.7	13.5	12.3	60.8			
3	Individual Rotation	Frequency	1	2	3	1	16	4.26	1.25	Very High
		Percent	4.3	8.7	13.0	4.3	69.6			
	Flipped Classroom	Frequency	4	4	4	3	13	3.61	1.54	High
		Percent	14.3	14.3	14.3	10.7	46.4			
	Lab Rotation	Frequency	5	1	3	5	12	3.69	1.56	High
		Percent	19.2	3.8	11.5	19.2	46.2			
	Rotation Model	Frequency	32	25	18	23	73	3.47	1.59	High
		Percent	18.7	14.6	10.5	13.5	42.7			
4	Individual Rotation	Frequency	3	0	5	1	14	4.00	1.44	High
		Percent	13.0	0	21.7	4.3	60.9			
	Flipped Classroom	Frequency	3	3	5	5	12	3.71	1.41	High
		Percent	10.7	10.7	17.9	17.9	42.9			
	Lab Rotation	Frequency	6	1	3	4	12	3.58	1.65	High
		Percent	23.1	3.8	11.5	15.4	46.2			
	Rotation Model	Frequency	34	19	19	27	72	3.49	1.58	High
		Percent	19.9	11.1	11.1	15.8	42.1			
5	Individual Rotation	Frequency	1	1	4	2	15	4.26	1.17	Very High
		Percent	4.3	4.3	17.4	8.7	65.2			
	Flipped Classroom	Frequency	4	2	4	6	12	3.71	1.46	High
		Percent	14.3	7.1	14.3	21.4	42.9			
	Lab Rotation	Frequency	5	0	7	2	12	3.62	1.55	High
		Percent	19.2	0	26.9	7.7	46.2			
	Rotation Model	Frequency	23	10	31	33	74	3.73	1.41	High
		Percent	13.5	5.8	18.1	19.3	43.3			
6	Individual Rotation	Frequency	1	0	4	4	14	4.30	1.06	Very High
		Percent	4.3	0	17.4	17.4	60.9			
	Flipped Classroom	Frequency	4	0	4	8	12	3.86	1.38	High
		Percent	14.3	0	14.3	28.6	42.9			
	Lab Rotation	Frequency	5	1	5	3	12	3.62	1.57	High
		Percent	19.2	3.8	19.2	11.5	46.2			
	Rotation Model	Frequency	17	11	30	32	81	3.87	1.34	High
		Percent	9.9	6.4	17.5	18.7	47.4			
7	Individual Rotation	Frequency	1	1	3	2	16	4.35	1.15	Very High
		Percent	4.3	4.3	13.0	8.7	69.6			
	Flipped Classroom	Frequency	4	2	3	2	17	3.93	1.53	High
		Percent	14.3	7.1	10.7	7.1	60.7			
	Lab Rotation	Frequency	4	0	2	2	18	4.15	1.48	High
		Percent	15.4	0	7.7	7.7	69.2			
	Rotation Model	Frequency	30	13	18	20	90	3.74	1.56	High
		Percent	17.5	7.6	10.5	11.7	52.6			
8	Individual Rotation	Frequency	2	0	4	2	15	4.22	1.27	Very High
		Percent	8.7	0	17.4	8.7	65.2			
	Flipped Classroom	Frequency	3	2	5	1	17	3.96	1.45	High
		Percent	10.7	7.1	17.9	3.6	60.7			
	Lab Rotation	Frequency	4	0	3	5	14	3.96	1.45	High
		Percent	15.4	0	11.5	19.2	53.8			
	Rotation Model	Frequency	23	15	18	20	95	3.87	1.49	High
		Percent	13.5	8.8	10.5	11.7	55.6			
9	Individual Rotation	Frequency	3	1	3	4	12	3.91	1.44	High
		Percent	13.0	4.3	13.0	17.4	52.2			
	Flipped Classroom	Frequency	4	1	5	6	12	3.75	1.43	High
		Percent	14.3	3.6	17.9	21.4	42.9			
	Lab Rotation	Frequency	4	0	4	4	14	3.92	1.46	High
		Percent	15.4	0	15.4	15.4	53.8			
	Rotation Model	Frequency	25	13	28	26	79	3.71	1.47	High
		Percent	14.6	7.6	16.4	15.2	46.2			
10	Individual Rotation	Frequency	5	3	1	2	12	3.57	1.72	High
		Percent	21.7	13.0	4.3	8.7	52.2			
	Flipped Classroom	Frequency	3	3	7	4	11	3.61	1.39	High
		Percent	10.7	10.7	25.0	14.3	39.3			
	Lab Rotation	Frequency	5	1	5	3	12	3.62	1.57	High
		Percent	19.2	3.8	19.2	11.5	46.2			
	Rotation Model	Frequency	31	23	20	25	72	3.49	1.56	High
		Percent	18.1	13.5	11.7	14.6	42.1			
11	Individual Rotation	Frequency	4	1	1	4	13	3.91	1.44	High
		Percent	17.4	4.3	4.3	17.4	56.5			
	Flipped Classroom	Frequency	0	2	6	3	17	4.25	1.04	Very High
		Percent	0	7.1	21.4	10.7	60.7			
	Lab Rotation	Frequency	4	1	3	2	16	3.96	1.53	High

No.	Model		aa	bb	cc	dd	ee	Mean	SD	Level
		Percent	15.4	3.8	11.5	7.7	61.5			
	Rotation Model	Frequency	20	8	17	33	93	4.00	1.37	High
		Percent	11.7	4.7	9.9	19.3	54.4			
12	Individual Rotation	Frequency	7	1	5	3	7	3.09	1.64	Medium
		Percent	30.4	4.3	21.7	13.0	30.4			
	Flipped Classroom	Frequency	7	4	3	5	9	3.18	1.63	Medium
		Percent	25.0	14.3	10.7	17.9	32.1			
	Lab Rotation	Frequency	8	0	4	2	12	3.38	1.76	Medium
		Percent	30.8	0	15.4	7.7	46.2			
	Rotation Model	Frequency	29	24	33	25	60	3.37	1.49	Medium
		Percent	17.0	14.0	19.3	14.6	35.1			
13	Individual Rotation	Frequency	3	1	0	4	15	4.17	1.43	High
		Percent	13.0	4.3	0	17.4	65.2			
	Flipped Classroom	Frequency	2	1	6	4	15	4.04	1.26	High
		Percent	7.1	3.6	21.4	14.3	53.6			
	Lab Rotation	Frequency	5	1	6	1	13	3.62	1.60	High
		Percent	19.2	3.8	23.1	3.8	50.0			
	Rotation Model	Frequency	17	12	20	40	82	3.92	1.33	High
		Percent	9.9	7.0	11.7	23.4	48.0			
14	Individual Rotation	Frequency	4	0	7	2	10	3.61	1.50	High
		Percent	17.4	0	30.4	8.7	43.5			
	Flipped Classroom	Frequency	4	2	7	4	11	3.57	1.45	High
		Percent	14.3	7.1	25.0	14.3	39.3			
	Lab Rotation	Frequency	3	2	7	2	12	3.69	1.43	High
		Percent	11.5	7.7	26.9	7.7	46.2			
	Rotation Model	Frequency	20	8	46	23	74	3.72	1.36	High
		Percent	11.7	4.7	26.9	13.5	43.3			
The axis of satisfaction with the entire blended learning style	Individual Rotation							56.39	15.04	High
	Flipped Classroom							53.54	15.48	High
	Lab Rotation							52.96	17.72	High
	Rotation Model							52.43	16.56	High

a: Student satisfaction items with the blended learning style; 1: The blended learning courses exceeded my comfort, as I no longer had to come to campus every day; 2: Blended learning courses provided the flexibility to complete assignments anywhere/at any time; 3: The blended learning courses contributed to increasing the interaction between my colleagues and me; 4: The blended learning courses increased the interaction between the faculty members and me; 5: Blended learning courses were fully defined in terms of objectives and assessment methods; 6: There are sufficient learning resources within the blended learning courses; 7: I will make sure to study blended learning courses in the future according to the available opportunities; 8: In general, I am satisfied with the blended learning courses that I have studied; 9: The combination of face-to-face and online education effectively affected improving performance in both modes; 10: The blended learning courses helped me understand the course content in a more comprehensive way; 11: The blended learning courses contributed to the development of my technical performance and the use of modern technologies; 12: There was a clear workflow plan for studying the combined courses in detail before the start of the study; 13: Faculty members facilitated work and provided support during the study of the blended courses; 14: Technical support was available throughout the semester while studying the blended courses; aa: Strongly disagree; bb: Dis agree; cc: Neutral; dd: agree; ee: Strongly agree

It is clear from the previous presentation that the order of the blended learning aspects differs from one style to another, making students feel satisfied. However, the order of blended learning aspects makes students feel satisfied with blended learning styles according to the average values shown in Table 4.

Table 4: Arranging the items of satisfaction with the blended learning styles according to the average values

No.	Items	Individual rotation	Flipped classroom	Lab rotation	Rotation model
1	The blended learning courses exceeded my comfort, as I no longer had to come to campus every day.	2	3	3	3
2	Blended learning courses provided the flexibility to complete assignments anywhere/at any time	1	1	2	1
3	The blended learning courses increased the interaction between my colleagues and me	5	11	7	13
4	The blended learning courses increased the interaction between the faculty members and me	9	9	13	11
5	Blended learning courses were fully defined in terms of objectives and assessment methods	6	10	9	8
6	There are sufficient learning resources within the blended learning courses	4	7	10	5
7	I will make sure to study blended learning courses in the future according to the available opportunities	3	6	1	7
8	In general, I am satisfied with the blended learning courses that I have studied	7	5	4	6
9	The combination of face-to-face and online education effectively affected improving performance in both modes	10	8	6	10
10	The blended learning courses helped me understand the course content comprehensively	13	12	11	12
11	The blended learning courses developed my technical performance and the use of modern technologies	11	2	5	2
12	There was a clear workflow plan for studying the combined courses in detail before the start of the study	14	14	14	14
13	Faculty members facilitated work and provided support during the study of the blended courses	8	4	12	4
14	Technical support was available throughout the semester while studying the blended courses	12	13	8	9

4.2. Results of the second question

The second question states, 'Is there a difference in the student's satisfaction with the blended learning styles (Individual Rotation-Flipped Classroom-Lab Rotation-Rotation Model) at Umm Alqura University?'

One-way analysis of variance (ANOVA) was used to determine the rotation model significance of the differences among the average scores of the study group students (individual rotation-flipped classroom-lab rotation-rotation model) in the total degree of satisfaction with the blended learning style to answer this question. Given the larger sample of the rotation model than the rest of the samples, a random sample was chosen. Then, the four samples were close in the number of individuals, and the results came as illustrated in Table 5.

Table 5: Results of one-way analysis of variance for the blended learning styles variable in the total degree of satisfaction with the blended learning style

Variable	Variance source	Sum of squares	df	Mean of square	F value	Sig.
Satisfaction with blended learning	Between groups	194.859	3	64.953	0.239	0.869
	Within groups	27187.256	100	271.873		
	Total	27382.115	103			

It is evident from Table 5 that there are no statistically significant differences (p>0.05) among the study group students' mean scores with satisfaction towards blended learning styles (individual rotation-flipped class-lab rotation-rotation model). These results align with the findings of several studies, such as Kuzmina and Golechkova (2012), Holm et al. (2022), and Suleiman and Al-Sayed (2016). They can be explained by the fact that there are no fundamental differences between these patterns. All these styles participate in the basic feature, the merging between traditional and online activities.

4.3. Results of the third question

The third question states: 'Does the student's satisfaction with the blended learning at Umm Alqura University differ according to gender (Male/Female)?'

Independent Samples T-Test was used to identify the difference among the average scores of males and females in the total degree of student satisfaction with the blended learning style. The results are in Table 6 to answer this question. It is evident from Table 6 that no statistically significant difference among the mean scores of males and females in satisfaction with the blended learning style exists. It means that males and females report approximately the same satisfaction with the blended learning style. In other words, they have an immediate sense of the pros and cons. These results can be explained according to the blended learning characteristics allowing different students to be active independent blended learning style learners and encouraging them to develop personal relationships and exchange ideas, information, and experiences.

Table 6: T-Test results for the gender variable in the total degree of satisfaction with the blended education style

Variable	Females (n=154)		Males(n=94)		t	Sig.
	Mean	Std. deviation	Mean	Std. deviation		
Satisfaction with blended learning	52.23	16.96	54.21	15.39	0.92	0.35

Blended learning improves learners' human and social relations and attitudes during education, achieving high satisfaction with the educational system. These results align with the findings of several studies, including a study by Alanzi (2018) that concluded no differences in the quality of the blended learning method in the computer course from the point of view of the preparatory year students at Northern Border University due to the variables of gender and specialization is present and Alotaibi (2021) revealed that the gender had a trivial impact on social presence levels in blended learning environments. Moreover, gender did not relate to any social presence dimensions (social context, privacy, interactivity, and online communication).

4.4. Results of the fourth question

The fourth question states: 'Does the student's satisfaction with the blended learning at Umm Alqura University differ according to the study level (Bachelor/Postgraduate)?'

Independent Samples T-Test was used to identify the significance of the difference among the average scores of bachelor and postgraduate students in the total degree of satisfaction with the blended learning style to answer this question. A random sample of bachelor's students was chosen given a larger sample of bachelor's students than postgraduate students. The two samples are close in the number of individuals, and the results are in Table 7.

Table 7: T-Test results for the educational stage variable in the total degree of satisfaction with the blended learning style

Variable	Postgraduate (n=39)		Bachelor (n=42)		t	Sig.
	Mean	Std. deviation	Mean	Std. deviation		
Satisfaction with blended learning	58.00	15.85	54.21	14.69	1.12	0.268

It is clear from Table 7 that there is no statistically significant difference (p>0.05) among the mean scores of bachelor and postgraduate students in terms of satisfaction with the blended

learning style. It means that bachelor's and postgraduate students have approximately the same level of satisfaction with the blended learning style, meaning that they have an immediate sense of the pros and cons of the blended learning style. It may be due to the equivalent experience and competencies of both bachelor's and postgraduate students in dealing with traditional education. In addition to dealing with electronic learning environments, the students did not find it difficult to learn in a blended way combining the traditional and electronic styles.

4.5. Results of the fifth question

The fifth question states, 'Does the student's satisfaction with the blended learning at Umm Alqura University differ according to the academic major (scientific/literary)?' Independent Samples T-Test was used to identify the significance of the difference between the average scores of the scientific specialization students and the literary

specialization students in the total degree of satisfaction with the blended learning style to answer this question. The results are in Table 8.

It is evident from Table 8 that there is a statistically significant difference (p<0.05) between the mean scores of the scientific specialization students and the literary specialization students in satisfaction with a blended learning style in favor of literary specialization students. It means that literary specialization students are more sensitive to the positives of the blended learning style than scientific specialization students.

Due to the nature of the theoretical subject, it requires the use of a limited number of cognitive strategies, such as memorization and retrieval, and limiting teaching strategies based on recitation and lecture. It is available in a blended learning environment through interaction face-to-face between students and their instructors inside classrooms.

Table 8: T-Test results for the specialization variable in the total degree of satisfaction with the blended learning style

Variable	Literary (n=114)		Scientific (n=134)		t	Sig.
	Mean	Std. deviation	Mean	Std. deviation		
Satisfaction with blended learning	55.64	15.75	50.72	16.62	2.38	0.018

These results align with Alharthi et al. (2021) concluded statistically significant differences among female attitudes at Umm Alqura University in Saudi Arabia towards blended learning due to the variable of academic specialization (scientific/literary). Orabi et al. (2020) added that the students of theoretical subjects show more acceptance and development than students of practical subjects in a blended learning environment at the College of Physical Education, University of Jordan.

5. Conclusion and recommendation

Blended learning emerges as the preferred instructional approach in the post-COVID-19 era, offering a combination of in-class and online learning experiences. However, the optimal blended learning style that effectively merges these two approaches remains uncertain. This study aimed to identify the ideal blended learning style used at Umm Alqura University and recommended its adoption for instructional content delivery, taking into account gender, study level, and academic major. Based on the research findings, several recommendations can be made. Saudi universities should develop a comprehensive strategy to implement blended learning as a recommended approach in the post-COVID-19 era. Financial and technical support should be provided to facilitate the adoption of blended learning models in teaching. Additionally, faculty members should receive training to enhance their skills in designing effective blended courses.

This research serves as a foundation for further investigations in blended learning, including exploring the most suitable blended learning styles

for enhancing student achievement. Evaluating the effectiveness of different blended learning styles in developing practical skills, attitudes, and scientific thinking among students is of great importance. Moreover, it is crucial to determine the most appropriate blended learning styles that align with specific academic majors (Practical/Theoretical) to ensure high levels of student satisfaction. Developing a proposed design model for the blended learning environment and examining its impact on student satisfaction are also significant areas for future research.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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