

## The Effects of Distance E-Learning (DEL) and Blended Learning (BL) on Irbid National University (INU) Students

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### Abstract

The purpose of this study was to examine the effect of Distance E-Learning (DEL) and Blended Learning (BL) on university students' academic achievement, attitudes and skills. The design that was used is a quasi-experimental of a Non-Equivalent Post-Test Only Control Group Design. The two groups were the experimental groups and the control group. The population is composed of Irbid National University (INU) students from all its six faculties (Nursing, Educational Sciences, Literature and Art, Law, Finance and Management). It was applied in the first semester of the 2022/2023 academic year. The results of this study indicated that there is an effect of Face-to-Face (FTF) learning mode improves students' academic achievement more than DEL and BL with  $(0.00 < 0.05)$  and  $(0.009 < 0.05)$  respectively. Also, DEL and FTF improve students' attitudes more than BL with  $(0.011 < 0.05)$  and  $(0.00 < 0.05)$  respectively. Furthermore, the DEL progresses students' Problem-Solving skills (PSS) more than face to FTF with  $(0.018 < 0.05)$ . And DEL and BL are more effective than FTF learning modes in improving students' 21<sup>st</sup> century skills (Cs21) with  $(0.00 < 0.05)$ . But there were no significant effects on Students' Self-Directed Learning (SDL) depending on learning modes.

**Keywords:** Distance E-Learning, Blended Learning, Face-to-Face, academic achievement, attitudes, Problem Solving skills, 21<sup>st</sup> Century Skills, Self-Directed Learning.

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## أثر التعلم الإلكتروني عن بعد والتعلم المدمج على طلبة جامعة إربد الأهلية

## الملخص

تهدف هذه الدراسة للكشف عن أثر التعلم الإلكتروني عن بعد والتعلم المدمج على تحصيل الطلبة الأكاديمي ومهاراتهم واتجاهاتهم نحو التعلم. تم استخدام التصميم شبه التجريبي مع مجموعة ضابطة فقط باختبار بعدي. تم تقسيم عينة الطلبة لمجموعتين تجريبيتين ومجموعة ضابطة. تكون مجتمع الدراسة من طلبة جامعة إربد الأهلية من جميع كلياتها الست (التمريض، والعلوم التربوية، والآداب والفنون، والعلوم الإدارية والمالية). تم تطبيق الدراسة في الفصل الدراسي الأول من العام الدراسي 2023/2022. أشارت نتائج هذه الدراسة إلى وجود تأثير إيجابي للتعليم التقليدي على التحصيل الأكاديمي لدى الطلبة بشكل أكبر من التعلم الإلكتروني عن بعد والمدمج وكانت النتائج كالتالي: ( $0.05 > 0.00$ ) و ( $0.05 > 0.009$ ) على التوالي. أيضًا، أن الطلبة الذين درسوا بطريقة التعلم الإلكتروني عن بعد والتقليدي كانت اتجاهاتهم نحو التعلم أفضل من الطلبة الذين درسوا بالطريقة المدمجة وكانت النتائج على النحو التالي: ( $0.05 > 0.011$ ) و ( $0.05 > 0.00$ ) على التوالي. علاوة على ذلك، أظهرت النتائج تفوق طلبة طريقة التعلم الإلكتروني عن بعد في اكتساب مهارات حل المشكلات بشكل أفضل من التعلم التقليدي ( $0.05 > 0.018$ ). وتعتبر طريقتي التعلم الإلكتروني والمدمج أكثر فاعلية من التعلم التقليدي في تحسين مهارات القرن الحادي والعشرين ( $0.05 > 0.00$ ). ولكن لم تكن هناك تأثيرات ذات أثر لتعلم الطلبة الذاتي الموجه اعتمادًا على طريقة التعلم.

**الكلمات المفتاحية:** التعلم الإلكتروني عن بعد، التعلم المدمج، التدريس التقليدي، التحصيل الأكاديمي، الاتجاهات، مهارات حل المشكلات، مهارات القرن الحادي والعشرين، التعلم الذاتي الموجه

## Introduction

Learning is an ongoing process in the world. The modes of delivery of educational content have undergone significant changes as the world and societies emerge. The changes in the technological aspects have brought about substantial changes in the delivery of education. For a long time, though the various levels ranging from the early education levels to the tertiary levels, education has been offered through a manual process, where the learners and the students have a physical interaction with each other. Such an education process provides the learners and those disseminating the information to interact and contact each other directly. The evolution of technologies has increased Distance E-learning (DEL) platforms' uptake as supplementary and the main media. Given its relatively younger implementation of DEL, there lacks significant evidence of its impact and influence on the learning process. There have been efforts to document the role of the traditional education program. Still, there is a need to have a more transparent and informed assessment of the influence of newer technology-driven education on students.

## Background

The concept of E-Learning had not existed for long in the education sector. It can be traced to the late 20<sup>th</sup> century when E-Learning was coined following the increasing integration of technologies in the learning and teaching process. Before E-Learning, several attempts had been made to introduce automated teaching and learning with minimal success and impact. The primary reason behind this limited input of technology in teaching and learning could be associated with the different views and approaches to technology, where it was mainly seen as industrial rather than soft skills. Though rudimentary, these earlier attempts at introducing machines to teaching. Students' learning and testing gave a futuristic window that future educationists would use to integrate technology into the learning process (Baber, 2020). These earlier initiatives were meant to allow the learners and teachers to achieve more with minimal resources using machines as a mediating tool.

The advances in computing power saw the introduction of the first computerized education program in 1960, dubbed PLATO, introduced at the University of Illinois to teach its students. This was a revolutionary introduction that allowed the reality of E-Learning to take precedence. The ease of the PLATO program saw it being scaled upwards to the schools within the vicinity of the university to offer teaching and learning methods. However, the limited access to these systems is due to the lack of interconnection between the various devices and over longer distances. The evolution of the internet in the late 1990s helped solve the interconnection problems of previous attempts. The internet gave rise to educationalists' tools to interact and mediate the communication between learners and teachers remotely. The Internet development allowed the education sector to move its presence from the brick-and-mortar approach to today's E-Learning platforms (Agarwa & Kaushik, 2020). The advances in WEB

2.0 and its communication tools have given rise to the DEL platforms' ability to be more interactive and more involving. They allowed the students and the teachers to have better interaction and communication that is instantaneous and high quality and can better track their presence and work. The internet helped break the physical barriers to accessing education by moving the classes from the material to the virtual platform. It has enabled the faculties and education providers to have students from any place globally attending their classes. The E-Learning is either fully DEL or BL system. There are elements of traditional and modern technology-aided learning where students participate in physical classes and use the E-learning elements to submit their works and communicate with their educators. More advances in technology have also introduced simulated platforms that allow students to interact with simulations and other augmented realities that would have otherwise required the students to physically attend to some of these factors (Gopal, Singh, & Aggarwal, 2021). These advances further advance the role of e-learning while also reducing the need for physical interactions between teachers and their students.

Given the evolution of technology in education delivery, several key elements have changed in the education sector. The role of teachers and their place in education delivery has evolved from where instructors have to physically monitor their students to that of a more facilitative role as more of the delivery roles are done over mediated learning. The students' attitudes are also evolving as they interact more with the E-Learning platform and require more self-teaching and self-follow-ups to meet the deadlines (Gopal, Singh, & Aggarwal, 2021). The imparting of skills is also changed, and the level of satisfaction differs across the students who use these platforms.

The social and cultural aspects of the education process have had to evolve with the technological processes. Whereas the internet and computer technology have had a significant impact on education in the Western world, the influence and uptake could be different in the other parts of the world. These differences could be influenced by the various underlying aspects such as the willingness and speed of adopting the technologies, the cost of impending these technologies, and the socio-cultural factors guiding the interaction in any given society. According to (Matar 2011), the penetration of E-Learning in the Middle East was slow due to the slow uptake and usage of the internet in this part of the world. Given the economic condition and literacy level in these regions, the uptake of E-Learning contributes to the slow uptake as most education sectors were not fully developed to use the Internet in their education services.

The penetration of broadband in the Middle East remains low, which affects the uptake of the E-Learning platforms. The digital divide in these regions remains high, such that the complete uptake of E-Learning creates barriers and divides in the communities (Bogdan-Martin, 2019). Access to the E-Learning platform remains a challenge that could directly impact the knowledge, access, skills, attitudes, and level of satisfaction from the E-Learning platform. The high costs of access act as a significant barrier to the uptake of higher learning. To some students, they interact with the teaching at higher education institutions, which

may challenge evaluating the E-Learning based on the various difficulties of usage and access (Harasim, 2000). Some of these challenging aspects include access to the internet, access to computers, and the reliability of the connectivity in some remote areas that allow for convenient E-Learning platforms. The economic development of the region has seen an increase in the region's literacy rates, which has increased the uptake of education at various levels of education (Hammoud, 2018). This expansion gives a better usage of the E-Learning platform to provide better information for evaluating such a study.

The uptake of E-Learning in the institutions of higher education has dramatically improved in the last decade from the realization of its role and the ease of offering education to the citizens of these regions. It has also seen the creation of purely online education facilities and institutions offering purely remote education via E-Learning platforms (Spinks & Bedi, 2012). The uptake of E-Learning has ensured a more extensive reach of students with varying experiences in using E-Learning platforms. In Jordan, the uptake of E-Learning has lagged behind its peers in the regions, such as Qatar, where internet penetration is high. According to (Matar 2011), the level of internet penetration in the country is at 19% as of 2019. This low penetration indicates a low uptake of E-Learning as a mode of teaching in the country. However, it is expected that the experiences of the few who have access to E-Learning in the various education platforms will be distinct.

The penetration of E-Learning in the country is increasing, and it's touted to have a significant impact on education, as evidenced by the COVID-19 pandemic where the school systems have to seek ways to abide by the recommended health protocol such as social distancing. However, the changes brought about by E-Learning could have a revolutionary change on the entire education system and impact the social and cultural aspects that have shaped and informed the delivery of education in the country. These changes in the education process have an undocumented impact on the learners and the entire education system, hindering the country's uptake and spread.

### **Purpose of the study**

This research study seeks to identify how E-Learning technologies influence students' attitudes to learning, skills levels, and the acquisition of knowledge of the students. The study will study E-Learning (DEL and BL) as the independent variable while the student's academic achievement, attitude toward learning, Problem solving skills (PSS), Self-Directed Learning (SDL), 21<sup>st</sup> century skills (Cs21) will form the dependent variables.

### **Significance of the study**

Given the global uptake of E-Learning (DEL and BL) in the modern world, the stakeholders must have better information on the various areas of how DEL and BL impacts education. The outcomes of this study will provide critical and crucial information that will form a great addition to the larger body of knowledge in the education sector. It will offer insight into the effects of DEL and BL on the

students and inform the stakeholders as they make their decisions concerning the uptake or use of the E-learning process. With such information, the stakeholders will have better tools to use when making educated decisions for themselves, the policy level, and the consumers and disseminators of education. The outcomes will also help advance the cause of or against DEL and BL in the university, the regions, and the world significantly. It will add more information and insight for consumption by the decision-makers. The data will also be crucial for government agencies and likely policymakers. They will have more information and tools to guide them when making budgetary and policy decisions concerning their uptake and investment in E-Learning.

### Research questions

The following key research question will guide the study

- 1- Does INU students' academic achievement differ according to their instruction mode (DEL and BL) compared to FTF mode?
- 2- Does INU students' attitude differ according to their instruction mode (DEL and BL) compared to FTF mode?
- 3- Do INU students' PSS skills differ according to their instruction mode (DEL and BL) compared to FTF mode?
- 4- Does INU students' SDL differ according to their instruction mode (DEL and BL) compared to FTF mode?
- 5- Does INU students' Cs21 differ according to their instruction mode (DEL and BL) compared to FTF mode?

### REVIEW OF THE LITERATURE

This chapter presents an analysis of the literature available in the area of study. The chapter will analyze the already available literature along with the robust theoretical framework guiding the research and the empirical literature on the study. The chapter will end with an identification of the gaps in the literature and where the task fits.

### Theoretical information

Several theories are crucial in student learning and their level of satisfaction with the E-Learning platforms. The main ideas of focus in this study are intrinsic and extrinsic motivation and the self-determination theory.

The intrinsic and extrinsic motivation theory premises that the sources of motivation can be traced to either their intrinsic factors or could be derived from outside elements (Tohidi & Jabbari, 2012). The intrinsic theory of motivation holds that a person's inspiration comes from doing things from their self-drive rather than from external sources. This is an internal locus where a person is driven to achieve something for themselves and their benefit. The source of the motivation is internal to the person and is an essential source of inspiration as it causes the person to take action without having to be forced (Cook & Artino, 2016). The person understands the importance of academic achievements and will therefore put effort into achieving their desired outcomes without relying on

any external source. The main elements of intrinsic motivation include the challenge at hand, the personal internal level of curiosity, and the person's fantasy. The student's attitude toward education is also a critical intrinsic factor that drives the students self-drive. Extrinsic motivation holds that the source of inspiration comes from external aspects. They are the factors that are involved in extrinsic motivation including reward, punishment, or compulsion. Extrinsic motivation can be an excellent initiating force. It may make the student interested in learning before realizing their intrinsic motivational elements to drive them to achieve their desired outcomes.

The self-determination theory builds upon the intrinsic and extrinsic factors of motivation. The theory holds that people achieve self-determination when three main elements in their lives interact. These are the needs for competence. Their connection and autonomy needs are met. Overall, this theory holds that people are motivated by their need to grow. The students will have a higher motivation in their learning process by their innate need to develop their knowledge and expertise. They gain a higher competence to overcome the challenges presented to them (Ross, Perkins & Bodey, 2016). As the students aim at gaining more knowledge and competencies to overcome obstacles, including in tests and exams, they will have higher self-determination in their academic efforts. An achievement that outgrows a given level no longer becomes motivational. The second assumption of the self-determination theory is that independent sources of motivation are the most critical (Patrick & Williams, 2012). The external achievements may not be enough motivating elements behind self-determination. Instead, a person needs to have internal sources of motivation to keep self-determination in the long run.

These theories are critical when evaluating the student's attitudes toward E-Learning, the success rates of the students in these learning programs, and understanding their perceptions about E-Learning. The intrinsic and extrinsic factors and the student's overall self-determination levels will form a critical part of the learning process. Several studies have studied the evaluation of the effectiveness of E-Learning in education. A study (Phipps & Merisotis, 1999) identified three main areas for measuring the success of E-Learning programs. The study identified the learning outcomes, student satisfaction, and student approval of such learning programs as the most critical elements for evaluating such programs. These aspects are crucial and form part of this study's analysis and evaluation.

### **Empirical literature**

#### **Face-to-Face (FTF), DEL and BL**

The usefulness, efficacy, and effectiveness of the various forms of learning have been explored in multiple research studies. The conclusion from the studies is diverse and has not fully arrived at a unanimous decision. A study by (Yashwant, et al., 2020) used a pre and post-test approach in a sample of 150 students grouped into two categories. The study found an improvement in the scores for the students in BL than in FTF education. The study found a higher

efficiency in BL that allows the teacher and the technology to interact in the delivery of knowledge than when the FTF method is the sole method of instruction. These results were also confirmed by (Evans, Yip, Chan, Armatas, & Tse, 2020), who found out that using a BL form of professional training allowed better utilization of institutional resources. The instructors were found to interact more with the students using the mediated forms of interactions used in the delivery of the classes, during and after the course is over. The researchers also observed that the instructors have a more genuine interaction with the students in the BL and concluded that this method was far better than the FTF methods. Additionally, (Nayar & Koul, 2020) used an experimental research approach and concluded that BL was more effective and efficient at delivering teaching and learning outcomes. The BL had a broader range of contents and resources available to both the students and teachers.

Besides using BL, technology has also allowed DEL where the learners are remotely located and only engage through correspondence with the instructors. This method of education has also been found to have parallels with the FTF methods of learning. Research by (Yusupova, 2021) opines that the use of technology and more improved communication algorithms are the best way to improve pedagogical skills and the learning process as it allows for faster interaction and response rates. Another study by (Appolloni, Colasanti, Fantauzzi, Fiorani, & Frondizi, 2021) used a contextual analysis case study. The researchers found that DEL with the app-test in the pandemic period offered a healthier and friendly interaction between the learners and the educator and was in compliance with the various health standards and requirements. The researchers conclude that this learning area has been neglected, but the emergence of the pandemic has brought to the fore its usefulness and how it offers excellent learning insights. Another study by (Raheem, Bani, & Bani, 2021) used a descriptive method to study the phenomena. The study concluded that using technologies and embedding them into the mainstream and delivering DEL is the most critical and crucial element of success. The study noted that the DEL environment in Jordan was weak and required improved technologies and human resources.

The above literature indicates that the more modern method of learning is more effective. When the traditional way blends with the newer educational technologies, it achieves more extraordinary results and is more effective in delivering learning outcomes.

### **Academic achievement**

Academic achievement is an essential element in the success of any teaching program. According to (Almaiah & Alyoussef, 2019), learners' success rates depend on several underlying factors that could be under the control of the delivery method or outside. However, in all cases, the mode of delivery of the teaching content is crucial as it determines the success rates of the students. The study (Pei & Wu, 2019) identified that the students who engage in DEL and FTF learning all have reasonable rates of success depending on the

effectiveness of the teaching model. The study determined that students in the DEL platform had higher achievement of more life factors as they had the time to attend to other matters outside the classes with ease, unlike the students in the conventional classes where the focus was on the course only. (Mensink & King, 2019) suggested that the success rate of DEL platforms depends on the level of access and the social-cultural aspects of the society, including genders that impact the success of the education delivery. Therefore, the success of the learners is not dependent on the online conventional teaching only but a host of other issues influencing the mode of instruction.

H1: There is no influence of instruction mode (DEL an DBL) compared to FTF on students' academic achievement.

### **Attitude of students**

The attitude of students towards learning and the internal aspects of life are critical in the learning process. A Study by (Ismaili, 2021) on the student attitude toward learning amidst the prevailing Covid-19 pandemic concludes that students had a more positive attitude towards learning and education. The study sighted the increase in flexibility and the ease of abiding by the various health recommendations as the primary driver of this positive attitude. Another study (Malkawi, Bawaneh & Bawa'aneh, 2021) found that education level differs among students using conventional on-campus education from those in off-campus education. These differences were driven by the ease, flexibility, and access of the instruction based on the teaching model. The attitude toward education is influenced by factors that influenced the student's perception of the education program and the student's expectation of the education program (Almaiah & Alyoussef, 2019).

A study was conducted on university students (930 students) at Hatay Mustafa Kemal University by using an explanatory mixed method design. It aimed to explore the students' attitude to E-Learning mode. The results found that students had a high level of attitude toward DEL (Uyar, 2023). Another study conducted on Undergraduate Students in Chengdu, China aimed to examine students' attitudes toward BL and if students' perceived usefulness, satisfaction, and self-efficacy could significantly influence their attitudes toward blended learning. The results showed that his study found that the students' perceived usefulness, satisfaction, and self-efficacy could significantly influence their attitudes toward BL, while gender, discipline, and social influence moderated the factors influencing students' attitudes to varying degrees (Li, 2023)

H2: There is no influence of instruction mode (DEL and BL) compared to FTF on students' attitude.

### **Problem-solving Skills (PSS)**

A fundamental aspect of the learning platform is its ability to allow the students to learn PSS and abilities. PSS are the program's ability to enable the students to interact with a wide range of tools and techniques that will allow them to interact with tools that will enable better challenges to empathize with their

creativity (zare, Sarikhani, Salari, & Mansouri, 2016). A study by (Malik, Mathew, Al-Nuaimi, Sideiri & Coldwell-Neilson, 2019), posits that DEL platforms have a better opportunity to enhance critical thinking in the students engaging in online learning. The study found that students in an integrated and efficient DEL platform had access to a broader range of tools and opportunities to utilize their creativity and PSS. Another study (Akugizibwe & Ahn, 2020) found that the integration of the DEL platform requires careful planning in a way that incorporates the students, teachers, and the institution's ability and objectives. The type of integration that will allow PSS must be at the general level of the learner's ability and accessible and understood by all.

A study was conducted in Bengkulu City to examine the effect of the BL mode with a Realistic Mathematics Education (RME) Approach on students' PSS. The results showed that there was a significant effect of the BL mode on understanding mathematical concepts and mathematical PSS (Widiarti, et al., 2023).

H3: There is no influence of instruction mode (DEL and BL) compared to FTF on students' problem-solving skills (PSS).

### **Self-Directed learning (SDL)**

Self-directing is the aspect where the learners take control of their learning pace. They are given room to direct the speed with which they go through the course contents and control their full learning speed. A study by (Geng, Law, & Niu, 2019) researched SDL in blended learning. The study found a higher SDL aspect in the online classes as the students had to choose their pace and days of the week to attend to the types, unlike the conventional platform where the students had minimal input in the speed and scheduling of the classes. A study by (Kizilcec, Pérez-Sanagustín, & Maldonado, 2017) found that online learning has a higher impact on SDL as it provides more opportunities for the learners to self-learn. These opportunities present the learners with a better chance to experience more effective SDL than in conventional learning. (Cho, Kim, & Choi, 2017). Also, online learning presents more opportunities for learners to better understand their communities through self-learning and self-pacing in their educational learning interactions.

H4: There is no influence of instruction mode (DEL and BL) compared to FTF on students' self-directed learning (SDL).

### **21<sup>st</sup> Century Skills (Cs21)**

Advances in information technology have important impacts on the government, financial system, and culture of countries in the world. So, students need to be prepared with suitable skills, which successfully deal with future life complexities and today's competitive world (kan'an, 2018). Cs21 is express the characteristics that allow people to become excellent citizens and skilled employees in this century's information society (Murat & Cam, 2021). Key skills used refer to raising a form of cognitive, emotional or behavioral expertise not only in school life but also beyond school. Skills are not just technical, but they can also be

universal as well as represent some intricate forms of skills. This comprehensive definition of skills makes it potential to get into account the variety of dispositions, knowledge and ability that a student must own to reveal a particular form of skills (Chehimi & Alameddine, 2022).

A study conducted by Eslit (in print) unveils the intricate interplay between BL and the development of Cs21 within the realm of higher education among students of Michael's College in Iligan City. The results revealed that BL empowers students by enhancing participation, flexibility and accessibility in language and literature education. Integrating diverse literary texts and cultural perspectives enhances intercultural competence and global awareness. Furthermore, the study emphasizes the development of critical Cs21 through immersive learning experiences (Ozturk, 2023). Also, Mohamed et al (2020) conducted the study in the College of Industrial Education to remedy the existing deficiencies in the achievement of students/teachers at the College of Industrial Education in the course of educational aids and to make them aware of Cs21. The results showed clear and significant growth in the level of achievement and awareness of students' Cs21 in the experimental group that studied using DEL. H5: There is no influence of instruction mode (DEL and BL) compared to FTF on students' 21<sup>st</sup> century skills (Cs21).

### Gaps in literature

The above literature presents evidence of the importance of E-Learning (DEL and BL) in the various aspects of learning and contrasts the information with the conventional learning process. The literature suggests an improvement in the learning outcomes when using the E-Learning platforms for the students. They have a higher quality access level to the various platforms such that they fall on the right side of the digital divide as they have the tools and means to benefit from the E-Learning platforms fully. However, the available literature points to the gaps in how these newer modes of learning platforms impact the student in an economy and society where E-Learning is not a standard feature to the extent that all have equal access. The learners' inputs on the disadvantageous side of the digital divide need to be taken into context. Therefore, the literature suggests that the expected perceptions, attitudes, and level of success of the E-Learning platforms depend upon the intrinsic factors of the students and the extrinsic elements as mediated by access to the E-Learning platforms and their knowledge of these systems. This study falls in the middle of this debate. It seeks to consider the intrinsic factors, students' attitudes, and the extrinsic factors; success, knowledge acquisition, and skills impartation. The study also finds that the students' context impacts their evaluation of the E-Learning platforms in higher education. The research seeks to add and improve the available literature by focusing on the student's view of the E-Learning platforms, evaluating their inputs in the knowledge and skills acquisition and their impact on educational success. This new focus will shed more light on the

role of E-Learning in the student's learning experiences and provide a way of viewing it from an evaluation perspective.

## **Methodology**

### **Research Design**

This study uses a quantitative design, a quasi-experimental study using experimental research design in the form of a Non-Equivalent Post-Test Only Control Group Design. The researchers used this design because it provides a high level of evidence without randomization. Also, it allows for the generalization of the results to the general population under investigation (Creswell, 2013).

### **Participants**

The sampling technique used was a non-probability purposive sampling technique. The researcher selected this sampling technique because it enables researchers to squeeze a lot of information out of the data that they have collected. Also, allows researchers to describe the major impact their findings have on the population. The sample size required for this study was determined by Raosoft's sample size calculation. According to Raosoft with a margin of error of 5% and a confidence level of 95%, the population size was 48 students with a response rate of 50%, bringing the total sample size required to 48 students with an added 20% response rate. The final sample size was 360 students. Students were recruited who met the following criteria: (1) regularly registered at INU; (2) register in one of these six faculties (Nursing, Educational Sciences, Literature and art, Law and finance and management); (3) don't absent; (4) willingness to participate; (register in one these subject (1) Morphology (2) accounting principles (3) Law of international organizations (4) educational research methods (5) operating systems and (5) Physiology.

### **Setting**

This study was conducted in all faculties (Nursing, Educational Sciences, Literature and Art, Law, Finance, and Management) at INU in Jordan. It was applied in the first semester of the 2022/2023 academic year. There are three groups present in the study. The first two groups are the experimental groups followed by the control group (FTF mode). The independent variable here refers to the teaching mode used in the study (DEL and BL modes). Six courses (Morphology (1), accounting principles (2), Law of international organizations, educational research methods, Operating Systems and Physiology) from the INU different faculties (Nursing, Educational Sciences, Literature and Art, Law and Finance and Management).

### **Instrument**

The researchers used these instruments to conduct the study:

### **Achievement test**

Six achievement tests (one for every course) were constructed as the following procedures, which were based on Bloom's six levels of Taxonomy. Bloom's six levels of Taxonomy include knowledge, comprehension, application, analysis, synthesis, and evaluation (Bloom 1956). A test blueprint is a specification of what the test questions should cover. A test blueprint should include the outcomes for the tought, which are covered by the test and the balance of the questions. Blueprint components are content outlines, categories, and the number of items (Kubiszyn & Borich 2007). The achievement test is composed of 20 Multiple Choice (MC) questions. For every MC will take half point and the total mark for every exam was 10 points.

The achievement test goes through a series of assessments. The first stage included the inspection of the test by two specialist instructors. These instructors asked to go through the questions and circle questions that are not clear and had some grammatical or scientific errors. In the next stage, the achievement test along with a feedback form and scheme of work was sent to two assessment experts from the evaluation institute that belongs to INU. They asked to group the questions, which were based on the levels of Bloom's Taxonomy and curriculum standards. It is a noticeable aspect that the achievement test improved according to their feedback.

Lastly, the achievement test was piloted and checked for reliability. The test was administered to 20 students from outside the sample and the Kuder-Richardson 20 (KR-20) was used to estimate reliability. It was found that multiple choice questions had a reading of 0.72 and the short essay questions 0.67 (Nitko 2004). Other than that, the discrimination index for all the items was determined. Results showed that the discrimination index for all items in the MC segment ranged from 0.17 to 0.92 (Varma 2006). Also, the difficulty index value for the MC question was found to be 0.33 to 0.73. This is in line with the range of the difficulty index, which was set from 0.20 to 0.80 (Kubiszyn & Borich 2007).

### **Attitude Inventory**

Attitude is one of the affective variables in which educators are interested for several reasons such as: (1) attitudes are relatively durable, (2) attitudes are learned and can therefore be taught and (3) attitudes are related to behavior (Young 1998). Many factors can influence a person's attitude including previous experiences and social influences (Craker 2006). To examine the attitude learning mode of the students after the treatment, an inventory was used in this study. Originally it was constructed by Sandman (1973). The inventory contains six scales namely: anxiety toward learning, perception of the instructor, value of learning in society, self-concept in learning, enjoyment of learning, and motivation of learning. A Likert scale was used to measure the response of the sample's attitude. The original Likert scale employed the following response: strongly agree, agree, disagree, and strongly disagree. These were rated on a 5-point Likert-type scale, ranging from 1 (Strongly Disagree) to 5 (Strongly agree).

The first procedure involved administering the inventory to ten students. Students were asked to circle statements that seemed to be confusing and words that were not familiar to them. The next stage was to send the inventory to two measurement and evaluation specialists for validation purposes. To ascertain the reliability of the instrument, a pilot study was conducted on 20 students. Data analysis found that the Cronbach alpha coefficients for all scales of ATBI ranged from 0.64 to 0.85, being greater than the threshold of 0.5 given by Nunnally (1967, 1978).

#### **Problem-solving questionnaire**

The instrument contains 31 items. These were rated on a 5-point Likert-type scale, ranging from 1 (Strongly Disagree) to 5 (Strongly agree). The questionnaire was tested to ensure reliability and validity. The reliability result showed that Cronbach's alpha was 0.9 for all items, so the questionnaire is reliable. Regarding validity, the researcher met with fifteen students to assess for face validity. They were invited to evaluate verbally if the items were difficult to understand and to provide suggestions for item revision if necessary. No modifications were made since no issues rose. The result of AVE is greater than .50, indicating high convergent validity for latent variables. Consequently, all items in this questionnaire have a good convergence. Moreover, the square roots of AVE for all constructs are greater than the correlation between the respective constructs. Based on the results, there is adequate discriminate validity between items. Depending on these results, the questionnaire is valid.

#### **Self-directed learning (SDL) Questionnaire**

The Self-directed learning Readiness Scale (SDLRS) is a self-report questionnaire with 58 Likert-type items developed by Dr. Lucy M. Guglielmino in 1977. It is designed to measure the complex attitudes, skills, and characteristics that comprise an individual's current level of readiness to manage his or her learning. The Cronbach Alpha internal consistency coefficient was 0.895, and the version of the questionnaire had high reliability. The validity of the questionnaire was 0.51 (Malkawi, 2015).

SDLRS is composed of a total of 58 items. Each item has a 5-point Likert format scale including '1=almost never true of me', '2=usually not true of me', '3=sometimes true of me', '4=usually true of me', '5=almost always true of me'. Each point has a score equal to its number. For Example, in positively stated items, selecting 'usually true of me', scores 4 points for that item. This means that if a participant selects 'almost always true of me', 5 points are assigned to that item. The summation of all 58 item scores equals the total score on the SDLRS. The scale contains 41 positive statement items and 17 negative statement items. Items number 3, 6, 7, 9, 12, 19, 20, 22, 23, 29, 31, 32, 35, 44, 48, 53, and 56 are negative statement items that should be scored reversely to show support for SDL characteristics, and other items are positive statements items.

The SDLRS was assessed by Finestone in 1984 and by Wiley in 1981 for test-retest reliability (Guglielmino & Guglielmino 2001). The SDLRS received test-retest reliability scores of 0.82 (Finestone 1984) and 0.79 (Wiley 1981). Therefore, the scale was shown to have high test-retest reliability. Reliability a split-half, odd-even reliability was computed using the scores of the 30 students. The coefficient, corrected by the Spearman-Brown method, was 0.92, which means high reliability.

### **21<sup>st</sup> Century Skills (Cs21)**

The Cs21 enables the current generation to face future challenges, which could encompass changes in business, financial system, culture, technology, and information (kan'an, 2018). The Cs21 include inventive thinking, digital literacy, high productivity, and effective communication. One of the most used measurements in educational research is self-rating or self-assessment. The Cs21 is a self-report questionnaire with 56 Likert-type items developed by kan'an (2018), which was, in turn, based on the enGauge Cs21 framework. A three-point Likert scale (Disagree 1 point to Agree 3 points) was employed to collect data. It is composed of three factors: Digital-Age Literacy, Inventive Thinking and Moral values and its factor analysis emerged three factors, explaining 30.74 percent of the overall variance. The reliability (Cronbach's alpha) values ranged from 0.78–0.83 for three factors, while that for the entire instrument was found to be 0.81 (Osman, Soh, &Arsad, 2010).

### **Ethical Consideration**

Approval for this study was obtained from the Research Ethics Committee of INU. The students were informed about the purpose of the study and were assured that participation was voluntary and that they could withdraw at any time.

### **Data collection**

The researcher explained the purpose and significance of the study to all potential participants. They were informed that their participation is voluntary, and they could choose to withdraw at any time. Additionally, the participants were assured that all data will be kept confidential. Written informed consent was obtained from students after they agreed to participate in the study. The researchers studied six subjects. Each subject follows one of the faculties at the university mentioned above. The researchers selected sixty students from each faculty. So, the total number of all students was 360. Each group, which consisted of 60 students, was divided into three groups (each group consisted of 20 students). The researchers learned the first group via DEL, the second group was learned via BL, and the third group was FTF approach. The researchers distributed the questionnaire only after attending the lectures. The data collection lasted three months.

### Data analysis

Descriptive statistics were used to obtain the mean scores and standard deviations. MANOVA test was used. Calculations using SPSS 21.0 for Windows were used to test the significance of the differences between the scores' means of each variable. Finally, MANOVA test calculation on Tests of Between-Subjects Effects and MANOVA Multiple Comparisons was used to test for differences among the three independent variables.

### Results

The hypothesis testing used in this study is the multivariate analysis of variance (MANOVA) test. Normality and homogeneity tests were carried out, while for the MANOVA test normality test, variant homogeneity, and matrix homogeneity were tested after the data is said to be normally distributed. The next step was MANOVA analysis of the post-test data. Before conducting the MANOVA analysis, the normality test, homogeneity test and multi-correlation test were carried out. The normality test with Kolmogorov-Smirnov showed that all data from the groups were normally distributed by the value of Sig. > 0.05 which is 0.100. This study uses a significance level of 5%. The test criteria are comparing  $\alpha$  value with significance levels with the following conditions.

The purpose of this study was to identify the differences in learning mode between groups of students who are exposed to DEL, BL and FTF modes. This experiment attempted to test the following hypotheses:

H1: There is no influence of instruction mode (DEL and BL) compared to FTF on students' academic achievement.

H2: There is no influence of instruction mode (DEL and BL) compared to FTF on students' attitude.

H3: There is no influence of instruction mode (DEL and BL) compared to FTF on students' problem-solving skills (PS).

H4: There is no influence of instruction mode (DEL and BL) compared to FTF on students' self-directed learning (SDL).

H5: There is no influence of instruction mode (DEL and BL) compared to FTF on students' 21<sup>st</sup> century skills (Cs21).

This study aims to analyze the effectiveness of instruction mode (DEL and BL) compared to INU students' academic achievement, attitudes, PSS, SDL, and Cs21. This study's results show that there are differences between those who did not treat through these modes. The results of the analysis of the descriptive data are presented in Table (1).

**Table (1):** Means and standard deviations of the scores of students in all variables

Variable	Learning mode	Mean	Std. Deviation	N
Academic achievement	DEL	5.79	2.692	120
	BL	6.22	1.646	120
	FTF	7.03	1.829	120
	Total	6.34	2.164	360
Attitudes	DEL	93.45	8.341	120
	BL	86.00	19.246	120
	FTF	82.21	27.341	120
	Total	87.25	20.338	360
PSS	DEL	123.54	22.225	120
	BL	118.67	34.564	120
	FTF	112.36	36.467	120
	Total	118.22	31.925	360
SDL	DEL	203.19	49.172	120
	BL	207.99	46.544	120
	FTF	199.97	26.275	120
	Total	203.72	42.001	360
Cs21	DEL	142.77	27.990	120
	BL	138.87	21.674	120
	FTF	120.64	32.366	120
	Total	134.15	29.238	360

Based on Table 1, scores of DEL, BL and FTF learning mode respectively with each variable showing as the following: (1) Academic achievement variable scores are  $5.79 \pm 2.692$ ,  $6.22 \pm 1.646$  and  $7.03 \pm 1.829$  (2) Attitudes variable scores are  $93.45 \pm 8.341$ ,  $86.00 \pm 19.246$ , and  $82.21 \pm 27.341$  (3) PSS variable scores are  $123.54 \pm 22.225$ ,  $118.67 \pm 34.564$  and  $112.36 \pm 36.467$  (4) SDL variable scores are  $203.19 \pm 49.172$ ,  $207.99 \pm 46.544$  and  $199.97 \pm 26.275$  (5)

Cs21 variable scores are  $142.77 \pm 27.990$ ,  $138.87 \pm 21.674$  and  $120.64 \pm 32.366$ . The analysis reveals that there is a difference in the mean scores on academic achievement, attitude, PSS, SDL, and Cs21 scores between the experimental groups (DEL, BL) and control group (FTF). To test the significance of the differences between the scores' means of each variable MANOVA test was used. Calculations used of SPSS 21.0 for Windows. The MANOVA test results can be seen in Table 2.

**Table 2:** MANOVA Test Results for the Effect of learning mode on all variables

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.988	5742.856 <sup>b</sup>	5.000	353.000	.000
	Wilks' Lambda	.012	5742.856 <sup>b</sup>	5.000	353.000	.000
	Hotelling's Trace	81.344	5742.856 <sup>b</sup>	5.000	353.000	.000
	Roy's Largest Root	81.344	5742.856 <sup>b</sup>	5.000	353.000	.000
Learning	Pillai's Trace	.229	9.171	10.000	708.000	.000
	Wilks' Lambda	.774	9.656 <sup>b</sup>	10.000	706.000	.000
	Hotelling's Trace	.288	10.142	10.000	704.000	.000
	Roy's Largest Root	.273	19.329 <sup>c</sup>	5.000	354.000	.000

Based on the MANOVA test results presented in Table (4) it reveals that the F value for Pillai's Trace, Wilk Lambda, Hotelling Trace and Roy's Largest Root has a significance value of less than 0.05, which means all are significant. Therefore, it is clear that there is a significant effect of learning mode (DEL, BL and FTF) on all variables (academic achievement, attitudes, PSSs, SDL, and Cs21).

Based on the results of data analysis it shows that the influence of dependent variables (academic achievement, attitudes, PSS, SDL, and Cs21) between students who are taught with different modes (DEL, BL and FTF) can be known by using the MANOVA test on Tests of Between-Subjects Effects. MANOVA test calculation on Tests of Between-Subjects Effects uses SPSS 21.0 for

Windows. MANOVA test results on Tests of Between-Subjects Effects can be seen in Table 3.

**Table 3:** Results of MANOVA for the between-subjects effect of the study variables

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Learning mode	Academic achievement	93.849	2	46.925	10.555	.000	.056
	Attitudes	7855.851	2	3927.926	9.971	.000	.053
	PSS	7529.452	2	3764.726	3.750	.024	.021
	SDL	3900.290	2	1950.145	1.106	.332	.006
	Cs21	33381.748	2	16690.874	21.785	.000	.109

P=0.05

Table (3) shows the significant effects of learning modes on students' academic achievement, attitudes, PSS and Cs21 with F values of 10.555, 9.971, 3.750 and 21.785 respectively and with significances of 0.000, 0.000, 0.024 and 0.000 < 0.05. This indicates that there is a significant effect of the use of learning mode on students' academic achievement, attitudes, PSS and Cs21. Also, results show no significant effects of learning modes on students' SDL with an F value of 1.106 and with a significance of 0.332 > 0.05, which means there is a significant effect of the use of learning modes on students' SDL. This means that all null hypotheses are rejected except H4 which is accepted.

MANOVA Multiple Comparisons were used to test for differences among the three independent variables (DEL, BL and FTF) on all dependent variables (Academic achievement, Attitudes, PSS, SD and Cs21). Table 6 shows the results of Multiple Comparisons.

**Table 4:** Multiple Comparisons (post-hoc MANOVA)

Dependent Variable	(I) Learning	(J) Learning	Mean Difference (I-J)	Std. Error	Sig.
Academic achievement	DEL	Blended	-.42	.272	.265
		Face to face	-1.23*	.272	.000*
	Blended	DEL	.42	.272	.265
		Face to face	-.81*	.273	.009*
	Face to face	DEL	1.23*	.272	.000*
		Blended	.81*	.273	.009*
Attitudes	DEL	Blended	7.45*	2.557	.011*
		Face to face	11.24*	2.562	.000*
	Blended	DEL	-7.45*	2.557	.011*
		Face to face	3.79	2.568	.304
	Face to face	DEL	-11.24*	2.562	.000
		Blended	-3.79	2.568	.304
PS	DEL	Blended	4.87	4.082	.458
		Face to face	11.18*	4.090	.018*
	Blended	DEL	-4.87	4.082	.458
		Face to face	6.31	4.099	.274
	Face to face	DEL	-11.18*	4.090	.018*
		Blended	-6.31	4.099	.274
SDL	DEL	Blended	-4.80	5.409	.648

		Face to face	3.22	5.421	.823
	Blended	DEL	4.80	5.409	.648
		Face to face	8.03	5.432	.303
	Face to face	DEL	-3.22	5.421	.823
		Blended	-8.03	5.432	.303
Cs21	DEL	Blended	3.90	3.566	.518
		Face to face	22.13*	3.574	.000*
	Blended	DEL	-3.90	3.566	.518
		Face to face	18.23*	3.581	.000*
	Face to face	DEL	-22.13*	3.574	.000*
		Blended	-18.23*	3.581	.000*

\* Sig. at  $\leq 0.05$

Table (4) shows that only statistically significant variables are reported in this table as the following:

- The dependent variable of academic achievement was found to be statistically different ( $0.00 < 0.05$ ) between FTF learning mode and DEL mode in favor of FTF. Also, there was a statistical difference ( $0.009 < 0.05$ ) between the FTF learning mode and the Blended mode in favor of face-to-face.
- The dependent variable of attitudes was found to be statistically different ( $0.011 < 0.05$ ) between the DEL mode and BL in the favor of DEL mode. Also, there was a statistically different ( $0.00 < 0.05$ ) between the DEL mode and FTF mode the favor of the DEL mode.
- The dependent variable of PSS was found to be statistically different ( $0.018 < 0.05$ ) between the DEL mode and FTF mode in the favor of DEL mode.
- The dependent variable of Cs21 was found to be statistically different ( $0.00 < 0.05$ ) between DEL mode and FTF mode in favor of DEL mode. Also, there was a statistically different ( $0.00 < 0.05$ ) between the Blended mode and FTF mode the favor of the Blended mode.

## Discussion

Based on the results of the research, it can be proved that face to face instruction mode is better than DEL and BL applied in INU, in improving INU students' academic achievement conflict with (Evans, Yip, Chan, Armatas, & Tse, 2020; Nayar & Koul, 2020; Yashwant, et al., 2020). The reason is that instructors at INU still have weeks in instruction knowledge activities and content in their blended and DEL modes, they still depend on lecturing in these two modes instead of shifting half of every week's credit hours (1.5 hours) to student-centered learning, they put recall quizzes or assignments that its scores Weight 60/100for DEL and Blended courses. So, students start to make whats-up groups by which they send the answers to each other. In this situation, students' knowledge will be weaker than in FTF mode in which students discuss with the instructors and they had no online assignments and quizzes by which they collect the scores in courses easily.

Also, results showed that there is an influence of DEL mode on students' attitudes, which means students like courses to be DEL courses. In DEL, students find themselves more comfortable for them and save time, academic and even physical effort, and money. Where the student does not need to go to the university and can attend it from anywhere and the assignments and short tests that are provided by the instructors on the electronic platform can be obtained from other students, and it reduces the percentage of the student's shyness to participate and present his answers. The results of this study are consistent with previous studies (Li, 2023; Uyar, 2023).

On the other hand, DEL has an impact on providing students with problem-solving skills compared to the FTF method, as DEL provides experiences that contain realistic problems that students need to solve through groups and individually, and these experiences are provided to students through electronic projects that do not provide teaching students in a FTF manner. These results are consistent with Widiarti, et al (2023).

The results indicate that both DEL and BL are more effective than FTF learning in developing Cs21 skills. Because students in Learning and BL use technology to obtain the necessary scientific information to solve problems, and they search for information using the Internet to verify scientific information, and they use technology for scientific purposes extensively, and they use various references and sources to obtain information, and they use electronic programs to analyze scientific data, and learn more about global problems than FTF learning. These results are consistent with Eslit (in print).

The researchers recommend the use of DEL and BL and training faculty members to use them in the best ways, especially in each of the following:

1. Basic computer skills.
2. Skills in using DEL platforms.
3. Preparing student-centered life experiences.
4. Instruction content and knowledge activities fit blended and DEL modes.
5. Using learning strategies commensurate with DEL and blended learning.

The researchers also recommend researching to find teaching strategies that are compatible with DEL and blended learning.

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