Heliyon 9 (2023) e20018

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

# Self-directed learning skills and motivation during distance learning in the COVID-19 pandemic (case study: The university of Jordan)

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ARTICLE INFO

*Keywords:*
Distance learning
Self-directed learning skills
Motivation
COVID-19 pandemic

ABSTRACT

This study aimed to assess the effect of distance learning on students' self-directed learning skills and motivation during the lockdown period of the COVID–19 pandemic. The study relies on a quantitative methodology. The data were collected using an administrative online survey distributed to 427 respondents with different majors (BBA) enrolled in the learning skills and scientific research skills course (obligatory course) in the second semester of the academic year 2020/2021 at The University of Jordan. Regression analysis was used to analyze the proposed hypotheses. The results showed that the independent variable (Distance Learning) positively influenced students' motivation and self-directed learning skills. The recommendations based on the outcomes of this research are useful for educational specialists to develop learning environments about the effects of distance learning on students' self-directed learning skills and motivation. In terms of limitations, the analysis was performed in one university only; therefore, attention must be paid when generalizing the results.

## 1. Introduction

Although there have been several pandemics throughout history, including cholera, the plague, and SARS, we recently found ourselves confused when dealing with the COVID-19 pandemic, especially those of us in the education sector. We used to talk about and encourage the use of e-learning systems, but when we were forced to deploy electronic learning systems, participants in the education system faced numerous challenges. For example, it was stated that the COVID-19 pandemic negatively affected preschool education (conducted studies in art, science, and mathematics, including activities and games), and it was proved that actions should be taken into account to sustain preschool education during pandemics [1] In addition, for the medical studies, some data collected showed a significant effect of the COVID-19 pandemic on the lives of residents and early-career surgeons. Actionable items from these data include how to mitigate burnout and depression through increased access to personal protective equipment and the provision of

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https://doi.org/10.1016/j.heliyon.2023.e20018
Received 2 June 2022; Received in revised form 4 September 2023; Accepted 8 September 2023
Available online 9 September 2023

wellness programs, with a particular focus on high-risk groups [2]. Social media platforms and learning management systems (LMS) are considered to be among the most frequently used sources of information around the world, and that was especially true during the pandemic. The cheapest method to access the Internet, easy log-on, and the huge number of other users make them the easiest and most effective methods of disseminating information. During the COVID-19 crisis, a large number of people searched for information about using them, and social media platforms played a positive and negative role during the pandemic. Social media has become a useful tool for helping individuals communicate with friends and family while quarantined, minimizing the negative effects of isolation that have been linked to anxiety, stress, and fear. They also help rapidly spread necessary information and helpful hints.

Because of the COVID-19 pandemic, the traditional method of face-to-face education became impossible, and universities reacted by actively developing new approaches to education, including adapting existing distance learning approaches. Distance learning is an educational strategy that allows for the delivery of education to students who are not physically present at the university. Distance education is today based primarily on the use of the Internet and is now readily available to the vast majority of students in their homes [3]. So, the most important factor in distance learning is the utilization of technology to distribute educational materials, keep students in contact with lecturers, provide methods of communication between students, and create an academic mood similar to that in the classroom [4]. The variance is that distance learning tools offer the flexibility and opportunity to complete course requirements from almost anywhere. According to Ref. [5], the increased ease of communication between participants, more equitable participation in discussions, reduced bias, and the ability to tackle more controversial topics are some of the advantages of distance learning.

In the University of Jordan strategic plan, one of its goals is to deliver intellectual and skillful alumni, so we believe that the courses offered by the Requirements Coordination Center at the University of Jordan should verify this goal. However, each student of the University of Jordan who studied at the Requirements Coordination Center last semester had a unique motivation for choosing learning skills and scientific research skills courses because of the COVID-19 pandemic. Currently, there is a lack of studies on the impact of distance learning on students' motivation and SDL skills in the middle east perspective more specifically in the Jordan context. Also, exploring these two terms contemporaneously has received limitedly investigated, especially during the COVID- 19 pandemic.

While COVID-19 challenges teaching and learning in the university of Jordan environment, our study findings would fill a gap in the literature on students' academic motivation and SDL skills during this pandemic by investigating, identifying and exploring barriers to distance learning to motivation and SDL skills among students during the COVID-19 pandemic and showing it's important in the educational environment and their effects [6]. In addition, most studies on motivation in online courses were investigated in the developed world, However, before the pandemic, a large number of students and teachers had limited experience with online and distance learning [7]. So, research on students' motivation and SDL in online courses outside of the developed world more specifically in Jordan is relatively limited, that only began implementing online learning during the pandemic [8]. In addition, the shift to online learning was sudden and unexpected, which added additional challenges for students, teachers, and the education system as a whole [6]. This sudden shift has likely had a significant impact on student's motivation and self-directed learning skills, but the extent of this impact is not well understood due to the limited research in this area [6].

Conducting research on students' motivation and self-directed learning skills in the context of online learning during the Covid-19 pandemic in developing countries more specifically in Jordan is important for several reasons. Firstly, it will provide insights into the unique challenges and opportunities that students in these countries face when learning online. Secondly, it will help to inform the development of effective strategies to support students and improve the quality of online learning in these countries. Finally, it will contribute to the global body of knowledge on the impact of distance learning on students' motivation and self-directed learning skills. In addition to the above reasons, there is a limited number of researchers investigating the topic in an Arabic country. So, it's a contribution to the previous literature in the field.

### *1.1. Study objectives and questions*

In light of the global spread of COVID-19 and the consequent circumstances, the distance learning process has been run at higher education institutions in Jordan, including the University of Jordan, including subjects affiliated with the University Requirements Coordination Office. This office supervises 10 compulsory courses at the university, along with elective courses included in the study plans for all the majors offered by the university. Therefore, a large part of each subject is extracted from that course of study and taught in these classes, which also means that each section typically contains a large number of students.

Researchers teaching the course Learning and Scientific Research Skills, which is offered by the University Requirements Coordination Office, have noticed that their students participate well in synchronized meetings and assignments, but have low levels of motivation, which influences their academic achievement. Therefore, this study aimed to (1) determine the types of educational platforms used and the most prevalent ones used by students in distance learning during the COVID-19 pandemic, (2) determine the impact of distance learning during the pandemic on improving self-directed learning skills among students in the Learning and Scientific Research Skills course at the University of Jordan, and (3) determine the impact of distance learning during the COVID-19 pandemic on improving and increasing the motivation of students in the Learning and Scientific Research Skill class at the University of Jordan. Hence, the core focus of the present study was to answer the following question:

What is the effect of distance learning on the self-directed learning skills and motivation of students at the University of Jordan?

Then, the question was divided into the following sub-questions.

1. What is the impact of distance learning on improving the self-directed learning skills of students at the University of Jordan?
2. What is the effect of distance learning on improving students' motivation at the University of Jordan?

3. What effects do the distance learning strategies used in Learning and Scientific Research Skills have on the self-directed learning and motivational skill of students at the University of Jordan?

### *1.2. Significance of the study*

In the past decade, distance learning styles have appeared that are sake at providing educational content effectively and enjoyably using a variety of ways to present information. These methods include multimedia technology, ready-made software, and the Internet and are aimed at improving the quality of learning by facilitating access to digital resources and services [9]. The changing educational environment created by the COVID-19 pandemic contributed to the use of these various devices and platforms in students' distance learning process.

This study took its importance from the need to adapt to the current pandemic situation by understanding the impact of distance learning at the University of Jordan on self-directed learning skills and student motivation, as well as gaining knowledge about the patterns of the technological means being used and the most widespread educational platforms. The aim was to gather data and results that will contribute to the development of a new educational reality that gives greater priority to the marginalized aspects of the current systems and takes these results into account when designing curricula and planning the overall educational process.

The current study contributes to existing knowledge by exploring the impact of distance learning on students' self-directed learning skills and motivation in a specific setting. A key contribution of this paper is its context because it is the first study that brings in evidence from Jordan, making it a good addition to the previous literature. In addition, no previous studies, to the best of our knowledge, have investigated the impact of distance learning on students' self-directed learning skills and motivation in Jordan at the same time. Hence, it is a new addition to previous studies in the field. Plus, limited numbers of research address the topic in the online context. So, it added to the previous literature on the topic. Finally, studying the impact of DL on students' self-directed learning skills and motivation is crucial in understanding how to better support students in emergency conditions in the future.

## 2. Literature review

### *2.1. Distance learning*

In 2020, the COVID-19 pandemic forced the government to problem social distancing rules. This infected all aspects of life, including the problem of follow-up education during the lockdown period, so the government changed face-to-face education with distance learning education during pandemic-induced restrictions [10]. The instruction style of distance education was convenient for this time when students and teachers could not be together in the classroom and was instead sometimes quite far from each other so that instruction cannot be done face-to-face and the transfer of information from educators to students must be done through online method [11]. This physical separation of instructors and students in distance education has been influenced by the limited interaction between teachers and students [12]. Instructors of distance learning classes cannot guide and organize their teaching for individual students in a regular method as face-to-face education, so adopting distance learning made it difficult for instructors to keep their teaching interesting [13]. Nonetheless, students' attentiveness to learning had to be maintained during the COVID-19 pandemic, and thus there is also a need to find methods to motivate students when undertaking a distance learning process [2].

### *2.2. Motivation*

Motivation plays a critical role in the learning process. A student's accomplishment is related to their way of thinking, feeling, and behaving [12], and students who have issues at university frequently show lower levels of motivation [14]. As a result, educators need to strive for an increase in students' enthusiasm for learning by providing support in the form of awards and reinforcements for academic achievements and attention to their studies, giving feedback that makes students feel capable [15].

Motivation in learning can be split into two key types: intrinsic and extrinsic [16]. [15] noted that intrinsic motivation arises from within the individual, originating from internal rewards rather than external ones like grades or money. Intrinsically motivated students get pleasure from the task itself or from the satisfaction of working on and ending a task.

For other students, extrinsic motivation influences learning [15]. stated that "extrinsic motivation is the outcome of any number of external factors." These outside elements include punishment and reward. Extrinsic motivation does not imply that the student gets no enjoyment from learning or accomplishing an assignment. It simply implies that the pleasure they get from the expectation of some extrinsic rewards is more motivating, especially when the task at hand holds very little or no interest for them. Accordingly, the authors constructed this hypothesis:

**H01**. Distance learning does not significantly affect the students' motivation in learning.

### *2.3. Self-directed learning skills*

Self-directed learning philosophy includes theories for adult education, humanism, constructivism, and empowerment, the process of increasing knowledge, skills, achievements, and self-development through self-planned and self-conducted learning towards autonomous, self-directed learning is a structure in which individuals take the responsibility for assessing their learning requirements, establish their learning objectives, and discover human and material resources. They then choose and apply suitable learning

techniques and evaluate the results [17].

Many students may benefit from self-directed learning in an integrated curriculum learning resonates well to achieve goals through their interaction with the educational material and proceeds with learning according to their abilities, preparations, and special capabilities, with a minimal level of guidance from the teacher [18]. There are certain required skills for self-directed learning, according to the learner's effort in the practices of learning, including skill in self-evaluation, a sense of appreciation, skill in applying self-reinforcement and cooperation, skilled sharing of opinions, willingness for self-improvement, and the desire and motivation to learn through skill in searching for answers by adopting independent thinking and problem-solving [19].

Besides, SDL is an interactive learning activity that builds on the learner's existing knowledge to solve issues and is supported by the learner's motivation to achieve competency [18]. In SDL, students make all of the decisions by themselves, including the learning objectives and outcomes that they will be in charge of controlling. SDL refers to a learning activity in which the students themselves specify the learning objectives and the techniques to achieve them [19]. Therefore, the authors formulate the current hypothesis:

**H02.** Distance learning does not significantly affect the students' self-directed skills in learning.

### *2.4. Learning theories*

Online Learning presents opportunities for self-directed learning for adults, concerning time, space, and learning pace, allowing online adult students to take charge of their learning experience through self-directed learning indicated a central theme of adult students preferring online instruction that offers choice in how the learning happens and how it is constructed [20]. No single theory or model provides complete knowledge about adult learners, learning context, and learner understanding.

As included in Humanism, andragogy, and Connectivism, humanism emphasizes adults taking ownership of learning. According to humanism, learners are responsible for their learning, and instructors are facilitators [21]. Humanists believe "the key purpose of humanistic education is to enhance personal growth and develop human potential" [22]. Humanists focus on human development, human feelings, and other affective parameters [23]. Humanists stress that learning involves not only a learner's inclination to learn but also how aware the learners are of their ability to learn. Humanism also focuses on the affective domain apart from cognitive abilities [12]. While andragogy is attributed to serving educators and trainers to comprehend adult learning [20], it does not meet the requirements to be categorized as a theory. Instead, it is a model based on the humanism theory students gradually transition from being dependent to independent learners. Learners travel on this educational journey which can be given by teachers [24].

The last learning theory that focuses on the new generation of learning is called the Connectivism theory, according to the connectivism theory, learning is the expansion, improvement, modification, or strengthening of the links between the entities that make up knowledge, such that a change in one entity may result in a change in the other entity. In addition to providing a connectivism explanation of learning and a thorough examination of how learning takes place in networks. Following that, it provides readers with an interpretation of connectivism, which is a collection of techniques for discussing and using connectivism in learning networks, before moving on to pedagogy [25–27].

### *2.5. Study model*

The present study adopted a conceptual framework based on a conceptual model that includes distance learning assumed to have negative impacts on students' motivation and self-directed learning skills [28–32]. The conceptual model that leads this investigation can be seen in Fig. 1.

## 3. Methods

This research employed a quantitative survey developed by Google Forms and the data collected from the students enrolled in the obligatory Learning Skills and Scientific Research course at the University of Jordan in the second semester of the 2020/2021 academic year, during the COVID-19 pandemic, and the course was introduced in a fully online environment (Microsoft Teams and Moodle) using a blended learning strategy. The study population comprised 3000 students who enrolled in the course through distance learning in prior semesters and the sample comprised 427 responses. Before collecting the data, the researchers obtained ethical approval from the Institutional Review Board at the University of Jordan/Deanship of Scientific Research with approval number 61–2023, which states that consent was obtained from all participants in this study. Then, we successfully collected the sample during the two weeks of

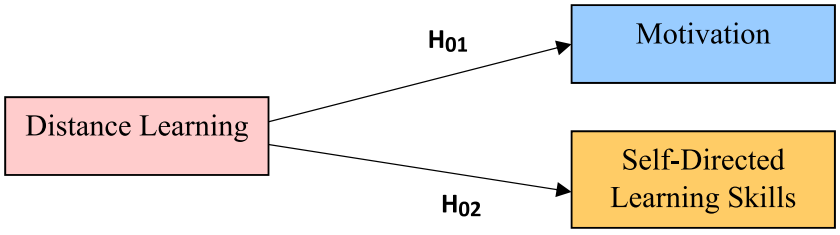


**Fig. 1.** Research model for self-directed learning skills and motivation during distance learning.

data collection, and the students who responded varied in their undergraduate programs and majors. This study employed a simple random sampling that is considered a probability sampling method [33]. The researchers used a simple random sampling method for several reasons. The first one is due to its representativeness of the population. In addition, due to the reasonability to make generalizations from the results of the sample back to the population [33,34]. The questionnaire was sent to the students through Microsoft Teams and Moodle platforms by the course instructors, who interact with students in the virtual environment. The researchers also sent the survey link in Google Forms format to several groups comprising the lecturers, researchers, and other colleagues to forward the link to their students during the online lecture. The data collection process starts on April 13, 2021, and closes on April 30, 2021.

### 3.1. Study tools

This study aimed to identify the effect of distance learning during the pandemic on self-directed learning skills and motivation to learn among students of the Learning Skills and Scientific Research course at the University of Jordan. To achieve this aim, the researchers used a 5-point Likert-type scale, where responses ranged from 1, "strongly disagree," to 5, "strongly agree." The first tool was a 9-questions distance learning scale adapted from Refs. [24,35,36]. Table 1 below shows the distance learning, factor loading for the items, and reliability of the whole construct.

The second tool was the motivation scale, which was developed to measure motivation in line with the study questions, making use of the tools employed for prior studies. This tool was developed because the scale was already in its final form, consisting of 28 questions within the three main diminutions of strengthening and ability, sense of value (self-esteem), and knowledge and understanding [37–39]. As seen in Table 2 below, the table describes measurement Items for motivation, factor loading for the items, and reliability of the whole construct.

The last tool was the self-directed learning skills development scale, the researchers develop and adapted the tool from previous literature, [40,41]. The developed tool was revised by many experts in the field to adapt to our study objectives, its final form contains 27 questions within four main dimensions depending on the study objectives according to the study problem in the light of SDL skills. The first diminution was organizational skills, the second was effective learning management skills, the third was the skill of using learning resources, and the fourth diminution was self-evaluation skills. Table 3 below describes measurement Items for the Self-Directed Learning Skills, factor loading for the items, and reliability of the whole construct.

The tools were built by the Google form, and the link was provided to the students through the course page on the Moodle learning management system, all the instructors for this course notify the students to fill up the uploaded questionnaires.

## 4. Results

### 4.1. Test of normality

Before beginning to analysis, the normality test was performed using skewness and kurtosis, with the skewness test performed to test the asymmetry, which reveals the manner of clustered items, and the kurtosis test was performed to determine how flat the top of the curve was and whether it was normal or bell-shaped [42]. The values of the skewness and the kurtosis coefficients were less than $+2$ and more than $-2$ [43]. As can be seen in Table 4, the results for skewness and kurtosis were within the acceptable range. Thus, the data were normally distributed.

### 4.2. Profile of respondents

The main characteristics of the research sample population in this study were collected through demographic data gathered in the

**Table 1**
Measurement Items for Distance Learning, factor loading for the items, and reliability of the whole construct.

| Distance Learning (DS) | | |
|---|---|---|
| Code | Full Statement | Factor loading |
| **DL1** | The e-learning applied in the course on learning and research skills helped me develop social communication skills between me and those who teach me and between me and my colleagues. | 0.881 |
| **DL2** | The e-learning applied in the course on learning and research skills helped me solve the learning problems I face. | 0.877 |
| **DL3** | The e-learning applied in the course on learning and research skills helped me ask questions and make inquiries. | 0.520 |
| **DL4** | The e-learning applied in the course on learning and research skills helped me in presenting distinctive scientific projects. | 0.743 |
| **DL5** | The e-learning applied in the course on learning and research skills helped me with the activities of the college and university. | 0.687 |
| **DL6** | The e-learning applied in the course on learning and research skills helped me discover my strengths and weaknesses. | 0.627 |
| **DL7*** ** | The e-learning applied in the course on learning and research skills helped me with submitting assignments through the tools provided by the e-learning system. | Deleted |
| **DL8** | Learning platforms allow me to employ multiple methods of evaluation for my performance in a course. | 0.782 |
| **DL9** | It is easy for me to submit online exams for this course. | 0.695 |
| | **Note: *** Deleted question Cronbach's alpha for the scale** | 0.750 |

Notes: Factor loadings $\geq$0.400 and eigenvalue proportion $\geq$1.000.
Note: Cronbach's alpha $\geq$0.600.

**Table 2**
Measurement Items for Motivation, factor loading for the items, and reliability of the whole construct.

| Motivation (M) | | |
|---|---|---|
| Code | Full Statement | Factor loading |
| **M1** | My learning is much easier and more flexible. | 0.460 |
| **M2** | I enjoy the thought-provoking questions asked by the teacher in the course. | 0.518 |
| **M3** | I receive various forms of reinforcement. | 0.408 |
| **M4** | I find that the course is related to my scientific and practical life. | 0.802 |
| **M5** | Due to this course, my desire has increased to complete postgraduate studies after completing my undergraduate degree. | 0.479 |
| **M6*** ** | I easily turn to my teacher when I have problems with this course. | Deleted |
| **M7** | I work hard when I receive reinforcement from my teacher. | 0.579 |
| **M8** | I prefer to study for the learning and research skills course within a group. | 0.570 |
| **M9** | I study the lecture by myself in case I could not attend it. | 0.436 |
| **M10** | I make sure to repeat the learning over and over again to reach mastery. | 0.486 |
| **M11** | I feel that my study skills have improved as a result of taking the learning and research skills course. | 0.438 |
| **M12** | I can do my homework for the course on learning and research skills anytime and anywhere. | 0.606 |
| **M13** | My efficiency in completing the tasks required of me for the course has increased and I can do them more quickly. | 0.939 |
| **M14** | My desire to learn has increased after the lecture in the learning and research skills course. | 0.609 |
| **M15** | The technology used increases my motivation to understand the learning and research skills course. | 0.537 |
| **M16** | I actively participate in the course on learning and research skills because it challenges my capabilities. | 0.534 |
| **M17** | My sense of confidence and strength greatly increased. | 0.608 |
| **M18** | I gained a sense of independence while taking the course on learning and research skills. | 0.595 |
| **M19** | My sense of satisfaction and comfort in doing activities with my peers has increased. | 0.433 |
| **M20** | I feel accomplished when I get a good mark in the learning and research skills course. | 0.730 |
| **M21** | My social relationships improved as a result of taking the learning and research skills course. | 0.454 |
| **M22** | I like to participate in the learning and research skills course because the content is fun, exciting, and subject to change. | 0.579 |
| **M23** | My happiness increases when I am present for the learning and research skills course lecture. | 0.622 |
| **M24** | My sense of the value of the education I get increased in the course. | 0.825 |
| **M25** | My enthusiasm and motivation increased to understand the educational content. | 0.798 |
| **M26** | My sense of the possibility of success and excellence increased. | 0.709 |
| **M27** | My ability to apply the concepts that were instilled in me increased. | 0.630 |
| **M28** | I can solve questions in the course of learning and research skills that my colleagues cannot solve. | 0.730 |
| | **Note: *** Deleted question Cronbach's alpha for the scale** | 0.944 |

Notes: Factor loadings ≥0.400 and eigenvalue proportion ≥1.000.
Note: Cronbach's alpha ≥0.600.

first section of the survey instrument. These demographic characteristics included the respondent's gender, age, academic year of study and scientific specialization. Table 5 presents the characteristics of the sample population.

As shown in Table 5, 72.4% are females and 27.6% are males. Exactly 98.1% of the respondents are aged between 18 and 25 years, 13.6% are in the first year of their studies, 29% are in the second year,51.8% are in the third year and 5.9 are in the fourth year of their studies. The largest category of respondents was from the humanitarian colleges, with a rate of 54.6%, followed by science Schools with 20.1%, then, Medical Schools with an average of 16.4% and lastly engineering schools with a ratio of 8.9% (Table 5). The distribution of respondents concerning age, academic year and scientific specialization is representative of the profile of the University of Jordan students.

### *4.3. Statical analysis*

In terms of analysis, the researchers used the SPSS statistical package (V26) for servals reasons, the first one is an appropriate statistical package to validate the study variables. Second, it performs EFA analysis by using a variety of extraction estimation techniques, including the Principal Component extraction technique, Principal Axis Factoring extraction technique, and Maximum Likelihood estimation technique. The third reason is it could be used to carry out the Liner Regression analysis with the organized output of regression analysis [44]. So, regression analysis was used to test the hypotheses of the study [33]. Moreover, the study model contains a simple model with 1 independent and 2 dependent variables. The last reason, the package has simple descriptive statistical methods to describe the study sample characteristics [33].

#### *4.3.1. Validity and reliability*

Validity refers to the accuracy of the research instrument and determining and confirming whether an instrument is measuring what it was intended to measure [33,42].

#### *4.3.2. Face validity*

Face validity was tested by consulting five experts in the field before distributing the questionnaire to benefit from their feedback on the validity of the scale [33,45]. Then, minor revisions were made for translation mistakes before the measurement instrument was piloted on a sample of 30 students, whose feedback was explored about face validity. The results of the pilot study were suitable to achieve the study objectives, and the questionnaire was considered acceptable for proceeding with the survey of the sample.

**Table 3**
Measurement Items for the Self-Directed Learning Skills factor loading for the items and reliability of the whole construct.

| Self-Directed Learning Skills (SDLS) | | |
|---|---|---|
| Code | Full Statement | Factor loading |
| SDLS1*** | I learn according to my ability and capabilities in the course on learning and research skills. | Deleted |
| SDLS2 | I choose the right topics for me through the learning style applied in the course on learning and research skills. | 0.438 |
| SDLS3*** | I would like to research and investigate the topics of lessons in the course on learning and research skills. | Deleted |
| SDLS4 | In the learning and research skills course, I can relate concepts to each other. | 0.763 |
| SDLS5*** | I depend on myself to learn while taking the course on learning and research skills. | Deleted |
| SDLS6 | It is easy for me to access new information about the learning and research skills course lessons. | 0.683 |
| SDLS7 | The learning and research skills course helps me accomplish the activities that are required to be completed with my colleagues. | 0.684 |
| SDLS8 | I relate my learning in the course to the environment and the realities of life. | 0.709 |
| SDLS9 | I can employ the learning tools from the course on learning and research skills. | 0.584 |
| SDLS10 | My learning in the course on learning and research skills is based on my technical skills using technology. | 0.866 |
| SDLS11 | My self-confidence increased in the course on learning and research skills. | 0.799 |
| SDLS12*** | I can help my classmates acquire self-directed learning skills from the learning and research skills course. | Deleted |
| SDLS13 | I study the educational content effectively by using the technology applied in the course on learning and research skills more than I do with traditional teaching methods. | 0.809 |
| SDLS14 | I choose the appropriate learning activities for me for the course on learning and research skills. | 0.665 |
| SDLS15*** | I acquired new skills in learning, such as management and decision-making skills. | Deleted |
| SDLS16 | I seek to obtain information and knowledge from many sources while studying for the course on learning and research skills. | 0.478 |
| SDLS17 | Diversity in using resources helps me develop my critical thinking skills and creative abilities while learning from this course. | 0.709 |
| SDLS18 | I would like to deal with modern tools and technologies in the course of learning and research skills. | 0.657 |
| SDLS19*** | I can enrich my information through the learning resources available in the course. | Deleted |
| SDLS20 | I strive to master the skill of knowledge discovery and learning during my studies in the learning and research skills course. | 0.707 |
| SDLS21 | I have the freedom to use information resources at any time I want continuously in the learning and research skills course. | 0.679 |
| SDLS22 | The learning skills and scientific research course allows me to discuss and share experiences with fellow students and faculty members through discussion forums. | 0.859 |
| SDLS23 | I have the opportunity to review previous essays and substantive exams of the course. | 0.487 |
| SDLS24 | I constantly test myself in various ways on the material from the course. | 0.621 |
| SDLS25 | I receive immediate feedback from my instructor in the course. | 0.463 |
| SDLS26*** | I can clearly understand the notes about my performance on course projects. | Deleted |
| SDLS27 | The communication skills I have learned positively affect my achievements. | 0.482 |
| | **Note: *** Deleted question Cronbach's alpha for the scale** | **0.906** |

Notes: Factor loadings ≥0.400 and eigenvalue proportion ≥1.000. Note: Cronbach's alpha ≥0.600.

**Table 4**
The kurtosis tests, and the skewness tests for normality.

| Skewness | | Kurtosis | |
|---|---|---|---|
| Statistic | Std. Error | Statistic | Std. Error |
| −.517 | .115 | 1.433 | .229 |
| −.830 | .115 | 1.667 | .229 |
| −.418 | .115 | .516 | .229 |

**Table 5**
Profile of participants (N = 427).

| Question | Categories | N | % |
|---|---|---|---|
| **Gender** | Male | 118 | 27.6% |
| | Female | 309 | 72.4% |
| **Age** | From 18 to 21 | 371 | 86.9% |
| | From 22 to 25 years old | 48 | 11.2% |
| | From 26 to 30 years old | 6 | 1.4% |
| | 31 years or above | 2 | 0.5% |
| **Academic year** | First-year | 58 | 13.6% |
| | Second year | 124 | 29.0% |
| | Third year | 221 | 51.8% |
| | Fourth-year | 24 | 5.6% |
| **Scientific specialization** | Schools of Humanities, Education, and Arts | 233 | 54.6% |
| | Medical Schools | 70 | 16.4% |
| | Science Schools | 86 | 20.1% |
| | Engineering Schools | 38 | 8.9% |

#### 4.3.3. Construct validity: Exploratory factor analysis (EFA)

Exploratory factor analysis (EFA) was used to examine the factor loading of the main research variables and the number of items in each construct, the Kaiser–Meyer–Olkin (KMO) index and Bartlett's test of sphericity were used to ensure that the sample size was sufficient to fulfill the requirements for the EFA. In addition, the KMO and Bartlett's tests measured the level of dependability of the variables. The researchers adopted EFA testing due to cultural differences [46,47] and because the researchers translated the study instrument from English into Arabic [48]. Hence, the results are provided in Table 6. The results shown in Table 6 show that the data were suitable for conducting the EFA and met the research objectives. Tables 1–3 present the results of the EFA of the respective study constructs and the reliability test.

Based on the results shown in Table 1, for the independent variable of the distance learning construct used in this study, eight of the nine items were retained, and one item (DL7) was dropped because its factor loading was below 0.40. For the dependent variables of motivation as shown in Table 7, 27 out of the 28 items were retained, and one item (M6) was dropped because they had a factor loading below 0.40. As shown in Table 2 regarding the dependent variables of motivation, 27 out of the 28 items were retained, and one item (M6) was dropped because the factor loading was below 0.40. It can be concluded that the remaining dimensions and items were well-constructed and valid. In other words, the results show that factor analysis is acceptable for analyzing the data in both instances. Also, eigenvalues for the resulting factors in the case of all constructs were greater than one, and all items had loadings greater than 0.4 [43].

As shown in Table 3 regarding the dependent variables of self-directed learning skills, 20 out of the 27 items were retained, and three items (SDLS1 SDLS12, and SDLS15) were dropped because the factor loading was below 0.40. In addition, 3 items (SDLS3, SDLS5 and SDLS26) were dropped because of cross-loading, and one item (SDLS19) was dropped due to negative factor loading. It can be concluded that the remaining dimensions and items were well-constructed and valid. In other words, the results show that factor analysis is acceptable for analyzing the data in both instances. Also, eigenvalues for the resulting factors in the case of all constructs were greater than one, and all items had loadings greater than 0.4 [43]. In addition, Cronbach's alpha was used to test the appropriateness of the internal consistency and reliability of the elements. Using [33] categories for reliability: $\geq$0.9 = excellent, $\geq$0.8 = good, $\geq$0.7 = acceptable, $\geq$0.6 = questionable, $\geq$0.5 = poor, and $<$0.5 = unacceptable. A larger value of Cronbach's alpha coefficient reflects greater internal consistency. So, the results, provided in Tables 3–5, show that the internal consistency values for the research instrument indicated good internal consistency and reliability for achieving the study's goals. Table 7 below, describes the mean and standard deviation values, and the relative importance of the various dimensions being studied.

The measured central tendency of the collected data was applied to determine the relative importance of each item in the research variables. Based on the standard deviation, the ranks were categorized as follows: a low degree ranged from 0 to $<$2.67; a moderate degree ranged from 2.67 to 3.67; and a high degree was greater than 3.67 [49]. The researchers examined the normality of the data to assess the representativeness of the sample [33].

### 4.4. Hypothesis testing results

Regression analysis was used to test the hypothesis, this step is concerned with testing the null hypothesis, $H_{0.1}$, which is assumed to be true but tested for possible rejection. To answer the questions related to the research problem about the nature of the impact of distance learning on motivation and self-directed learning skills, when the significance level ($p$-value) is below 0.05, the null hypothesis ($H_{0.1}$) will be rejected, and the alternative hypothesis ($H_1$) will be accepted, which indicates a positive impact. Conversely, the null hypothesis is accepted when the $p$-value is more than 0.05 [33]. Table 8 below, shows the results of the regression analysis of distance learning's effect on motivation.

Table 8 shows that F = 742.720 and the $p$-value = 0.000, which is less than the 0.05 level of significance, so the main hypothesis ($H_{0.1}$) was rejected and the alternative hypothesis accepted. The table also indicates that R = 78.9% is the correlation value between distance learning and motivation. Additionally, $R^2$ = 62.3%, so the independent variable explains the variation in the dependent variable (motivation) at 62.3%. This indicates that if distance learning is applied to students, they will be motivated in their studies.

In addition, the results shown in Table 8 indicate that the impact of distance learning on motivation is positive and significant ($\beta$ = 0.783, p = 0.000, $>$0.05). Therefore, hypothesis $H_{0.1}$ was rejected.

Table 9 shows F = 742.720 and the $p$-value = 0.000, which is less than the 0.05 level of significance, so the main hypothesis ($H_{0.2}$) was rejected and the alternative hypothesis accepted. The table also indicates that R = 66.5% is the correlation value between distance learning and self-directed learning skills, and $R^2$ = 44.2%, so the independent variable explains the variation in the dependent variable (self-directed learning skills) at 44.2%. This indicates that if distance learning is offered to students, they will improve their self-directed learning skills.

In addition, the results shown in Table 9 revealed that the impact of distance learning on self-directed learning skills is positive and significant ($\beta$ = 0.743, p = 0.000, $>$0.05). Therefore, hypothesis $H_{0.2}$ was rejected.

Lastly, the results shown in Table 10 summarized the results of the hypothesis testing for the research variables based on the data

**Table 6**
KMO and Bartlett's scales of the study's main variables.

| Variables | KMO | Bartlett's test of sphericity |
|---|---|---|
| Distance learning | 0.800 | 0.000 |
| Self-learning skills | 0.917 | 0.000 |
| Motivation | 0.928 | 0.000 |

**Table 7**
Mean and standard deviation values, the relative importance of the various dimensions being studied.

| Items | Item Means | Std. Deviation | Relative Importance |
|---|---|---|---|
| Distance learning | 3.5888 | 0.58367 | High |
| Motivation | 3.6961 | 0.57914 | High |
| Self-Directed Learning Skills | 3.4667 | 0.65204 | Moderate |

**Table 8**
Simple regression of distance learning's effect on motivation.

| Variables | Model Coefficients | *p*-value |
|---|---|---|
| (Constant) | 0.886 | 0.000 |
| Distance learning | 0.789 | 0.000 |
| R | 0.789 | |
| $R^2$ | 0.623 | |
| Adj. $R^2$ | 0.622 | |
| F | 742.720 | 0.000 |
| β value | 0.783 | 0.000 |

**Table 9**
Simple regression of distance learning's effects on self-directed learning skills.

| Variables | Model Coefficients | *p*-value |
|---|---|---|
| (Constant) | 0.886 | 0.000 |
| Distance learning | 0.665 | 0.000 |
| R | 0.665 | |
| $R^2$ | 0 .442 | |
| Adj. $R^2$ | 0.441 | |
| F | 357.133 | 0.000 |
| β value | 0.743 | 0.000 |

analysis.

## 5. Discussion

### 5.1. Motivation

This study aimed to investigate whether student motivation was affected by distance learning conducted during the COVID-19 pandemic. The results of a survey conducted with students taking the Learning and Scientific Research Skills course at the University of Jordan showed that distance learning had a statistically significant effect on increasing students' motivation along with the four main dimensions of reinforcement of ability, sense of value, self-worth, and knowledge and understanding. This result specifically relates to the effectiveness of distance learning during the COVID-19 pandemic and shows that distance learning led to a further strengthening of students which may be due to learning being easier and more flexible [50] they could access the educational content at convenient times and in an appropriate way that best suited them. In addition, they received feedback enjoyably and positively through more relaxed and easier communication with the teachers [51] and increased their ability to link the learned knowledge with reality as we need. They also increased their efforts toward learning because groups in classes had become more interesting. This effect was reflected in the students' desire to complete their higher education [2,52].

Furthermore, the results showed a significant impact of distance learning on increasing students' academic abilities due to the ability to easily access the courses to which they may have been absent [53]. Students were pleased to reach the stage of mastery of these skills, and their adequacy in the study material improved when they were able to study at a time and at a place that was convenient for them [54]. This was reflected in their quicker completion of tasks. Moreover, the use of technology in distance learning increased their motivation to understand the scientific material.

The results revealed that distance learning had a significant effect on increasing students' sense of value (self-esteem) by increasing their confidence and feelings of independence with the educational process. This was reflected in an increased feeling of satisfaction

**Table 10**
Summary of the results of testing the study's hypotheses.

| | Null hypothesis | Result |
|---|---|---|
| $H_{0\cdot1}$: | Distance learning does not significantly affect the students' motivation in learning. | Rejected |
| $H_{0.2}$: | Distance learning does not significantly affect the students' self-directed skills in learning. | Rejected |

with their academic activities and increased happiness with their academic achievements [55]. The results also showed that distance learning had a positive impact on students' social relationships, and they became more involved and present because the content of the material felt fun, exciting, and adapted to the individual student's preferred learning style [2,56].

There was also a significant impact from distance learning in the area of knowledge and understanding, with students gaining an increased sense of the value of education, reflected in their enthusiasm, motivation, and sense of the possibility of success and excellence. It appears that distance learning has facilitated an increase in the ability to apply and consolidate concepts for application in a problem-solving approach [57].

This result is in agreement with several earlier studies that indicated a positive impact of modern technology on increased motivation. Including studies from Refs. [58,59]. In addition, a study by Ref. [60] concluded that differences in scores on the motivation scale revealed statistically significant improvements in the experimental group. The researchers attribute the results in the present study to the capabilities and features provided by distance learning during the COVID-19 pandemic, with methods of presentation that were out of the ordinary in terms of attending the educational meeting, methods of interaction, and the nature of the educational content, as well as the educational activities that were included. Whether related to the organizational processes around the educational material or the skills included in the duties and activities, all of these factors led to increased motivation among these students and fostered a desire to learn the material.

### *5.2. Self-directed learning skills*

This study also investigated the effects of distance learning during the COVID-19 pandemic on self-directed learning skills among students taking the Learning Skills and Scientific Research course at the University of Jordan during the second semester of the 2020/2021 academic year. The results showed a statistically significant effect of distance learning on enhancing students' self-directed learning skills along with the four main dimensions (organizational skills, effective learning management skills, learning resource use skills, and self-evaluation skills). This indicates the effectiveness of distance learning during the COVID-19 pandemic, which is interpreted as distance learning makes the students more organized in their learning and this going with [61], and it should be noted that the importance of developing the university graduates' organizational skills will increase with time to enforce students to rely more on themselves in distance learning more than they have to in face-to-face education. While The use of technology made it easier for students to access educational material and communicate with their peers to solve group assignments, it also provided the possibility of communicating with the teacher at any time [62], as the material was designed to suit the distance learning environment. It includes accessing various learning activities that adapt to student's learning styles and what best suits them in using learning resources, which improve skills in management and decision-making [63].

The researchers relate this to the freedom afforded to students through being able to use learning platforms and resources at times that are convenient for them. However, successful implementation of online learning into the curriculum requires a well-thought-out strategy and a more active approach to the use of modern devices and technologies to enrich access to information. Educational platforms have provided opportunities for students to discuss and exchange experiences among themselves as the results showed [64,65]. These offerings aim to keep students in contact with their teachers and to provide immediate feedback so that students can constantly test themselves in different ways and this positively affects their educational attainment [13,66]. The result is convenient with earlier studies indicating a positive role of distance learning in improving self-directed learning among students [25,67]. The presented results revealed a positive and statistically significant relationship between distance learning and self-directed learning skills in the overall environment during the spread of COVID-19.

## 6. Conclusions

The COVID-19 pandemic that has swept across the world affected all social sectors, and more specifically, the university sector. As this sector affects a large segment of society, this study aimed to investigate the impact of distance learning on self-directed learning skills and students' motivation during the pandemic. The findings indicated that these factors were positively affected by the use of online learning methods during the pandemic lockdown. This effect was possible because there is a good infrastructure to support distance learning, research processes, and exam platforms. The outcomes of this study will be useful for developing countries by helping educational decision-makers better understand the possible effects of distance learning on students' self-directed learning skills and motivation.

### *6.1. Recommendations and future studies*

The researchers recommend that, in addition to the theoretical nature, future studies examine the impact of distance learning on the emergence of problems and disorders in family relationships; the possibility of converting study materials and all courses to electronic delivery methods for all academic years, without practical and laboratory courses; and diversity in instruction and providing learning materials, including presentations, data, pictures, and videos.

### *6.2. Practical implications and limitations*

Universities should work to provide more training to develop their existing infrastructure in such a way that the above methods can continue to offer a good alternative for permitting the continuation of education, even in abnormal circumstances. In terms of

limitations, the study has many issues. Firstly, the speed of the data collection process, where data were collected only during two weeks of the semester. So, it may affect the accuracy of the results. Secondly, data were collected from only one university in Jordan, so, the results of this study cannot generalize. Thirdly, the study did not review the answers of postgraduate students. Therefore, future studies should focus on postgraduate students. Fourthly, the study was conducted in only one country; therefore, future studies should aim to clone the results in larger and more diverse contexts to generalize the results. Finally, the results of the study are descriptive and provide only one level of information. Furthermore, when studying the effect of DL on SDL, it is necessary to perform advanced statistical methods (similar to path analysis or structural equation modeling) that can lead to different search results.

## Author contribution statement

Laith M. Almomani: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper. Niveen Halalsheh: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper. Hanadi Al-Dreabi, Leena Al-Hyari: Analyzed and interpreted the data; Wrote the pape. Raed Al-Quraan: Performed the experiments; Contributed reagents, materials, analysis tools or data.

## Data availability statement

Data will be made available on request.

## Additional information

No additional information is available for this paper.

## Declaration of competing interest

All the authors prepared the paper they don't have any competing financial interests or personal relationships that could have appeared to influence the work reportedly in this paper and we declare that none of the above-mentioned conflicts of interest had any influence on the study design, data collection, analysis, interpretation of results, writing of the manuscript, or the decision to submit for publication.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e20018.

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