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Original Article

Evaluation of the Role of Critical Thinking Disposition and Academic Self-efficacy in Acceptance of e-learning by Tenth-grade Male Students in Experimental Sciences and Mathematics Disciplines

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Abstract

Given the growing importance of the use of novel technologies, especially in the field of education, and with regard to the necessity of learning the use of e-learning by community members, specifically students, the present study aimed to evaluate the role of critical thinking disposition and academic self-efficacy in the acceptance of e-learning by students. This was a descriptive survey research, and the statistical population (n=1289) included tenth-grade male students in experimental sciences and mathematics disciplines in Mashhad, Iran. In total, 288 students were selected by cluster sampling method and based on the Morgan table. Data were collected using Morgan and Jing Academic Self-Efficacy Scale (MJSES) (1999), Ricketts' Critical Thinking Disposition Questionnaire (2003), and Technology Acceptance Model by Davis and Bagozzi (1989). Notably, the instruments had confirmed validity and reliability. Data analysis was performed in SPSS version 20 using Pearson's correlation coefficient and stepwise regression. The research question was "do critical thinking disposition and academic self-efficacy play a role in acceptance of e-learning by tenth-grade male students in experimental sciences and mathematics disciplines?" According to the results, critical thinking disposition and academic self-efficacy significantly predicted students' acceptance of e-learning. In fact, the variable of critical thinking disposition had a share of 0.068 in the amount of acceptance of e-learning in a significant way and based on the standardized beta coefficient. Therefore, this concept can be used as a predictor of e-learning acceptance. Therefore, it is suggested that these skills be reinforced in students by families, principals, teachers and educational authorities to improve the acceptance of new educational innovations and enhance students' academic achievement.

Keywords

E-learning Acceptance, Critical Thinking Disposition, Academic Self-efficacy, High-school Students.

Introduction

A successful community is a thinking one; a society in which the citizens' scientific talent is flourished to the fullest and at permanent level. If thinking is the same as understanding experience, children can learn more by using thinking about whatever they see, say and do (Browne and Keeley, 2015). Critical thinking is the main objective of education and a necessity for understanding knowledge in any field (Maleki and Habibipour, 2007). A part of the conventional necessity in teaching thinking skills is the result of increased awareness of the fact that the society has changed and the skills that were use ful to the previous generation can no

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longer equip students for the world outside of school (Meyers, 2015). Given that students are supposed to deal with an unpredictable world, they are forced to learn skills in order to master life and science. Therefore, they should think critically and creatively as much as possible and learn about global topics and issues (Maroofi and Mohammadi Niya, 2013; Sumak, Hericko & Pusnik, 2011).

In general, the concept of critical thinking encompasses two dimensions of critical thinking disposition and skills (Mirzaie et al., 2019). While the former refers to cognitive processes, the latter includes personality areas, internal motivation and thinking disposition (Dehghanzadeh et al., 2018). In fact, critical thinking disposition is a set of psychological habits and consists of truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, inquisitiveness, and intellectual maturity (Mirzaie et al., 2019). Ricktes believes that critical thinking disposition is formed by an internal motivation. According to this scholar, creativity, cognitive maturity and mental conflict are among the components of critical thinking. He defines the creativity component as a person's tendency toward creative and clever curiosity to discover new facts. In addition, cognitive maturity is the extent to which a person is aware of the complexities of real issues, and the level of acceptance of other people's views and criticism based on one's own knowledge and that of others. Moreover, mental conflict is a person's readiness to reason and predict situations that require reasoning and the belief in one's ability to reason in these situations (Ghobadian, 2020). Overall, critical thinking disposition has been regarded as an integral part of critical thinking because a positive tendency toward critical thinking is a necessity for the realization of this type of thinking (Shakurnia et al., 2019). In fact, critical thinking disposition has been recognized as a habitual desire and an internal motivation, which encourages the person to use critical thinking skills, in a way that there is no desire to use critical thinking without disposition (Nekoui Manesh, 2018: 70). It is clear that critical thinking cannot occur without disposition, and there should be sufficient tendency to develop and use critical thinking and relevant skills (Ajam, 2015). Training learners with acceptable critical thinking and high academic self-efficacy will positively affect not only e-learning but also other different types of learning, especially in the field of education, which is crucial for success. On the other hand, teachers and instructors' knowledge of factors affecting e-learning will improve their performance and interaction with students. Notably, students will not be able to acquire information literacy without nurturing their critical thinking skills (Elder and Paul, 2013). In fact, critical thinking is not restricted to a particular area and is used for effective reading, writing, speaking, and hearing. In addition, critical thinking is important for any educational environment and all levels of education. It helps students overcome systems, be more self-aware, analyze ideas more effectively and have more control over their learning and values in life (Ghazi Moradi, 2014). Introduced as one of the important constructs of Bandura's social cognitive theory (SCT), self-efficacy is defined as "the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations" (Mirheydari and Neyestani, 2016). Self-efficacy judgments are significantly important owing to their role in the growth of internal motivation. This is mainly due to the fact the impact of self-efficacy on overcoming and enduring obstacles (Bandura, 2005).

The growth and development of information and communication technologies have led to the introduction of e-learning, which has attracted significant attention in the field of education (Babaei, 2010). However, e-learning realization requires preparedness in various areas such as technical infrastructure, as well as political, human resources, and organizational readiness. Meanwhile, it is worth noting that finding an appropriate model for assessing preparedness in this area extremely depends on the ecological requirements and conditions of the examined organization. Accordingly, it is crucial to develop a proper framework for the evaluation of e-learning readiness by determining the main structure of the research. The general framework of e-learning readiness assessment can be categorized into three parts of hard readiness, soft

readiness, and monitoring, coordination, and supporting readiness (Darab and Montazer, 2010; Cheng, 2006). Learners' entry into an e-learning environment requires prerequisites, some of which necessitate the existence of previous experience and some depend on the mental readiness of the individual. In fact, entry without the necessary knowledge and skills will result in a waste of time, demoralization, incomplete learning, and program failure. The institution of education is one of the biggest producers of information, and, without a doubt, a major consumer and conserver of information and knowledge (Selim, 2007). Production and appropriate exploitation of knowledge in the education process will increase teachers' and students' knowledge and abilities and will more successfully assist the education system in its most important mission- i.e., training capable and efficient human resources. Given the speed, breadth, and depth of developments resulting from information technology, recognition of specifications of the phenomenon and conscious and intelligent management of the concept are among the most significant strategies of those responsible for education in the country. This creates an opportunity for rebuilding the education system and transforming the learning-training process (Anderson and Elloumi, 2014).

Today, the amount of information available through computers and communications seems to be exceeding people's information processing and use capabilities. Pupils must improve their thinking and reasoning skills and use data after processing (Gholamali Lavasani et al., 2012). Today, the development of virtual education is one of the most important projects of the education system. Over time, the institution of education has become an extensive organization, which has always dealt with the challenge of developing an efficient structure (Afzalkhani et al., 2010). With regard to the speed, breadth, and depth of IT developments, its intelligent management can be one of the most important strategies of those involved in education in the country, applied to reconstruct the education system and transform the teaching-learning process (Anderson and Elloumi, 1950). Significant advancements have been made in the design of learning environments owing to the development of technological tools and facilities in various fields. In fact, the development of these tools and technologies has strengthened in-person learning environments and has led to the formation of e-learning and hybrid learning environments. The features and characteristics of these technologies, such as anyplace and anytime, multimedia, as well as communication and information, have given educational managers, policy-makers, designers, and executors the chance to deal with barriers to the use of in-person learning environments by preparing new learning settings. Therefore, one should know that the design, development, and maintenance of such an environment requires various skills and knowledge in technical, pedagogical (educational), and managerial fields. In addition, understanding users' perspectives of e-learning can contribute to the development of a more suitable learning space for education. In other words, awareness of the attitudes, skills, and point of view of users and those involved in the field can help better implement e-learning programs (Seraji and Attaran, 2011). While various studies have separately assessed the variables mentioned in the current research, no research has accurately evaluated the role of critical thinking disposition and academic self-efficacy in the acceptance of e-learning by students. Nevertheless, some examples of previous studies are presented below.

In a study entitled "the Comparison of Critical Thinking and Academic self-efficacy among Students at Farhangian University of Khorramabad", Ghobadian (2020) reported a higher mean score of critical thinking disposition among male subjects, compared to female students. In addition, among the three components of critical thinking disposition, the male subjects received higher creativity mean scores, compared to female participants. Meanwhile, no significant difference was observed between male and female students regarding the other two components. Mirzaei et al. (2019) performed a study entitled "Evaluation of the Relationship between Curriculum Elements and Medical Students' Disposition Toward Critical Thinking" using the descriptive-correlational method. In the end, their results were indicative of a positive

significant relationship between curriculum components and students' critical thinking disposition.

Khatib Zanjani et al., (2017) performed a study to determine the relationship between self-directed learning readiness and acceptance of e-learning and academic achievement of students. Based on their findings, there was no significant relationship between different dimensions of students' self-directed learning readiness and variables of gender and level of education. However, a significant correlation was found between the components of self-directed learning readiness and acceptance of e-learning and academic achievement. In the end, it was concluded that self-directed learning readiness could be a suitable predictor of the level of acceptance of e-learning and academic achievement of students. Ajam et al. (2017) performed a study to predict e-learning acceptance through nursing students Enthusiasmscale. However, their results were indicative of no significant difference between male and female subjects regarding the components of academic motivation. Meanwhile, a significant relationship was observed between academic motivation components and acceptance of e-learning. In addition, the components of behavioral, emotional, and cognitive motivation were identified as suitable predictors of students' level of acceptance of e-learning.

Khorasani et al. (2012) conducted a study entitled "Factors Affecting E-Learning Acceptance among Students of Tehran University of Medical Sciences Based on Technology Acceptance Model". According to their results, researchers encountered problems related to the application of information technology in education from individual, organizational, cultural, and social aspects despite the benefits of its use in the field of education. Therefore, there has been a need for more studies in order to evaluate the factors affecting the use of information technology in the past few years. Individual factors such as students' perceptions and attitudes toward information technology affect their acceptance and use of this technology. In this regard, Tabrsa and Nazarpoori (2015) introduced the e-learning system based on the technology acceptance model as a favorable tool for learning.

In terms of foreign research background, Hrtonovaa, Kohoutb, Rohlíkovac & Zounekd (2014) demonstrated a considerable correlation between students' e-learning acceptance and teachers' e-learning acceptance. In their research, it was shown that teachers' previous experience of e-learning had no significant impact on their acceptance of e-learning. In fact, the most important factors were teachers' expectations of e-learning, which caused an inclination toward the use of e-learning in these individuals. Zhang et al. (2014) performed a study to evaluate the role of information technology in e-learning. According to their results, self-efficacy played the most important role in the acceptance of e-learning as a construct that reveals people's belief in their skills and abilities. In their research, Tarhini, Hone & Liu (2013) concluded that perceived self-efficacy, ease of use, social norms, and quality of working life had the most effect on students' acceptance of e-learning and inclination toward the use of technology in education. Hsia, Chang & Tseng (2012) showed that control source and self-efficacy significantly affected ease of use and perceived efficiency of e-learning, which led to an increase in the acceptance of e-learning. Furthermore, other studies have demonstrated the lack of a significant association between students' acceptance of e-learning and variables of teachers' age and gender, as well as the type and schedule of the school (Huang & Wu, 2011; Pynoo et al., 2011).

Given the necessity of investigation of factors affecting e-learning acceptance by students, the present study attempted to answer the following question: "is there a significant relationship between academic self-efficacy and critical thinking disposition with e-learning acceptance of tenth-grade male students in experimental sciences and mathematics disciplines?"

Materials and Methods

This was a quantitative study in terms of nature and an applied, descriptive-correlational one regarding the type of research. In general, researchers seek to find a relationship between a

variable with other variables in correlational studies. The statistical population included 1289 tenth-grade male students in experimental sciences and mathematics disciplines in Mashhad, Iran, 288 of whom were selected by cluster sampling and based on the Krejcie and Morgan table (the selected cluster included tenth-grade male students in experimental sciences and mathematics disciplines in Districts 1 and 2 of Mashhad Ministry of Education.

Data were collected using the following instruments:

A) Ricketts' Critical Thinking Disposition Questionnaire (2003), which is a self-reporting tool that evaluates the level of the tendency toward critical thinking. The questionnaire encompasses 33 items scored based on a five-point Likert scale, from completely disagree (one score) to completely agree (five scores). Notably, items 2, 12, 15, 19, 23, 30, 32, and 33 are scored reversely. All scores must add up to achieve the final score of the questionnaire. The face validity of the scale was approved by a group of teachers. Moreover, its construct validity was confirmed since the tool was developed based on Facione's model.

B) Morgan and Jing Academic Self-Efficacy Scale (MJSES) (1999), which comprises 30 items scored based on a four-point Likert scale from completely disagree (one score) to completely agree (four scores). The validity of the scale has been reported to be favorable based on the factor analysis method (Karimzadeh and Mohseni, 2006; quoted by Mashayekhi Dolatabadi and Mohammadi, 2014).

C) Technology Acceptance Model by Davis and Bagozzi (1989), which includes 25 items and focuses on variables such as perceived usefulness, perceived ease-of-use (PEU), attitude toward usability, and decision to use. The items are scored based on a five-point Likert scale from completely disagree (one score) to completely agree (five scores). It is worth noting that the reliability of the tool was confirmed at a Cronbach's alpha of 0.71. In addition, the validity of the instrument was approved using the factor analysis method (r=%88) (Khorasani and Abdolmaleki (2012). Data analysis was performed in SPSS version 20 using Pearson's correlation coefficient, regression, and independent t-test.

Results

In this study, the mean and standard deviation of critical thinking disposition was reported at 123.43 and 12.79, respectively. For academic self-efficacy, the mean and standard deviation were estimated at 91.67 and 10.30, respectively. Ultimately, the mean and standard deviation of e-learning acceptance was reported at 87.76 and 11.43, respectively.

First (main) hypothesis: there is a significant relationship between critical thinking disposition and academic self-efficacy with e-learning acceptance in tenth-grade male students in experimental sciences and mathematics disciplines.

Table 1. Pearson correlation between critical thinking disposition and academic self-efficacy with e-learning acceptance in tenth-grade male students in experimental sciences and mathematics disciplines

Correlation of main variables of the research	Critical thinking disposition	Academic self-efficacy
E-learning acceptance	0.267**	0.171*
Critical thinking disposition		0.486**

According to Table 1, there was a significant correlation between critical thinking disposition and e-learning acceptance (0.267) (P=0.01) and between critical thinking disposition and academic self-efficacy (0.486) (P=0.01). Moreover, a significant correlation was observed between academic self-efficacy and e-learning acceptance (0.171) (P=0.05).

Second hypothesis: critical thinking disposition and academic self-efficacy significantly predicted e-learning acceptance in tenth-grade male students in experimental sciences and mathematics disciplines.

Table 2. Correlation and regression of criterion variable of e-learning acceptance and predictive variable of critical thinking disposition

Standard error of estimate	Coefficient of determination	Correlation coefficient
11.039	0.071	0.267

	Non-standard coefficients		Standard coefficients	T	Significance
	B	Standard error	Beta		
Constant	58.746	6.233		9.425	0.000
Critical thinking disposition	0.235	0.050	0.267	4.682	0.000

Following multiple regression analysis carried out by stepwise method, the variable of academic self-efficacy was eliminated due to lower impact on the variable of e-learning acceptance. This was due to the weak relationship between self-efficacy and e-learning acceptance. Therefore, the variable of academic self-efficacy failed to predict the variable of e-learning acceptance, and was, therefore, removed from SPSS. On the other hand, critical thinking disposition significantly contributed to the acceptance of e-learning based on the standardized beta coefficient (0.068).

Discussion and Conclusion

The present study aimed to evaluate the role of critical thinking disposition and academic self-efficacy in e-learning acceptance among high-school male students in Mashhad, Iran. The results were indicative of a significant relationship between critical thinking disposition and academic self-efficacy with e-learning acceptance. In addition, critical thinking disposition contributed to the prediction of e-learning acceptance in students. In this respect, our findings are congruent with the results obtained by Huang & Wu (2011), Pynoo et al. (2011), Sumak, Hericko & Pusnik (2011), and Selim (2007). As a learner feature in e-learning, critical thinking is accepted as a part of the learning process and helps the learner challenge their thoughts (Babaei, 2010). The ability to evaluate different hearsays, readings, thoughts, and beliefs faced in one's life and make rational decisions about them is a valuable thinking skill that must be attained in schools. Not only does training learners with acceptable critical thinking disposition and high academic self-efficacy improve their e-learning acceptance, but also it positively affects other different learning areas, especially in the education field, which is crucial for success. It is notable that teachers' and instructors' knowledge of factors affecting e-learning will improve their performance and interaction with students. Critical thinking disposition influences any learning environment and is essential for all educational levels. It enables students to overcome systems, be more self-aware, analyze ideas more effectively, and have more control over their learning and values in life (Linda Elder, 1962, p. 21). Learners' entry into an e-learning environment requires prerequisites, some of which necessitate the existence of previous experience and some depend on the mental readiness of the individual. Given the

speed, breadth, and depth of developments resulting from e-learning, recognition of specifications of the phenomenon and conscious and intelligent management of the concept are among the most significant strategies of those responsible for education in the country. This creates an opportunity for rebuilding the education system and transforming the learning-training process. Our results suggest that an appropriate infrastructure be laid by education policy-makers and families so that learners with high levels of self-efficacy, increased tendency toward critical thinking, and the desire to accept e-learning with self-confidence are trained. Even though student intellectual development has always been a complicated issue in the field of education, it has now become a crisis since our culture's output of information far exceeds our ability to think critically about that information.

According to the results of the present research, critical thinking disposition more considerably contributed to the prediction of e-learning acceptance, compared to the other variable. Therefore, it is recommended that greater efforts be dedicated to the education of critical thinking disposition in schools and increasing students' hardware and software skills in e-learning. It is also suggested that critical thinking, as well as hardware and software skills, be included in the syllabus of students from younger ages in order to improve their e-learning acceptance. By doing so, students will be able to follow an effective and continuous learning process by using critical thinking and improving their academic self-efficacy, which will guarantee their success in education and life. It is worth mentioning that critical thinking improvement is not limited to the classroom and school and requires the help of students and their families, in addition to teachers and principals, to happen.

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