Current Psychology
https://doi.org/10.1007/s12144-022-03211-x

Examining various variables related to authentic learning self-efficacy of university students in educational online social networks: Creative self-efficacy, rational experiential thinking, and cognitive flexibility

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Accepted: 10 May 2022

Abstract
The purpose of this study is to examine the relationships between creative self-efficacy (CSE), rational experiential thinking, and cognitive flexibility thinking skills, and authentic learning self-efficacy (ALSE) as a result of authentic learning (AL) activities in educational online social networks. The participants of the research are 102 university students. The study group was determined by a convenient sampling method. Variance-based PLS-SEM using partial least square was used to examine the relationships between research variables. According to the research findings, it is seen that cognitive flexibility in online social networks has a significant effect on experiential ability and rational favorability. Findings show that rational favorability has a positive and significant effect on CSE. Research findings indicate that personal variables such as gender, age, and academic success perception do not have a significant effect on CSE in learning that takes place in online social networks. It was evaluated whether CSE has an effect on online ALSE, and it was found that other sub-dimensions other than "keeping up with technological advancements" are significant.

Keywords Authentic learning self-efficacy · Creative self-efficacy · Rational experiential thinking · Cognitive flexibility · University students

Introduction

Educational online social networks are frequently preferred for academic purposes thanks to their increasing features (Liu et al., 2018; Yildiz-Durak, 2019). Educational online social networks contain many tools to enrich users' learning experiences. These learning environments provide a structure where students can interact with each other for the presentation of learning problems, the sharing of solutions, and alternative ideas about the problems (Ansari & Khan, 2020; Moran et al., 2011). In this context, the use of an AL approach in educational online social networks can be interpreted as the right choice to increase the effectiveness of the educational process. The Covid-19 outbreak has made it clear that students in online education should take responsibility for their learning in the learning environment.

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Educational online social networks are more preferred over online learning management systems (LMS) (Cavus et al., 2021) because of their advantages in accessing educational resources, increasing student-teacher interaction and participation, collaborative learning capabilities and sharing learning responsibilities, and ease of use (Hsu & Yen, 2014; Jong et al., 2014; Liao et al., 2015; Yildiz-Durak, 2019). According to Sobaih et al. (2020) states that the shift of education to online environments has created problems in the provision of official online LMS in many countries, as the COVID-19 pandemic poses unique challenges to face-to-face education. The use of online social networking sites to provide free communication and interaction and to continue learning activities has become widespread in higher education institutions suffering from the lack of official online LMS. According to Cavus et al. (2021), while LMSs have some usage difficulties depending on the technical competencies of the users, social networking sites provide ease of use. In the process of suddenly transitioning to online education with the Covid-19 epidemic, the readiness of students to use e-learning environments can be considered as a hindering factor in education. Such difficulties in the pandemic process

Published online: 13 June 2022

can be overcome by making use of online social networks. The importance of utilizing social networks in alleviating the educational difficulties caused by the COVID-19 pandemic has become evident.

Social networks that encourage both collaborative and independent work among learners can support the sustainability of students' learning efforts by presenting real-context problems. In addition, the AL experience of students in educational online social networks can provide important opportunities to improve their different skills and self-efficacy, as well as increase their learning performance. However, there is not enough evidence in the literature for this. Therefore, in this research, the relationships between CSE, rational experiential thinking, and cognitive flexibility thinking skills, and ALSE, which are thought to be effective on students' AL, were examined as a result of AL activities carried out in educational online social networks. In the following chapters, the variables and their relationships were explained.

Authentic Learning Self-Efficacy in Educational Social Networks

AL is a multidisciplinary approach that allows students to explore and construct concepts and relationships in the context of real problems (Herrington & Herrington, 2006). Lombardi (2007) defined AL as an effective teaching strategy in that it allows students to make connections between existing knowledge and discover new knowledge in context. Banas & York (2014), on the other hand, emphasized that the use of digital technologies in education requires approaches that link technologies and context, and that AL can be a solution in this regard.

In this context, AL may be a good approach choice to provide more effective teaching in educational social networks. Social networks that encourage both collaborative and independent work among learners provide the presentation of real-context problems and effective feedback for them. According to Uzunboylu et al. (2020), the focus of technology-supported environments on problem and learning ensures that learning environments close to real-world learning are supported. On the other hand, multimedia learning environments provide important opportunities for an AL approach designed to increase students' learning performance and improve their learning transfer skills.

Cognitive Flexibility in Educational Social Networks

Cognitive flexibility is a feature that helps multitask, perform complex tasks, and adapt to new environmental conditions (Ionescu, 2012). According to Martin and Anderson (1998), cognitive flexibility refers to the flexibility of individuals to be aware of alternative situations related to any situation and to adapt to different situations. According to Batting (1979), cognitive flexibility is the ability to use the most effective learning strategies in the learning process and to determine the solution steps while solving a problem. According to Sagar (2021), cognitive flexibility can be evaluated as the tendency and ability of individuals to create alternatives by suggesting options, to perceive many alternatives, and to perceive situations defined as difficult to cope with as controllable.

Based on these definitions, cognitive flexibility in learning environments is the ability to choose the most appropriate alternative learning strategies, problem-solving skills, and alternative ways for a solution, and adapt to different subjects and situations (e.g. Alper & Deryakulu 2008).

In educational social networks, there are many different ways for multidimensional interaction, social interaction, collaborative work, and information sharing with learning stakeholders (Yildiz Durak, 2019, 2021a). In this context, it can be said that in educational social networks, students are actively participating in online discussions, active for interaction, and active participants in problem-solving related to different situations. For this reason, cognitive flexibility is thought to be very important in the success of educational social networks.

Rational Experiential Thinking in Educational Social Networks

People differ in how they process information, and these differences can be used to understand and explain behavior in various domains (Björklund & Bäckström, 2008; Chaiken & Trope, 1999). It is thought that approaches that deal with processes based on emotion and intuition, as well as explanations based on logic and cognition alone in reasoning, decision making, or processing information, are necessary to explain student behaviors and various skills in educational social networks. New approaches suggest that people process information in two different ways in decision-making and thinking processes and emphasize that emotion plays an important role in cognitive-based decisions (Türk & Artar, 2014).

According to Epstein's (2003) Cognitive Experiential Self Theory, it is stated that explanations based on logic or cognition will not be sufficient in reasoning, and it is important in processes based on emotion and intuition. Experiential processing is a continuous, automatic, uncontrolled processing associated with emotions and beliefs (Pacini & Epstein, 1999). Logical processing is inferential, analytical, predominantly verbal, and relatively emotion-free processing based on culturally transmitted reasoning rules (Evans, 2008). According to Shirzadifard et al. (2018), although the behavior is jointly determined by the two processing pathways, one pathway is often more dominant, and this dominance depends on various factors such as the importance of

the decision, knowledge of the situation, past experiences, and extent of emotional involvement. It is thought that it is necessary to determine this thinking style to use educational approaches that support interaction, presentation of information content, decision-making styles, and educational approaches that support decision-making skills through critical thinking and reflection in educational social networks.

Creative Self-Efficacy in Educational Social Networks

CSE is the belief that an individual can produce creative results (Tierney & Farmer, 2002). Creativity is one of the basic competencies in education (Liu et al., 2016). However, according to Mathisen and Bronnick (2009), the creative effort is often a demanding activity that takes time and effort. It is very important to maintain permanence during this difficult process. According to Liu et al. (2016), it is important to develop effective practices to encourage and develop students' creativity. Educational social networks contain many features to encourage students to interact, collaborate, and have creative learning experiences (Yildiz Durak, 2019). In this context, it is thought that educational social networks are important in increasing students' belief in their CSE.

The Role of Cognitive Flexibility in Rational Experiential Thinking

According to Epstein (2008), some people approach events and situations more intuitively and less logically, while others rely more on logical rules and consider each problem objectively and comprehensively. According to Laureiro-Martínez and Brusoni (2018), while cognitive flexibility refers to the ability to adapt to various problems, we do not have an in-depth understanding of the individual-level mechanisms behind them. Therefore, determining the role of cognitive flexibility in rational experiential thinking in AL environments may offer clues for the design of more effective learning environments.

The Role of Rational Experiential Thinking in Creative Self-Efficacy

In online learning, students need to use decision-making strategies effectively in their practice environment (Yildiz Durak, 2019). In educational social networks; interaction, presentation of information content, determining instructional strategies for decision-making styles, and using educational approaches that support decision-making skills through critical thinking and reflection are important. Experiential processing, one of the decision-making skills, is processing related to emotions and beliefs (Pacini & Epstein, 1999), while logical processing is inferential, analytical, and relatively emotion-free processing based on reasoning rules (Evans, 2008). Creativity self-efficacy in online learning environments may depend on the dominant use of one model over the other in decision making. The experiential or intuitive system can be used more as one grasps the experience and pattern, while the rational or analytical system can be used more in different and uncertain situations. In this study, it was investigated whether the student's decision-making style could be associated with CSE in educational online social networks.

The Role of Gender, Age and Academic Success Perception in Creative Self-Efficacy

CSE has a significant impact when engaging in creative endeavors (Gong et al., 2009). In this context, the perception of academic success may be related to CSE. Mathisen (2011) points out that there is a possible relationship between self-efficacy and creative performance. A high perception of academic success requires a sense of creative competence. Bandura (1997) defined self-efficacy as a person's belief that they can perform successfully in a particular environment. On the other hand, CSE is the belief that one can produce creative results (Tierney & Farmer, 2002). When the literature was examined, it was seen that CSE beliefs changed according to the gender factor (e.g. Karwowski et al., 2013). Karwowski (2011) emphasizes that this change is in favor of men and men tend to perceive their creativity only at a higher level. In the context of mixed findings in the literature, He and Wong (2021) emphasize that the gender-based CSE model is difficult to understand and more studies are needed. It is thought that the age variable on CSE will also affect CSE depending on maturity and experience.

The Role of Creative Self-efficacy in Authentic Learning Self-Efficacy

AL provides an opportunity for more in-depth learning experiences due to the contextual nature of learning experiences and the nature of activities and relationships with people (Lombardi, 2007). Authentic tasks enable students to create a learning environment where they can deal with real-world problems and bring their own life experiences to the classroom environment (Yildiz Durak, 2021b). With authentic tasks, the learning environment will be organized in an interactive and connected way with the real world of the students. Liu et al. (2016) state that web 2.0 platforms are effective for increasing creative activities as they allow students to create and share their creative work. In this context, it is thought that CSE in educational online social networks where AL is offered will improve ALSE by supporting student participation and creativity in educational environments. Bennett et al. (2012) point out that there is a significant contrast

between the creative nature of web 2.0 learning activities and structured learning activities. Therefore, a critical way to develop students' creativity is to design AL applications for students. In addition, it is thought that the ALSE of students who deal with real problem solutions in these environments will improve.

Purpose of the Research

This research is intended to reveal a model as a result of AL activities in educational online social networks, a study that is thought to be effective on AL of students, explains and predicts the relationships between CSE, rational experiential thinking, and cognitive flexibility thinking skills, and ALSE. Within the framework of the purpose of the research, the research question was expressed as "What is the explanatory and predictive relationship pattern between the ALSE of the students in educational online social networks and various variables?".

Method

This study aimed to reveal a model that explains and predicts the relationships between university students' ALSE and various variables. This study is in the correlational screening model because it aims to reveal the existing relationships. The research model, variables, and research hypotheses were shown in Fig. 1.

Participants and Features

The participants of the research consist of 102 university students studying in various classes in Turkey. The study group was determined by a convenient sampling method. Participation in the study was based on the volunteerism of the participants. All the participants used educational social networks for at least 3 weeks and participated in at least 5 AL tasks using educational social networks. AL tasks have changed in the context of the course taken. 48.5% of the participants are female and 51.5% are male. The average age of the participants is 22.98. The academic success perceptions of the participants were calculated as 3.64 out of 5.

Data Collection Tools

Personal Information Form This form was developed by the researcher. There are 4 items in this form and the data regarding the personal information of the participants were collected with this form.

Online Authentic Learning Self-Efficacy Scale This scale, which can be used to determine online ALSE, was developed by Tezer et al. (2018). The rating is in 5-point Likert type. During the development of the scale, the Cronbach's Alpha coefficient was calculated as 0.97.

Cognitive Flexibility Scale This scale was developed by Martin and Rubin (1995). The Turkish adaptation of the scale was made by Çelikkaleli (2014). The rating is 6-point Likert type. This scale consists of 12 items and a single factor. Higher scores indicate higher cognitive flexibility. In the adaptation study, the Cronbach's alpha coefficient (α) of the measurement tool was calculated as 0.74.

Creative Self-Efficacy Scale This scale, which was developed by Tierney and Farmer (2011) to measure their belief in their ability to be creative, was adapted into Turkish by Atabek (2020). The scale consists of three items. The rating is 7-point Likert type. The range of points that can be obtained from the scale is between 3 and 21. The higher the score obtained from the scale, the stronger the CSE. Cronbach's

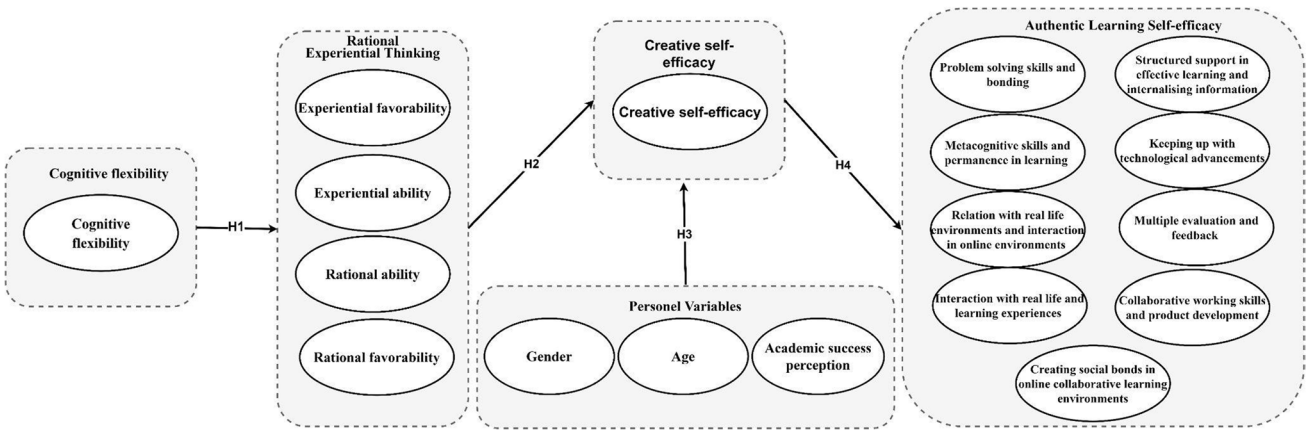

Fig. 1 The Research Model

α internal consistency coefficient of the original scale was calculated between 0.83 and 0.87 and 0.847 in the adaptation study.

Rational Experiential Inventory This scale was developed by Pacini and Epstein (1999). It was adapted into Turkish by Türk and Gülleroğlu (2014). The rating is 5-point Likert type. In the adaptation study, Cronbach's α internal consistency coefficient of the scale was calculated between 0.69 and 0.85.

Data Analysis

Data were collected via an online form. After the data is collected, it was analyzed with Smart PLS 3.0. Variance-based PLS-SEM using partial least square was used to examine the relationships between research variables. PLS-SEM makes the non-normally distributed data set suitable for analysis, and it is stated that the PLS-SEM method does not require large samples and is suitable for complex models (Hair et al., 2012, 2017). Data analysis, validity, and reliability of the indicators in the model were carried out in the next section.

Findings

Measurement Model

The findings of convergent validity, discriminant validity, and reliability were discussed to evaluate the measurement model. Hair et al. (1998) suggest that item factor loads should be above 0.65. Factor loads bigger than 0.65 and average variance extracted (AVE) value above 0.50 are required for convergent reality (Hair et al., 2017). In this context, items with a factor load below 0.65 were excluded from the measurement model. According to Table 1, the factor load of all the items in the measurement model is higher than 0.65. AVE values are above 0.50.

Composite reliability (Joreskog, 1971) and Cronbach's alpha (Dijkstra & Henseler, 2015) values above 0.60 are within the acceptable range. According to Table 1, it can be said that the measurement model meets the specified criteria.

According to the Fornell-Larcker Criterion discriminant validity criterion, it was determined that the square roots of the constructs were higher than the correlation of the square roots of the AVEs with the other constructs (see Table 2).

As a result, satisfactory values were reached regarding the validity and reliability of the measurement model.

Table 1 The measurement model

	Construct	Factor Loading	Cronbach' alpha	Rho_A	CR	AVE
ALSE	Problem solving skills and bonding	0.815–0.903	0.824	0.842	0.895	0.739
	Metacognitive skills and permanence in learning	0.771–0.861	0.787	0.792	0.875	0.701
	Relation with real life environments and interaction in online environments	0.800–0.880	0.808	0.822	0.886	0.722
	Interaction with real life and learning experiences	0.831–0.888	0.839	0.859	0.902	0.754
	Creating social bonds in online collaborative learning environments	0.858–0.935	0.868	0.908	0.919	0.791
	Structured support in effective learning and internalising information	0.830–0.883	0.815	0.826	0.890	0.730
	Keeping up with technological advancements	0.905–0.939	0.907	0.930	0.941	0.841
	Multiple evaluation and feedback	0.771–0.861	0.765	0.827	0.857	0.668
	Collaborative working skills and product development	0.910–0.925	0.813	0.817	0.914	0.842
Rational Experiential Thinking	Experiential favorability	0.734–0.987	0.763	2.187	0.859	0.757
	Experiential ability	0.819–0.878	0.615	0.628	0.837	0.720
	Rational ability	0.911–0.930	0.907	0.913	0.941	0.843
	Rational favorability	0.861–0.956	0.911	0.940	0.944	0.850
CSE	CSE	0.834–0.896	0.825	0.829	0.896	0.742
Cognitive flexibility	Cognitive flexibility	0.925–0.926	0.832	0.832	0.923	0.856
Personal variables	Gender	1.000	1.000	1.000	1.000	1.000
	Age	1.000	1.000	1.000	1.000	1.000
	Academic success perception	1.000	1.000	1.000	1.000	1.000

Table 2 Fornell-larcker criterion

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CSE	0.861																	
Problem solving skills and bonding	0.606	0.860																
Experiential favorability	0.181	0.287	0.870															
Experiential ability	-0.057	-0.109	-0.139	0.849														
Rational ability	0.404	0.400	0.243	-0.025	0.918													
Rational favorability	0.470	0.541	0.195	-0.125	0.781	0.922												
Gender	-0.018	0.069	-0.136	-0.022	-0.057	0.083	1.000											
Age	0.199	0.177	0.140	0.054	0.156	0.126	0.100	1.000										
Academic success perception	0.233	0.428	0.238	-0.122	0.266	0.296	0.014	0.237	1.000									
Metacognitive skills and permanence in learning	0.415	0.683	0.200	-0.004	0.450	0.560	0.018	0.252	0.312	0.837								
Relation with real life environments and interaction in online environments	0.396	0.661	0.227	0.035	0.457	0.526	0.070	0.133	0.334	0.815	0.850							
Interaction with real life and learning experiences	0.442	0.709	0.216	0.067	0.446	0.497	0.074	0.142	0.324	0.775	0.839	0.868						
Creating social bonds in online collaborative learning environments	0.322	0.572	0.229	0.163	0.265	0.398	0.037	0.172	0.344	0.724	0.734	0.640	0.889					
Structured support in effective learning and internalising information	0.451	0.660	0.240	0.016	0.308	0.425	0.049	0.203	0.345	0.790	0.802	0.736	0.781	0.854				
Keeping up with technological advancements	0.247	0.534	0.240	0.004	0.248	0.270	0.072	0.084	0.338	0.629	0.687	0.694	0.453	0.632	0.917			
Multiple evaluation and feedback	0.470	0.656	0.248	-0.086	0.241	0.412	-0.011	0.170	0.323	0.690	0.665	0.631	0.603	0.762	0.657	0.817		
Collaborative working skills and product development	0.540	0.672	0.096	0.070	0.125	0.298	0.025	0.149	0.286	0.536	0.559	0.531	0.597	0.664	0.416	0.679	0.918	
Cognitive flexibility	0.027	-0.217	-0.173	0.470	-0.211	-0.220	-0.161	-0.176	-0.178	-0.114	-0.077	-0.091	0.004	-0.112	-0.097	-0.187	-0.091	0.925

Structural Model

To examine the significance of the path coefficients in the structural model, bootstrapping was run for 1000 sub-samples. The findings obtained as a result of testing the proposed model in this study were presented in Table 3.

According to the hypothesis test (see Table 3), it partially supported H1, H2, and H4. The findings show that cognitive flexibility in online social networks has a significant effect on experiential ability ($\beta = 0.470$, $t = 4.712$, $p < 0.05$) and rational favorability ($\beta = -0.220$, $t = 2.014$, $p < 0.05$). Accordingly, while the H1b and H1d hypotheses were supported, the H1a and H1c hypotheses were rejected. The H2 hypothesis evaluates whether rational experiential thinking dimensions affect CSE. Findings show that rational favorability has a positive and significant effect on CSE ($\beta = 0.396$, $t = 2.567$, $p < 0.05$), and the H2d hypothesis is supported, while H2a, H2b, and H2c hypotheses are not supported. Research findings show that personal variables such as gender, age, and academic success perception do not have a significant effect on CSE in learning that takes place in online social networks, and H3 is not supported. H4 assesses whether CSE has an impact on online ALSE. The findings support that other hypotheses except the H4g hypothesis are significant.

Discussion

The purpose of this research is to examine the relationships between CSE, rational experiential thinking, and cognitive flexibility thinking skills, and ALSE as a result of AL activities in educational online social networks. A model was built and four hypotheses were tested by considering AL in educational online social networks and related literature.

It has a significant effect on cognitive flexibility, experiential ability, and rational favorability in online social networks. Accordingly, while the H1b and H1d hypotheses were supported, the H1a and H1c hypotheses were rejected. According to Ionescu (2012), cognitive flexibility is a feature that helps to solve problems, perform complex tasks and adapt to new environmental conditions. While experiential ability is a continuous, automatic, uncontrolled processing associated with emotions and beliefs (Pacini & Epstein, 1999), logical processing is inferential and analytical processing based on reasoning rules (Evans, 2008). It can be accepted as an expected result that both ways of processing information are related to cognitive flexibility. While cognitive flexibility in educational environments supports adapting to new situations and easily experiencing new applications, it can be associated with logical and experiential processing as it encourages creativity and problem solving

Table 3 Path coefficient, hypothesis testing and decision

Hypothesis	Path	Path Coefficient	T Statistics	P Values	Decision
H1a	Cognitive flexibility -> Experiential favorability	-0.173	1.228	0.220	Not supported
H1b	Cognitive flexibility -> Experiential ability	0.470	4.712	0.000	Supported
H1c	Cognitive flexibility -> Rational ability	-0.211	1.799	0.072	Not supported
H1d	Cognitive flexibility ->Rational favorability	-0.220	2.014	0.044	Supported
H2a	Experiential favorability -> CSE	0.054	0.538	0.591	Not supported
H2b	Experiential ability -> CSE	0.001	0.012	0.991	Not supported
H2c	Rational ability -> CSE	0.043	0.268	0.789	Not supported
H2d	Rational favorability -> CSE	0.396	2.567	0.010	Supported
H3a	Gender -> CSE	-0.055	0.608	0.543	Not supported
H3b	Age -> CSE	0.125	1.524	0.128	Not supported
H3c	Academic success perception -> CSE	0.063	0.566	0.571	Not supported
H4a	CSE -> Problem solving skills and bonding	0.606	8.124	0.000	Supported
H4b	CSE -> Metacognitive skills and permanence in learning	0.415	3.958	0.000	Supported
H4c	CSE -> Relation with real life environments and interaction in online environments	0.396	3.713	0.000	Supported
H4d	CSE -> Interaction with real life and learning experiences	0.442	4.579	0.000	Supported
H4e	CSE -> Creating social bonds in online collaborative learning environments	0.322	2.380	0.017	Supported
H4f	CSE -> Structured support in effective learning and internalising information	0.451	4.325	0.000	Supported
H4g	CSE -> Keeping up with technological advancements	0.247	1.691	0.091	Not supported
H4h	CSE -> Multiple evaluation and feedback	0.470	5.331	0.000	Supported
H4i	CSE -> Collaborative working skills and product development	0.540	6.695	0.000	Supported

by nature. On the other hand, Paloşa et al. (2013) discussed the relationship between cognitive and motivational variables and student learning. The results of the study showed that the motivation and learning strategies used by the students were affected by the information processing styles (rational-experiential).

The H2 hypothesis is about whether rational experiential thinking dimensions affect CSE. The results show that rational favorability has a positive and significant effect on CSE and the H2d hypothesis is supported, while H2a, H2b, and H2c hypotheses are not supported. Logical processing can be defined as inferential analytical processing competence based on reasoning rules (Evans, 2008). CSE is the belief that an individual can produce creative results (Tierney & Farmer, 2002). According to Deci and Ryan (2013), high perceptions of control and a systematic approach in uncertain activities can lead to higher cognitive flexibility and creativity. Therefore, it can be said that authentic activities that support logical processing and cognitive thinking style in educational environments can support creativity self-efficacy.

It was found that personal variables such as gender, age, and academic success perception did not have a significant effect on CSE in learning in online social networks and H3 was not supported. In the study conducted by He and Wong (2021), which investigated gender differences in CSE among undergraduate students, the male superiority model was revealed and it was concluded that gender differences should be taken into account in the cultivation of CSE. On the other hand, there are contradictory findings of gender and age in the literature. The reason why no relationship was found with gender, age, and academic success in this study may be that CSE is affected by many personal, psychological, and motivational variables, and a sample-dependent result was obtained.

The results of the H4 hypothesis, which evaluates whether CSE affects online ALSE, supports that other hypotheses are significant (except for the H4g hypothesis). According to Liu et al. (2016), learning environments that allow students to create and share their creative work are effective for increasing creative activities. In this context, it can be said that as a result of the active application of CSE level, creative work, and problem-solving competencies in educational online social networks where the AL approach is used, it will improve ALSE by supporting student participation and creativity. However, the relationship between CSE and keeping up with technological advancements examined in H4g was not found significant. The dimension of keeping up with technological advancements is about keeping up with new technological developments by using online communication tools (Yahoo, Skype, Gmail etc.) and social networks (Facebook, twitter, WhatsApp etc.). Chiang et al. (2014) emphasizes that individuals with high CSE tend to be sensitive to positive stimuli and set goals. Similar results were obtained by Santoso et al. (2019) and the relationship of CSE with creative and transformational leadership, digital literacy was examined. Therefore, the findings of this study do not coincide with the results in the literature. The reason for this situation may be that the tasks given in the context of the application did not create the need to use different online communication tools and social networks. On the other hand, the technology usage proficiency and innovativeness beliefs of the sample examined may be an effective factor on the research results.

Implications, Limitations, and Future Works

Identifying university students' AL and skill development levels and relationships in online learning environments will help instructors understand and shape students' expectations for their capacity to develop thinking styles, and encourage their development towards higher-order thinking levels. The results of this study provide tips for instructors to design AL activities in online learning environments. Determining the student's way of processing information (experiential-rational), flexible thinking levels and creativity self-efficacy forms the starting point for effectively designing learning environments. To highlight the value of online AL tasks and translate them into practice, these research results are expected to raise awareness.

However, the study has some limitations. The structure of the sample examined (academic success, technology use proficiency, etc.) may have an impact on the results of the study. It can be suggested to test the model applied in the study by controlling these characteristics of the sample. On the other hand, experimental designs can be used to more clearly reveal the contribution of the AL approach in the relationships between research variables. Studies in different cultures can be carried out to generalize the results obtained in this study. In addition, another limitation of this study concerns the sample size. Therefore, when generalizing the results of this study, it should be kept in mind that the sample size was not very large.

Data Availability The data that support the findings of this study are available from the corresponding author upon request.

Declarations

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent In addition, informed consent was obtained from all individual participants included in this study.

Conflict of Interest The authors declare that they have no conflict of interest.

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