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

Hatice Yildiz Durak

Accepted: 10 May 2022 / Published online: 13 June 2022
© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 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.

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...
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
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 (β = 0.470, t = 4.712, p < 0.05) and rational favorability (β = -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 (β = 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, Paloša 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.

References

Alper, A., & Deryakulu, D. (2008). The Effect of cognitive flexibility on students’ achievement and attitudes in web mediated problem based learning. *Education and Science, 33*(148), 49
Ansari, J. A. N., & Khan, N. A. (2020). Exploring the role of social media in collaborative learning the new domain of learning. *Smart Learning Environments, 7*(1), 1–16
Atabek, O. (2020). Adaptation of creative self-efficacy scale into Turkish language. *World Journal on Educational Technology: Current Issues, 12*(2), 084–097
Banas, J. R., & York, C. S. (2014). Authentic learning exercises as a means to influence preservice teachers’ technology integration self-efficacy and intentions to integrate technology. *Australasian Journal of Educational Technology, 30*(6). https://doi.org/10.14742/ajet.362
Bandura, A. (1997). *Self-efficacy: The Exercise of Control*. Macmillan.
Batting, W. T. (1979). Are the important “individual differences” means to influence preservice teachers’ technology integration self-efficacy and intentions to integrate technology. *Computers in Human Behavior, 5*, 146–151. HERDSA.
He, W. J., & Wong, W. C. (2021). Gender differences in creative self-efficacy: Findings of mean and variability analyses. *Thinking Skills and Creativity, 42*, 100955.
Herrington, J., & Herrington, A. (2006). Authentic conditions for authentic assessment: Aligning task and assessment. In A. Bunker & I. Vardi (Eds.), *Research and Development in Higher Education* (pp. 146–151). HERDSA.
Laureiro-Martínez, D., & Brusoni, S. (2018). Cognitive flexibility and creative personal identity: Does gender matter? *The Journal of Creative Behavior, 47*(3), 215–232
Lombardi, M. M. (2007). Authentic learning for the 21st century: An overview (ELI paper 1: 2007). In D. G. Oblinger (Ed.), *Boulder CO: Educause Learning Initiative*. Retrieved from http://net.educause.edu/ir/library/pdf/ELI13009
Liao, Y. W., Huang, Y. M., Chen, H. C., & Huang, S. H. (2015). Exploring the antecedents of collaborative learning performance over social networking sites in a ubiquitous learning context. *Computers in Human Behavior, 43*, 313–323
Liu, C. C., Lu, K. H., Wu, L. Y., & Tsai, C. C. (2016). The Impact of Peer Review on Creative Self-efficacy and Learning Performance in Web 2.0 Learning Activities. *Educational Technology & Society, 19*(2), 286–297
Liu, D., Wright, K. B., & Hu, B. (2018). A meta-analysis of social network site use and social support. *Computers & Education, 127*, 201–213
Marcela, M. M. (2007). Authentic learning for the 21st century: An overview (ELI paper 1: 2007). In D. G. Oblinger (Ed.), *Boulder CO: Educause Learning Initiative*. Retrieved from http://net.educause.edu/ir/library/pdf/ELI13009
Martin, M. M., & Rubin, R. B. (1995). A new measure of cognitive flexibility. *Psychological Reports, 76*(2), 623–626. https://doi.org/10.2466/pr0.1995.76.2.623
Martin, M. M., & Anderson, C. M. (1998). The cognitive flexibility scale: Three validity studies. *Communication Reports, 11*(1), 1–9. https://doi.org/10.1080/08934219809367680
Mathisen, G. E. (2011). Organizational antecedents of creative self-efficacy. *Creativity and Innovation Management, 20*(3), 185–195
Mathisen, G. E., & Bronnick, K. S. (2009). Creative self-efficacy: An intervention study. *International Journal of Educational Research, 48*(1), 21–29
Moran, M., Seaman, J., & Tinti-Kane, H. (2011). Teaching, learning, and sharing: How Today’s higher education faculty use social media (pp. 1–16). Babson survey research group. https://doi.org/10.1016/j.chb.2013.06.015
Pacini, R., & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and of Marketing Science, 40*(3), 414–433. https://doi.org/10.1007/s11747-011-0261-6
Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). A primer on partial least squares structural equation modeling (PLS-SEM). Thousand Oaks, CA.
and the ratio-bias phenomenon. *Journal of Personality and Social Psychology*, 76(6), 972–987. https://doi.org/10.1037/0022-3514.76.6.972

Paloșa, R., Drobotb, L., Costeaa, I., & Munteanua, A. (2013). Cognitive and motivational variables that shape academic learning: A preliminary study. *Romanian Journal of Applied Psychology*, 15(1), 1–8

Sagar, M. E. (2021). Predictive role of cognitive flexibility and self-control on social media addiction in university students. *International Education Studies*, 14(4), 1–10

Santoso, H., Elidjen, E., Abdinagoro, S., & Arief, M. (2019). The role of creative self-efficacy, transformational leadership, and digital literacy in supporting performance through innovative work behavior: Evidence from telecommunications industry. *Management Science Letters*, 9(13), 2305–2314

Shirzadifard, M., Shahghasemi, E., Hejazi, E., Naghs, Z., & Ranjarb, G. (2018). Psychometric properties of rational-experiential inventory for adolescents. *SAGE Open*, 8(1), 2158244018767219

Sobaih, A. E. E., Hasanein, A. M., & Abu Elnasr, A. E. (2020). Responses to COVID-19 in higher education: Social media usage for sustaining formal academic communication in developing countries. *Sustainability*, 12(16), 6520

Tezer, M., Yildiz, E. P., & Uzunboylu, H. (2018). Online authentic learning self-efficacy: A scale development. *Quality & Quantity*, 52(1), 639–649

Tierney, P., & Farmer, S. M. (2011). Creative self-efficacy development and creative performance over time. *Journal of Applied Psychology*, 96(2), 277–293

Tierney, P., & Farmer, S. M. (2002). Creative self-efficacy: Its potential antecedents and relationship to creative performance. *Academy of Management Journal*, 45(6), 1137–1148

Türk, E. G., & Artar, M. (2014). Adaptation of the rational experiential inventory: study of reliability and validity. *Ankara University, Journal of Faculty of Educational Sciences*, 47(1), 1–18.

Türk, E. G., & Gülleroğlu, D. (2014). The validity and reliability of the Turkish version of rational experiential inventory. *Kastamonu Education Journal*, 22(2), 555–571

Uzunboylu, H., Tezer, M., & Yildiz, E. P. (2020). The effects of the authentic learning approach with a course management system (Moodle) on students’ mathematics success and online authentic learning self-efficacy. *Educational Research and Reviews*, 15(11), 679–689

Yildiz Durak, H. (2019). Examining the acceptance and use of online social networks by preservice teachers within the context of unified theory of acceptance and use of technology model. *Journal of Computing in Higher Education*, 31(1), 173–209

Yildiz Durak, H. (2021a). Modelling of relations between K-12 teachers’ TPACK levels and their technology integration self-efficacy, technology literacy levels, attitudes toward technology and usage objectives of social networks. *Interactive Learning Environment*, 26(5), 5365–5387. https://doi.org/10.1080/10494820.2019.1619591

Yildiz Durak, H. (2021b). Preparing pre-service teachers to integrate teaching technologies into their classrooms: Examining the effects of teaching environments based on open-ended, hands-on and authentic tasks. *Education and Information Technologies*, 26, 5365–5387.

**Publisher’s note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.