Learner Autonomy in Online Learning: Development and Validation of a Scale

Çevrimiçi Öğrenmede Öğrenci Özerkliği: Ölçek Geliştirilmesi ve Doğrulanması

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ABSTRACT

In online learning, autonomy is one of the significant factors for academic success, and learners' being aware of her/his skills can have effect on academic performance. Hence, the purpose of this study is to develop a valid and reliable measurement scale for the evaluation of learner autonomy in online learning environments. An item pool was generated based on both existing literature and perceptions of experts in the field of online learning. The sample of the study consisted of 903 university learners taking online courses. The study revealed that the scale consists of 28 items under four dimensions: self-control, self-reflection, self-interaction, and self-motivation. Confirmatory factor analysis proved that the items were appropriately loaded into the factors defined by the study. Based on these findings, the learner autonomy scale was found to be a valid and reliable instrument that may be employed in measuring learners' autonomy which exist in online learning environments.

Keywords: Learner autonomy, Online learning, Scale development, Scale validation

ÖZ

Çevrimiçi öğrenmede, özerklik akademik başarı için önemli faktörlerden biridir ve öğrenenlerin kendi becerilerinin farkında olmaları akademik performans üzerinde etkilidir. Dolayısıyla bu çalışmanın amacı, çevrimiçi öğrenme ortamlarında öğrenen özerkliğinin değerlendirilmesi için geçerli ve güvenilir bir ölçme aracı geliştirmektir. Hem mevcut literatüre hem de çevrimiçi öğrenme alanındaki uzmanların algılarına dayalı olarak bir madde havuzu oluşturulmuştur. Araştırmanın örneklemini çevrimiçi ders alan 903 üniversite öğrencisi oluşturmuştur. Çalışma, ölçeğin dört boyut altında 28 maddeden oluştuğunu ortaya koymuştur: öz kontrol, öz yansıtma, öz etkileşim ve öz motivasyon. Doğrulayıcı faktör analizi, maddelerin çalışma tarafından tanımlanan faktörlere uygun şekilde yüklendiğini kanıtlamıştır. Bu bulgulara dayalı olarak öğrenen özerkliği ölçeğinin çevrimiçi öğrenme ortamlarında var olan öğrenen özerkliğini ölçmede kullanılabilecek geçerli ve güvenilir bir araç olduğu görülmüştür.

Anahtar Sözcükler: Öğrenen özerkliği, Çevrimiçi öğrenen, Çevrimiçi öğrenme, Ölçek geliştirme

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INTRODUCTION

Online learning is one method of education that enables implementation of instruction with appropriate technologies. It provides the delivery of instructional content and activities via digital tools and environments (Author, 2022; Mayer, 2019). Online learning provides flexibility with respect to time and place, hence learners can largely choose a place and time for their learning that is appropriate for them. Online learning enhances the communication and interaction among instructors and learners. Online learning is cost efficient since it diminishes the need for travelling for learners and reduced need for classrooms to be built. Learners' differences are considered important within online learning, hence learners are provided with adaptive instructional materials. In addition, learners can learn at their individual pace and select from extensive instructional resources (i.e., text-based, narrated, multimedia, video, and interactive exercises, etc.) in online learning. Hence, these benefits of online learning enhance learner satisfaction and also help to lower their stress levels (Arkorful & Abaidoo, 2015). These have been offered as the major advantages of online learning for learners and instructors.

Some points need to be considered to fully benefit from online learning. The benefits of online learning are mostly dependent on learners' being able to take responsibility and manage the process of their own learning, guide their own training, and use time management skills (Weinstein, 1987; LaTour & Noel, 2021). In other words, learners need to be flexible, self-motivated, as well as needing to know how to work independently within an online platform (Davis et al., 2019). In online learning, autonomy is considered one significant aspect of self-learning (Firat, 2016), and as such is also seen as an important determinant for academic success (Lynch & Dembo, 2004). Since online learning provides flexibility, it is important for learners to be self-motivated and self-disciplined in this context. Hutapea (2019) indicated that individuals having high learning autonomy can work better and are able to observe, evaluate, and manage their studies effectively and efficiently while allocating appropriate time to perform course tasks.

In online learning environments, autonomy has a great importance since there is a need for learner participation due to the geographical distance among learners and instructors (Fotiadou et al., 2017). Hence, it is significant for each learner to make a plan at the beginning of their adaptation to online learning, and act according to that plan during the learning process. Additionally, it is more important than ever to discover to what extent university learners have adapted to this change, to what extent they have become autonomous in their learning, and how they learn independently within the online learning process. Yet, there has been limited number of study that has analysed the autonomy of learners in online learning contexts (Firat, 2016). In this respect, there is a need for conducting studies related to autonomy of online learners.

In addition, there is not sufficient number of research that investigated how learner autonomy is structured in online learning contexts (Zhong, 2018). Learners' autonomy in online learning can be investigated through an appropriate assessment tool. In this regard, the current study was conducted to offer an appropriate scale to assess the autonomy level of university learners undertaking their studies through online learning.

REVIEW of LITERATURE

Autonomy relates to learners' capability to manage their learning. As initially defined by Holec (1981), learner autonomy is taking responsibility in learning journey. In this regard, learners should set their goals, decide about expected instructional experiences, and the assessment strategies depending on the program they engaged (Moore, 1993). Yet, for the achievement of autonomy of learning, it is important to cover both psychology related factors (e.g., instructional strategies, motivation, perspectives) and environment related factors (e.g. task structure, ideal learning context) (Zhong, 2018). In other words, it is better to expect autonomy from learners after developing online programmes which consider instructor roles, learning platforms, and instructional strategies.

Tsai (2019) categorised the perspectives on learner autonomy as psychological, technical, sociocultural, and political–critical. According to the psychological perspective, learners' personal attributes considered include both cognitive and behavioural. While the cognitive aspects focus on learners' beliefs, awareness, perceptions and reflections, behavioural aspects focus on learners' actions and strategies (Benson, 2007). In terms of the technical perspective, learners need to be responsible for identifying, modifying or creating instructional resources provided within online learning environments (Dang, 2012). The sociocultural perspective covers interactions within online learning environments, and these interactions can be with people and/or resources (Dang, 2010). According to the political–critical perspective, it is important to consider learners' ideologies, their access to learning materials, and their control in the learning platform (Oxford, 2003).

Autonomous learners are represented by various characteristics. In terms of the psychological perspective, autonomous learners are identified as being 'self-regulated, emotionally intelligent, resilient, psychologically engaged, self-determined, existentially free, and effective' (Oxford, 2015, p. 59). Based on an action-oriented perspective, autonomous learners are able to determine their individual aims, choose suitable instructional strategies, follow their use of these strategies and assess their learning (Dickinson, 1994). Similar approaches were also considered in the CIEL handbook, where autonomous learners are addressed as engaging in interactive learning processes for reaching either long or short-term learning goals and make self-assessment (Ciel Language Support Network, 2000).

In order to achieve instructional goals in online learning, learners should be able to self-regulate their learning processes and sustain their motivation (Gu & Lee, 2019). In online learning environments, self-regulation holds significant importance in terms of the effectiveness of learning (Wong et al., 2019). Self-regulated learners have appropriate control over their cognition, behaviour, emotions, and motivation while employing individual techniques to accomplish their educational

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aims (Panadero & Alonso-Tapia, 2014). Self-regulated learners are defined by having characteristics that they: (a) intend to control their own behaviour, motivation, affect, and cognition; (b) aim to achieve a certain goal; and, (c) have control over their actions (Pintrich, 1995).

Scales Proposed for Measurement of Learner Autonomy

According to review of the relevant literature, it was identified that several scales were offered for the assessment of learner autonomy. One of the scales which was developed by Guglielmino (1977) and named as the Self-Directed Learning Readiness (SDLR) Scale, addressed 8 factors within a total of 41 items. Those factors were openness to learning opportunities, self-concept as an effective learner, initiative and independence in learning, informed acceptance or responsibility for one's own learning, love of learning, creativity, future orientation, and ability to use basic studying and problem-solving skills. Similarly, Fisher et al. (2001) proposed the SDLRS-40 scale composed of 40 items under three subscales, which were self-management, desire for learning, and self-control. The authors defined self-management as the learner's ability to manage time, being organised, and also self-disciplined where as they defined desire for learning as the learners' wishes to learn and their enjoyment related to learning. As the last subscale, Fisher et al. (2001) defined self-control as learners' setting their own goals and making appropriate decisions.

Walker and Fraser (2005) proposed a survey called DELES in order to assess online learning environments, and covers five items for the assessment of learner autonomy. According to these items, learners are mainly evaluated as to whether or not they make decisions about their own learning, whether they work at times convenient to themselves, and whether or not they are in control of their own learning.

Yet another scale for the measurement of university learners' autonomy was developed by Macaskill and Taylor (2010) which was composed of 12 items under two factors, namely independence of learning, and study habits. The authors defined independence of learning as learners' responsibility for learning, openness to experience, intrinsic motivation, and self-confidence whilst involved in new activities, whereas they defined study habits, as learners' study practices, time management, and lone-working related attitudes.

Zhong (2018) qualitatively investigated how learner autonomy has evolved within online learning environments, and proposed learners' psychological factors considered effective, as well as environmental factors such as teacher support and learning environment. According to Zhong (2018), autonomous learners become important users of numerous online materials, cooperative online learners, and are more talented managers and organisers within online learning environments.

In a recent study, Bei et al. (2020) proposed a scale to measure the perceived autonomy of distance learners. Although the study mainly focused on learners of the Hellenic Open University, it was additionally offered that the scale was applicable for similar distance education environments. Their developed scale consists of 25 items within two dimensions, as personal autonomy and educational autonomy. While personal autonomy covers 'self-awareness' and 'managing difficulties', educational autonomy covers 'autonomy in planning' and 'autonomy in action' as the respective sub-factors.

Although there are some scales that have been developed to evaluate learner autonomy within online learning, the social aspect has not yet been adequately dealt with. Interaction within online learning is important, hence online courses are proposed to be designed to support interactions in the form of learner-learner, learner-content, and learner-instructor interactions (Moore, 1993). Online learning interactivity can help prevent lack of retention and also reduce drop-out levels (Anderson, 2003). Considering the importance of interactivity in online learning as well as other important factors, the current study attempted to propose a valid and reliable instrument for the evaluation of learner autonomy within online learning environments. Thus, this research was designed to answer the following research questions:

1. How learner autonomy could be evaluated in online learning environments?

2. Which factors should be considered for evaluation of learner autonomy in online learning?

METHODOLOGY

The Ethics Committee approval required for conducting the study was obtained from the Ethics Committee of a state university in Ankara (22.06.2020/5/99). The study was done at a state university in Turkey during the autumn semester of the 2020-2021 academic year, between September and December of 2020. In the study, it was aimed to propose a scale to measure learners' autonomy in online learning. Scales are considered as effective tools for measuring phenomena which are believed to exist according to related theories, yet cannot be measured in a direct way (DeVellis, 2016). Hence, the scale development method was applied in the current study (Carpenter, 2018).

Participants

Purposive sampling technique was utilized in order to find the sample of the study. This technique is considered suitable for obtaining data from definite individuals or events which are chosen purposely (Taherdoost, 2016). In this present study, undergraduate level learners taking online courses were considered.

Data were obtained from learners on a volunteer basis. The questionnaire was distributed in different elective courses where instructed by the researchers. As a result, the sample of the study involves 903 learners studying at a state university in Turkey. Among this sample, data from 400 learners were used in the context of exploratory factor analysis, and data from 503 learners were considered in the context of confirmatory factor analysis. The demographic profile of the participant learners are summarised in Table 1. The sample consists of learners from five different age groups, and from 16 different faculties of the university.

Table 1: Participant Demographics

Category	Sub-categories	Frequency (f)	Percentage (%)
Gender	Female	636	70.4
	Male	267	29.6
Age	18-25	819	90.7
	26-33	38	4.2
	34-41	23	2.5
	42-49	13	1.4
	50+	10	1.1
Academic Discipline	Applied	552	61.3
	Pure	351	38.7
	Life	584	65.8
	Non-life	319	34.2
	Soft	702	78.3
	Hard	201	21.7
	Total	903	100.00

Development of Scale Items

The development of the scale items was undertaken by the study's researchers considering the theoretical foundations of the relevant current literature, supported by similar studies (Firat, 2016; Joshi, 2011; Kırtık, 2017). Thus, this research initially explored the intended meaning and breadth of the theoretical concepts of learner autonomy (Carpenter, 2018). For this purpose, a selection of appropriate conceptual labels and definitions were compiled in order to identify potential dimensions and items for the draft scale through conducting a search of the relevant literature. Initially, a total of 30 items were considered by the researchers for assessing the level of autonomy of learners. These questions were shared with three field experts, with minor modifications applied subsequently based upon their feedback. Also, a pilot application was conducted with learners (N = 12) in order to ensure that the item wording and meaning was appropriate and understandable. The scale used a Likert-type format, including options that ranged from 1 (*completely disagree*) to 5 (*completely agree*).

After finalising the questionnaire design and items, the final form was created using a digital platform. It was decided that reaching volunteer learners through elective courses provided university-wide would be quicker and easier as a means to achieving coverage of learners from different disciplines. Therefore, the 'accessible sampling' method was preferred, and instructors requested to publicise the study and to share a link to the questionnaire within their courses. All of the participants were then presented with a consent form which informed them about the details of the research as well as making sure that they were participating in the study voluntarily.

Data Analysis

As Carpenter (2018) suggested, appropriate statistical analysis methods were employed to interpret and understand the data obtained from the questionnaire. First, the data were cleansed in terms of outliers, and then the data was verified for factorability using Bartlett's Test of Sphericity (.05) and Kaiser-Meyer-Olkin test of sampling adequacy (.60) for inspecting correlation matrix (.30).

Then, Exploratory Factor Analysis (EFA) was applied by choosing Principal Factors Analysis/Maximum Likelihood for factor extraction method. According to the results of this analysis, four factors were established as dimensions of learner autonomy in online learning. The reliability of factors was presented according to Cronbach's Alpha estimations. The validity of the scale was then calculated based on model fit estimations and Confirmatory Factor Analysis (CFA). SPSS and AMOS software were employed for the analysis of data.

FINDINGS

Validity-related Findings

Exploratory Factor Analysis (EFA) was employed to investigate the scale validity. After developing first set of items, EFA was utilized to investigate the dimensionality of the item set, with items grouped into logical subsets for the measurement of various factors (Worthington & Whittaker, 2006).

Prior to the implementation of EFA, Kaiser Meyer Olkin (KMO) and Bartlett's Sphericity tests were employed to investigate the suitability of the data for the study. The corresponding results were provided in Table 2. The KMO value was found to be .934, which is rated as 'superb' according to Field (2009), and which is higher than the recommended value of .90. Hence, the sample was identified as being suitable for the factor analysis (Hutcheson & Sofroniou, 1999). Furthermore, Bartlett's test of sphericity (χ^2 (435) = 6647.351, $p < .001$) was estimated as 'significant', and thus factor analysis was found suitable in the context of the current study.

Table 2: Results of KMO and Bartlett's Sphericity Test

Measure		Value
Kaiser-Meyer-Olkin (Sampling Adequacy)		.934
Bartlett's Test of Sphericity	Approx. Chi-Square	6647.351
	Df	435
	Sig.	.000

After confirming both the sample size and appropriateness of the data for factor analysis, principal component analysis was then applied. That is, the initial analysis was employed to find eigenvalues for the components of the data. During this analysis, the varimax method (Kaiser, 1958) was utilized as the method of rotation. According to the analysis, four components were found to have eigenvalues greater than Kaiser's criterion of 1, and which combined explained 55.955% of the variance (Table 3).

According to the Table 3, the scale consists of four factors. The 1st factor explained 37.516% of total variance, whilst the 2nd factor explained 7.233% of total variance, the 3rd factor explained 6.030% of total variance, and the 4th factor explained 5.176% of total variance.

Table 4 presents the factor loadings of each item following the rotation. The item loadings demonstrated that the factor loads ranged from .401 to .728 in the first factor, from .402 to .789 in the second factor, from .605 to .827 in the third factor, and from .478 to .791 in the fourth factor. Only Item 19 was not in-cluded under any of the four factors. In addition, following the review of the factor loadings, it was identified that Item 18 had not been loaded into the correct factors, and was subsequently removed from the scale. The resulting scale was comprised of 28 items.

Table 3: Variance Explained by the Scale

Factor	Initial Eigenvalues			Values after Rotation		
	Total	Explained Variance (%)	Cumulative (%)	Total	Explained Variance (%)	Cumulative (%)
1	11.255	37.516	37.516	5.056	16.854	16.854
2	2.170	7.233	44.750	4.651	15.504	32.358
3	1.809	6.030	50.780	3.664	12.214	44.572
4	1.553	5.176	55.955	3.415	11.384	55.955

Table 4: Item Factor Loadings

	Component			
	1	2	3	4
8. I take care to complete all the reading and homework given in the relevant week before entering the class.	.728			
4. I regularly follow my lessons and homework during the online learning process.	.712			
13. I do homework and activities given after the virtual classroom on time.	.683			
12. I repeat my lessons after virtual classroom.	.680			
7. I review the teaching materials and content before joining the virtual classroom.	.680			
5. I often check the deadlines of course tasks.	.661			
6. During my online learning process, I keep the distracting devices (telephone, television, etc.) turned off.	.598			
21. I act in accordance with the study plan I have made myself in the online learning process.	.519			
20. I manage my time well in the online learning process.	.401			
29. The distance of the learning process positively affects my desire to learn.		.789		
30. I can shape my online learning process in line with my personal expectations.		.708		
1. I think I have the ability to learn with the online learning method.		.663		
28. I think I learn better in a more flexible learning process.		.618		
25. I can improve my digital literacy competencies in the online learning process.		.525		
22. I evaluate myself to learn better.		.510		
3. I make good use of my free time in acquiring new information through online learning.		.466		
23. I can take responsibility for my own learning.		.450		
2. I make my own decisions and set goals for my learning process		.453		
27. I can easily access the learning resources I need in the Internet environment.		.402		
11. I communicate comfortably with other students in the virtual classroom.			.827	
10. I communicate comfortably with my instructor in the virtual classroom.			.812	
9. I can easily ask my questions in the virtual classroom.			.777	
14. I communicate with my instructor and friends outside of the virtual classroom.			.610	
26. I have no difficulty conducting collaborative work in the online learning process.			.605	
16. I try to learn course content from different sources by reaching different audio-visual materials.				.791
15. I try to learn course content from different sources by reaching open educational resources.				.751

Table 4: Cont.

	Component			
	1	2	3	4
17. I enrich my online learning process by reaching different resources.				.725
24. In the online learning process, I can learn without an instructor's guidance.				.478
18. I know the positive and negative aspects of online learning.				.533
19. I reward myself when I make progress in online learning process.				

The items that clustered on identical components indicated that Component 1 represented self-control, Component 2 represented self-reflection, Component 3 represented self-interaction, and Component 4 represented self-motivation. This categorization was done considering the studies of Fisher et al. (2001), Moore (1993) and Walker and Fraser (2005).

The first factor of the scale was named as 'self-control', which refers to learners' actions to achieve their goals, and considers learners' actions before, during, and after the learning process. Learners are evaluated as to whether or not they complete their assigned reading and homework prior to attending the virtual class. In the online learning process, learners are evaluated as to whether or not they regularly follow their lessons and homework, whether they check the coursework deadlines, whether they act in parallel to the study plan, whether they manage their time well, and whether or not they keep distracting devices turned off. Following their lessons, learners are evaluated as to whether they repeat the course and whether they perform self-evaluations.

The second factor of the scale was named as 'self-reflection', which refers to learners evaluating their own performance and presenting self-explanations related to both their successes and failures.

The third factor of the scale was named as 'self-interaction', which focuses on learners' communication with their peers and instructors, as well as their collaborative efforts with other learners.

The fourth factor of the scale was named as 'self-motivation', which includes learners' intentions to seek information from the Internet. According to this factor, learners have motivations to learn from different resources, to access audio-visual materials, and also to learn from open instructional resources.

Reliability-related Findings

The reliability of the developed scale was calculated with the use of an internal consistency coefficient (Cronbach's Alpha). Reliability coefficients estimated for scale factors are presented in Table 5.

As can be seen from Table 5, the reliability coefficients are between .812 and .884 for the scale factors, and .939 for the overall scale. Each factor has high reliability, since their Cronbach's Alpha values were higher than .80, which satisfied the criteria of Kline (1999) related to high reliability.

Table 5: Reliability Analysis Results

Factor	# of Items	Cronbach's alpha	Reliability
1	9	.884	High
2	10	.867	High
3	5	.871	High
4	4	.812	High
Whole Scale	28	.939	High

Table 6: Model Fit Results

Fit Indices	Estimated Value	Recommended value
X^2/df	4.583	<5 (Sümer, 2000)
CFI	.867	>=0.85 (Kline, 2011)
GFI	.800	>=0.80 (Byrne & Campbell, 1999)
TLI	.854	>=0.85 (Carlback & Wong, 2018)
IFI	.867	>=0.85 (Kline, 2011)
RMSEA	.085	<=0.1 (Carlback & Wong, 2018)

Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) can be defined as an analysis applied to test whether a developed structure can be verified or not (Özel et al., 2013). CFA was carried out in AMOS software. The model fit was first estimated to examine the validity of the model's structure, as presented in Table 6.

Within the scope of the results, the X^2/df value was found to be 4.583. The fact that the X^2/df value is less than 5 indicates model fit (Sümer, 2000). CFI, TLI and IFI values were found higher than 0.85, hence in the recommended range according to Kline (2011) and (Carlback & Wong, 2018). Furthermore, GFI value more than 0.80 is proposed for model fit (Byrne & Campbell, 1999). In addition, the RMSEA value was .085 and was found to be less than 0.1 (Carlback & Wong, 2018).

The CFA results (Figure 1) proved that the items were appropriately loaded to the respective factors as defined by the study. The standardised correlation among the factors were found to be greater than the expected values. Based on the results of the CFA, it can be indicated that the items were loaded under four factors, namely self-control, self-reflection, self-interaction, and self-motivation.
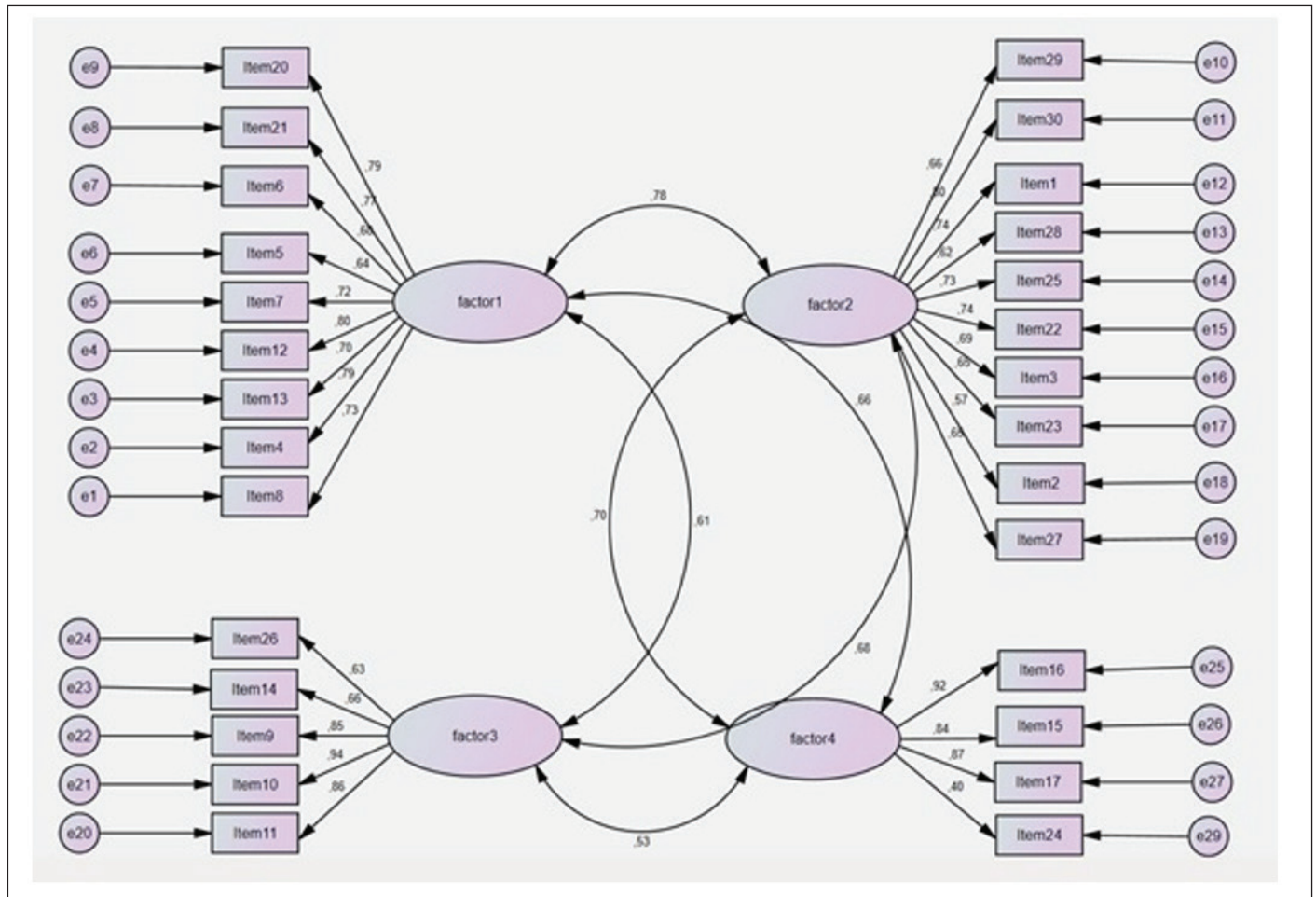
Figure 1: CFA results.

DISCUSSION and CONCLUSION

This study was conducted to develop an instrument for evaluation of the learner autonomy in online learning and reveal the factors of this process in detail. Hence, a scale consisting of 28 items was proposed in order to assess learner autonomy in online learning. In this regard, the scale was generated based on existing current literature, with reviews from experts in the field of online learning, together with the results of exploratory and confirmatory factor analyses.

As a result of EFA conducted on the data of 400 university learners taking online courses, it was revealed that the developed scale included four factors, and that these factors explained 55.955% of the total variance. The reliability of the scale was estimated as .939, which satisfied Kline's (1999) criteria for high reliability. The four factors of the scale for learner autonomy in online learning were identified as self-control, self-reflection, self-interaction, and self-motivation (Figure 2). Confirmatory factor analysis was employed in order to assess the validity of the model structure. The model fit values were found to be within the recommended levels, with X^2 / df = 4.583, CFI = .867, TLI = .854, and RMSEA = .085.
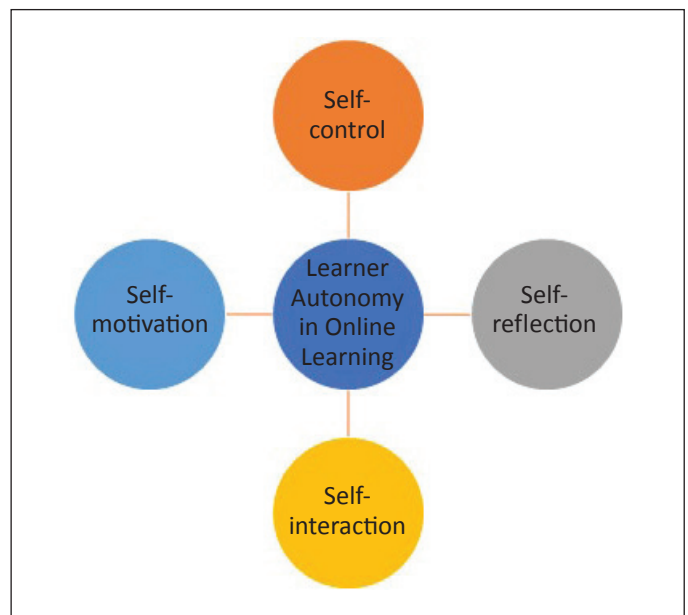

Figure 2: Learner autonomy explained.

Traditional learning environments differ from online learning environments with respect to learners' flexibility in the learning process. While learners follow a linear sequence in accessing learning content and materials in traditional learning, the online learning environment offers them flexibility in accessing instructional materials (Hung et al., 2010). That is, learners can freely select their own learning pace and path whilst studying online (Hannafin, 1984). According to the self-control dimension, learners are expected to develop their own plans, then implement their them in order to achieve their own goals (Zhu et al., 2016). Goals cover learners' intentions during learning and can be based on intrinsic or extrinsic motivation (Cho & Shen, 2013). Tsai (2009) proposed that university learners can employ various self-control strategies while concentrating on learning within an online learning context. It was identified that learners can employ self-control strategies such as avoiding interruptions, concentrating on learning, and managing time effectively (Zhu et al., 2016).

Self-reflection 'involves purposeful self-monitoring of one's own learning goals, plans, process, experience and outcomes, as well as understanding and making judgments regarding one's own learning performance related to problem solving, deepened understanding, or acquiring new perspectives' (Choi et al., 2017, p. 81). The self-reflection aspect is also included in the self-regulation model of Zimmerman and Moylan (2009), in which learners can evaluate their own performance and present self-explanations related to both their successes and failures (Panadero, 2011). It was revealed that reflection on learning within online learning environments provides various advantages such as enhancing the depth of knowledge, detecting missing or problematic knowledge areas, personalising and contextualising knowledge, presenting references for learning, and allowing learners to form relations between their acquired and prior knowledge (Chang, 2019).

Learner engagement plays an important role, especially within online contexts in which learners may feel either isolated or disconnected (Dixson, 2010). Moreover, it is suggested that there exists a close relation between engagement and interaction in online learning environments (Martin & Bolliger, 2018). In this respect, interaction also has a key role in online learning. Lack of interaction in online learning results in ineffective learning, which may also cause lack of retention in learners or increased drop-out levels (Anderson, 2003). Hence, online courses are proposed to be designed in such a way so as to support interactions that may occur in three forms: learner-learner, learner-content, and learner-instructor interactions (Moore, 1993). Learners can utilise instructional materials, online activities, and also communication tools to achieve the required level of interaction with the instructional materials, with their peers, and also with their instructors within the online environment (Afacan Adanır et al., 2020).

According to the model of Zimmerman and Moylan (2009), one aspect of self-motivation indicates learners' self-efficacy, which both involves learners' beliefs about their own capability, as well as their digital self-efficacy (Alqurashi, 2016) on the basis of technological perspective (Shen et al., 2013). The Internet provides a vast number of digital resources that may be used by individual learners. In this regard, online learners need to seek out the appropriate digital materials to make their online learning effective. For instance, Tang and Tseng (2013) proved that learners with greater self-efficacy for researching also demonstrated high level self-efficacy for online learning.

Certain problematic issues were reported with regards to the current literature's scales. Guglielmino's (1977) SDLR scale faced issues related to construct validity, whilst Fisher et al.'s (2001) SDLRS-40 scale addressed learners only from nursing school. Walker and Fraser's (2005) DELES scale considered learning in distance education platforms, but some scales do not completely consider online learning. Also, Bei et al.'s (2020) scale addressed only a single university and similar distance education environments. In this respect, the scale proposed and developed in the current study considers the known issues of inadequacy and offers a comprehensive scale for assessing learner autonomy in online learning.

Being shaped in the digital era and realising the importance of lifetime learning, all learners need to be equipped with a high level of autonomy in order to be successful in their academic career. Learner autonomy will be an important variable in future studies that will try to explore the learning process in online environments. Hence, the proposed scale may be used to reveal not only the autonomy levels of learners, but also to explore different variables that either directly or partially correlate with this coefficient.

This study has some limitations. In the context of the study, data were obtained from only Turkish participants. In a future study, sample from different countries can be selected and country- wide comparisons can also be done. The other limitation is that the sample mostly covers learners between ages 18 and 25. Therefore, the suggested scale is mostly appropriate for this age group. The future research may consider balanced age distribution, hence obtain more data from age groups older than 25.

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