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Examining the reliability and validity of a Mongolian version of the student online learning readiness instrument using exploratory and confirmatory factor analysis

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Examining the reliability and validity of a Mongolian version of the student online learning readiness instrument using exploratory and confirmatory factor analysis

Abstract

This study examines the reliability and validity of a Mongolian version of the Student Online Learning Readiness (SOLR) instrument in the Mongolian context. The instrument consists of 20 items used to evaluate technical competencies, social competencies with instructor, social competencies with classmates, and communication competencies. One thousand seven hundred and eight-six undergraduate students at the National University of Mongolia in Ulaanbaatar, Mongolia, participated in this study. Data were randomly split into two groups. The four-factor structure of the SOLR instrument explained 69.355% of the variance in the pattern of relationships among the items in the first half-sample. All four competencies had high reliabilities (all Cronbach's alpha values were .84 or higher). The validity of the four-factor structure of the Mongolian-language version of the SOLR model was confirmed with the deletion of one item that cross-loaded on multiple factors. Confirmatory factor analysis confirmed the validity of the hypothesised model of the 19-item structure of the Mongolian-language version of the SOLR instrument using the second half-sample.

Practitioner Notes

1. The Mon-SOLR instrument can be used to assess the online readiness of university students in Mongolia.
2. The Mon-SOLR instrument consists of four dimensions to define student readiness for online learning: social competencies with an instructor, communication competencies, social competencies with classmates, and technical competencies.
3. The Mon-SOLR instrument can be used to measure learners' competencies in online learning before they take an online course.

Keywords

online learning, student readiness, Mon-SOLR, Mongolia

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Introduction

The Mongolian higher education has experienced a remarkable expansion since its transition from planned economy to open-market economy when Mongolia became a democratic country in 1990. Between 1991 and 2017, the number of higher education institutions grew from 14 to 95, and gross enrolment ratio in tertiary level grew from 14.0% to 69.0% (Gantogtokh, 2018). Mongolia adopted the shared governance system inspired from that of the USA in the mid-1990s in order to enable its higher education institutions autonomy and self-sufficiency at the institutional level. From this time, Mongolia embarked a policy of decentralization of its higher education, aiming for building autonomous and self-sufficient higher education institutions (Munkh-Erdene, 2008). Reform actions were implemented to introduce academic degree system and credit-based system, promote self-financing of universities, and upgrade academic programs to reach international standards. The Ministry of Education and Science in Mongolia (MESM) has overall responsibility for higher education in Mongolia at the system level (Gantogtokh, 2018). Some recent studies strongly encourage to digitizing of higher education in Mongolia, and to organize higher education learning in various ways to develop essential competencies among students (Gerelmaa et al., 2021).

In the 21st century, online learning has emerged as an essential educational tool and provided teachers with a new instrument to expand learning opportunities and enhance learning outcomes (Navani & Ansari, 2016). In recent years, many governments have taken measures to avoid the spread of the COVID-19 outbreak and maintain the stability of the educational process, and tertiary institutions worldwide have organized online learning (Ali, 2020; Sobaih et al., 2020; Coman, 2020).

Like many other countries, the MESM instructed all public and private institutions of higher education to conduct teaching and learning activities via online learning from the end of January until the end of June 2021 due to the spread of COVID-19 (MESM, 2020a; MESM, 2020b). Teachers placed their course materials on a learning management system and organized online learning using video conference tools such as Microsoft Teams, Google Meet, Facebook Live, and Zoom. Students used various ICT tools, including desktops, smartphones, and laptops, to participate in online learning (NUM, 2021). Currently, since online learning in higher education means having excellent technical infrastructure, preparing students to be ready for online learning is critical (Küsel et al., 2020).

Therefore, studies have been conducted in many countries such as Ghana (Forson & Vuopala 2019), Hong Kong (Tang et al., 2021), Malaysia (Chung et al., 2020), Pakistan (Rafique et al., 2021), the Philippines (Reyes et al., 2021), and Turkey (Herguner et al., 2020) to determine student readiness for online learning. However, lack of instrument has been developed and validated for measuring online learning readiness in the Mongolian higher education context. Consequently, this study was designed to examine the reliability and validity of instruments that assess the online learning readiness of students in Mongolian higher education.

The research on readiness for online learning of students has explored learners' preparedness and contexts for successful online education (Blayone, 2018). Student readiness for online learning has a positive impact on students' achievements in online learning, satisfaction in learning experiences, self-confidence, and lifelong learning (Küsel et al., 2020).

Many studies have sought to characterize the key factors underlying readiness for online learning (Watkins et al., 2004; Pillay et al., 2007; Farid, 2014; Martin et al., 2020), and many researchers have developed and validated tools to measure student readiness for e-learning [20–29] (Mattice & Dixon, 1999; McVay, 2001; Osborn, 2001; Muse, 2003; Bernard et al., 2004; Kerr et al., 2006; Dray & Miszkiewicz, 2007; Hung et al., 2010; Yu & Richardson, 2015; Zimmerman & Kulikowich, 2016). This variety shows that readiness for online learning is a multi-dimensional construct and that there has been a lack of consensus about its components (Farid, 2014). Readiness for online learning consists of various aspects, including self-regulation, computer literacy, and awareness of the learning community (Liu, 2019).

Several studies have been conducted to determine the online learning readiness of students in Mongolia before COVID-19 (Tsolmon et al., 2014; Sukhbaatar et al, 2017; Navchaa, & Tumenbayar, 2017; Navchaa, 2020). According to a survey which was carried by NUM (2021), lecturers pointed out that the major challenge to organize online learning basically stemmed from students' poor preparedness for online learning. Although, it was unexpected shift due to the pandemic related situation, on the another hand, it is because of lack of valid and reliable instruments to identify or measure students' preparedness for online learning. In this regard, predicting students' background related to online learning is critical to evaluate effectiveness of online learning and to organise it in more efficient ways.

In September 2020 (i.e., during COVID-19), Miyejav et al. (2021) analysed the content validity of the English versions of 16 instruments that determine student readiness for online learning in the Mongolian context, based on the Osterlind index congruence (Osterlind, 1998). Content analysis was then performed based on the dimensions of each instrument. The analysis was performed using the Osterlind index of congruence in three sections: representativeness (R), utility (U), and feasibility (F) for each dimension. Ten experts participated in the content validity study. As a result, the Student Online Learning Readiness (SOLR) instrument, developed by Yu and Richardson (2015), was found to be suitable for use in the higher education environment of Mongolia.

Theoretical framework

The theoretical framework for the SOLR model was based on Tinto's student integration model (Tinto, 1975), reflecting on diverse measures for online learning (see Table 1). Figure 1 presents the SOLR model consists of four dimensions to measure student readiness for online learning: social competencies with an instructor, communication competencies, social competencies with classmates, and technical competencies (Yu & Richardson, 2015; Yu, 2018).

The SOLR instrument consists of 20 items: six items for technical competencies, five items for social competencies with an instructor, five items for social competencies with classmates, and four items for communication competencies, as shown in Table 2. This instrument was tested for factorial validity, internal consistency reliability (Yu & Richardson, 2015), and predictive validity (Yu, 2018).

Yu and Richardson examined the validity of the SOLR instrument by conducting exploratory factor analysis (EFA) and found that the final four-factor structure was composed of 20 items with no cross-loading (Yu & Richardson, 2015). This 20-item structure explained 66.69% of the variance in the pattern of relationships among the items (e.g., technical competencies, 40.28%;

social competencies with an instructor, 11.02%; social competencies with classmates, 7.92; and communication competencies, 7.47%).

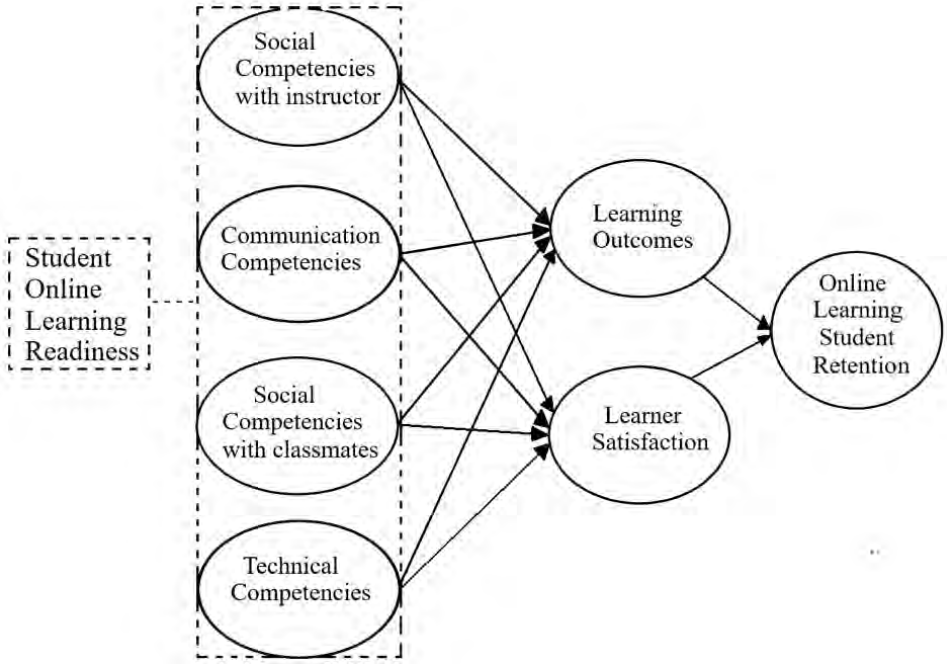
Table 1.
Instrument of online readiness of students

	Author (year)	Name of instrument	Number of dimensions	Valid	Invalid
1.	Bernard et al. (2004)	Questionnaire for Predicting Online Learning Achievement	4	2	2
2.	Dray et al. (2007)	Online Learning Readiness Survey (OLRS)	4	2	2
3.	Hung et al. (2010)	Online Learning Readiness Scales (OLRS)	5	3	2
4.	Kerr, Rynearson, & Kerr (2006)	Test of Online Learning Success (TOOLS)	5	3	2
5.	Martin, Stamper, and Flowers (2020)	Student Readiness for Online Learning (SROL) instrument	4	2	2
6.	Mattice, and Dixon (1999)	Distance Learning Survey	3	1	2
7.	McVay (2001)	Readiness for 13 Online Learning Questionnaire	3	1	1
8.	Muse (2003)	Distance Learning Survey	7	3	4
9.	Osborn (2001)	Distance Learning Survey	6	3	3
10.	Parnell & Carraher (2003)	The Management 12 Education by Internet Readiness (Mebir) Scale	3	2	1
11.	Smith (2005)	Readiness for Online Learning (ROL)	2	1	1
12.	Pillay et. (2007)	Tertiary students' readiness for online learning (TSROL)	4	3	1
13.	Roblyer et al. (2008)	Model for predicting failure and promoting success in virtual school environments	4	2	2
14.	Watkins, Leigh, and Triner (2004)	E-learner Readiness Self-assessment	6	5	1
15.	Yu & Richardson (2015)	Student Online Learning Readiness (SOLR)	4	4	0
16.	Zimmerman and Kulikowich (2016)	Online Learning Self-Efficacy scale (OLSES)	3	1	2

Also, the internal consistency of the 20 items of the SOLR instrument was good, with a Cronbach's alpha of .874 for social competencies with an instructor, .823 for social competencies with classmates, .871 for communication, and .882 for technical competencies. With respect to predictive validity of the SOLR instrument, Yu (2018) conducted confirmatory factor analysis (CFA) and found that the hypothesized model of the 20-item structure of the SOLR instrument was confirmed as an adequate fit for the data ($\chi 2(164, N = 347) = 512.218$, $p < .001$, IFI = .912, CFI = .911, NFI = .875, and RMSEA = .078) (Yu, 2018).

Using instruments in their original form in different countries is almost impossible because of the constraints of spoken language and cultural and social differences (Fernández-Pascual et al., 2015). Hence, this study aimed to examine the reliability and validity of the SOLR instrument based on students' perceptions of its use in the Mongolian context.

Figure 1.
SOLR model adapted from Yu & Richardson (2015)



Method

During the Spring and Autumn 2020 semesters, all courses (1,624 courses) at the National University of Mongolia (NUM) were provided through forms of online learning, and there was no face-to-face component (NUM, 2021). Most online courses were in the SISi information system and used the Microsoft Teams platform. Online courses had the following features: (a) all courses were only offered online, (b) most class assignments and exams were implemented in Microsoft Teams and Google Forms, and (c) all instruction was conducted using the NUM SISi information system.

Table 2.
Student Online Learning Readiness (SOLR) instrument

Factor (Code)	Item code	Item number	Items
Factor 1: Technical competencies (TC)	TC1	1	I have a sense of self-confidence in using computer technologies for specific tasks.
	TC2	2	I am proficient in using a wide variety of computer technologies.
	TC3	3	I feel comfortable using computers.
	TC4	4	I can explain the benefits of using computer technologies in learning.
	TC5	5	I am competent at integrating computer technologies into my learning activities.
	TC6	6	I am motivated to get more involved in learning activities when using computer technologies.
Factor 2: Social competencies with an instructor (SCI)	*How confident are you that you could do the following social interaction tasks with your INSTRUCTOR in the ONLINE course?*		
	SCI1	7	Clearly ask my instructor questions
	SCI2	8	Initiate discussions with the instructor
	SCI3	9	Seek help from the instructor when needed
	SCI4	10	Inform the instructor in a timely manner when unexpected situations arise
	SCI5	11	Express my opinions to the instructor respectfully
Factor 3: Social competencies with classmates (SCI)	*How confident are you that you could do the following social interaction tasks with your CLASSMATES in the ONLINE course?*		
	SCC1	12	Develop friendships with my classmates
	SCC2	13	Pay attention to other students' social actions
	SCC3	14	Apply different social interaction skills depending on the situation
	SCC4	15	Initiate social interaction with classmates
	SCC5	16	Socially interact with other students with respect
Factor 4: Communication competencies (CC)	CC1	17	I am comfortable expressing my opinion in writing to others.
	CC2	18	I am comfortable responding to other people's ideas.
	CC3	19	I can express my opinion in writing so that others understand what I mean.
	CC4	20	I give constructive and proactive feedback to others even when I disagree.

Sample

The participants for this study were 1,786 Mongolian undergraduate students: 708 (39.6%) male and 1,078 (60.4%) female students enrolled in the NUM. There were 318 freshmen (17.8%), 547 sophomores (30.6%), 567 juniors (31.8%), and 354 seniors (19.8%). The total sample (N = 1786) was randomly divided into two equal halves by using the Statistical Package for the Social Sciences (SPSS, version 26.0). EFA was performed on the first sample (N = 893) and CFA was performed on the second sample (N = 893). Demographic information for each sample is shown in Table 3.

Table 3.
Demographic information for each sample (N = 1,786)

Demographic characteristics		Sample 1		Sample 2	
		N	**%**	***N***	**%**
Gender	Male	354	39.6	354	39.6
	Female	539	60.4	539	60.4
	Total	893	100.0	893	100.0
Grade level	Freshmen	160	17.9	158	17.7
	Sophomore	271	30.3	276	30.9
	Junior	285	31.6	282	31.6
	Senior	177	19.8	177	19.8
	Total	893	100.0	893	100.0
School	Business	228	25.5	197	22.1
	Arts and Sciences	79	8.8	90	10.1
	Engineering and Applied Sciences	298	33.4	310	34.7
	Law	74	8.3	87	9.7
	International Relations and Public Administration	65	7.3	55	6.2
	Total	893	100.0	893	100.0

Measures

The instrument was conducted using questionnaires that consisted of two sections: demographics (Section A) and items of the Mongolian SOLR (Mon-SOLR) instrument (Section B), which was derived from the original English-language SOLR instrument (Yu & Richardson, 2015). Each item was measured on a 5-point Likert scale (1 = *disagree*, 2 = *tend to disagree*, 3 = *neutral*, 4 = *tend to agree*, 5 = *agree*).

The process of the translation of the items of the original SOLR instrument was carried out using the method used by Cardona-Molto (Cardona-Molto et al., 2020). During the translation process, SOLR items were first translated from English into Mongolian by the first author, who is a native Mongolian speaker. The items were then translated back to English by two bilingual native English-Mongolian speaking translators. The original SOLR and the back translated Mon-SOLR items were then compared. Finally, the translated version was revised by three experts in inclusive education, educational measurement, and curriculum to investigate item content validity, based on their professional experience.

Data collection and analysis

After development, the Mon-SOLR instrument was administered through online information system of NUM. In November 2020, 11,123 undergraduate students from NUM were invited to participate in the study over a 2-week period. Descriptive statistics were calculated using the means, standard deviations, skewness, kurtosis, minimums, and maximums of the four competencies using SPSS 26.0. If the mean of an item was found to be close to either 1 or 5, eliminating it as inappropriate should be considered because it may decrease the standard of correlation among the rest of the items (Yu & Richardson, 2015). After that, the data were subjected to tests of multivariate normality. Normality of data distribution was verified by the absolute values of skewness and kurtoses being less than 3 and 8, respectively (Kline, 2010).

Next, mean, and standard deviation were calculated for gender, grade level, and school. An independent-sample t-test was carried to compare the means for gender while ANOVA test was carried to compare the means across grade levels and schools. Comrey and Lee suggest that for factor analysis the size of a sample is not large enough at 100, moderate at 200, good at 300, and very good at 500 (Comray & Lee, 1992). Williams also pointed out that there should be 3 to 20 participants per item (Williams et al., 2010).

Exploratory factor analysis (EFA) is a statistical method employed to increase the reliability of the scale by identifying inappropriate items that can be removed and the dimensionality of constructs by examining the existence of relationships between items and factors when the information of the dimensionality is limited (Netemeyer et al., 2003). Specific criteria of EFA are used to assess the data information suitability for factor analysis to produce factor extractions. These criteria include the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy test and the Bartlett's test of sphericity. A KMO value is greater than .70 is considered to be good and less than 0.50 is considered to be unsuitable, and it is recommended that Bartlett's values be less than 0.05 (Kline, 2010).

Reliability concerns the extent to which a measurement of a phenomenon provides stable and consistent results. Testing for reliability is important as it refers to the consistency across the parts of a measuring instrument (Hamed, 2016). To evaluate the reliability of each competency, we calculated each of the Cronbach's alpha coefficients using SPSS 27.0. For reliability, these values should be higher than 0.70 to be considered good (Hair et al., 2010). A coefficient is considered good at 0.7 to 0.9 and very good when higher than 0.9 (Taber, 2016).

Following EFA, confirmatory factor analysis (CFA) was conducted to verify the 20 items of the Mon-SOLR instrument using analysis of a moment structures (AMOS, version 26). The main purpose of CFA is to examine the relationships among the latent and observed variables supported by logic or theory (Schrieber et al., 2006). The CFA is used to confirm a conceptual structure (Maruyama, 1998). Multiple goodness of fit indices was used to examine the predictive validity of the 19 items of the SOLR instrument. The χ^2(CMIN), χ^2/df (CMIN/DF), root mean square error of approximation (RMSEA), Tucker-Lewis index (TLI), comparative fit index (CFI), incremental fit index (IFI), normed fit index (NFI), goodness of index (GFI), and adjusted goodness-of-fit index (AGFI) were used to determine the best fit for CFA. χ^2/df is considered good enough at a maximum of 5.0 (Wheaton et al., 1977) and minimum of 2.0 (Tabachnick & Fidell, 2007) to recommend the model. If the RMSEA is less than 0.06, it is assumed that analyzed data are valid for reasonable reliability, and a value greater than 0.08 indicates that there is a specific error (Hu & Bentler, 1999). The cutoff values for an acceptable model fit are TLI, CFI, NFI, GFI, and AGFI above 0.9 and RMSEA below .08 (Miyejav, 2018).

Results

Descriptive statistics

Table 4 shows the descriptive statistics including means (M), standard deviations (SD) of the Mon-SOLR instrument by gender, grade level, school and total. For each item, the minimum and maximum values were 1 and 5 respectively. The results reveal that participating students perceived high TC1 (M = 3.9877) and low SCC1 (M = 2.7480) (Table 5). All items, the value of the skewness and the value of the kurtoses of the distribution range from –1.178 to 0.118 and from –1.265 to 1.898, respectively, which satisfy the normal requirements. Results indicated that

students had a high level of technical competencies (M = 3.761), communication competencies (M = 3.669), social competencies with the instructor (M = 3.472), and, whereas a relatively low level of social competencies with classmates (M = 2.998).

Table 4.
Descriptive statistics and results of t-test and ANOVA by gender, grade levels and schools

Demographic characteristics		Total		Test	
		M	SD	t/F	Sig.
Gender	Male	3.559	0.737	-1.471	.142
	Female	3.505	0.715		
Grade level	Freshmen	3.493	0.714	2.469	.043
	Sophomore	3.445	0.703		
	Junior	3.492	0.686		
	Senior	3.492	0.686		
School	Business	3.485	0.640	8.374	.000
	Arts and Sciences	3.470	0.752		
	Engineering and Applied Sciences	3.667	0.665		
	Law	3.142	0.842		
	International Relations and Public Administration	3.584	0.649		
Total		3.505	0.715		

The results of independent-sample t-test between gender indicated that there was no statistically significant difference (t (891) = -1.471, p = .142). In contrast, the results of ANOVA test between the mean scores in grade levels and schools indicated that there were statistically significant differences respectively (F (4, 888) = 2.469, p = .043; F (4, 888) = 8.374, p = .000).

Exploratory factor analysis

EFA was conducted on the 20 items with varimax rotation using SPSS 27.0. The KMO measure confirmed the sampling adequacy for the analysis, KMO = .929. Bartlett's test of sphericity, ^{2} (190) = 10,731.3, p < .000, indicated that correlations between items were sufficiently large for the EFA.

Based on the results of descriptive statistics analysis, we could confirm that the data in this study were appropriate to conduct an EFA. The 893-student sample size was large enough for the EFA because it was larger than the suggested sample size of 500 (Comray & Lee, 1992). Results from the EFA identified four factors, which were the same four factors as originally proposed by the SOLR instrument (Yu & Richardson, 2015), by deleting one item which cross-loaded on multiple factors. The four-factor structure with 20 items had been tested previously and confirmed for the English language by Yu and Richardson (2015). They conducted an EFA on the 20 items of the SOLR instrument with 331 students who participated in 12 online courses at Midwestern University. The internal consistency of each competency was good, with Cronbach's alpha values of technical competencies, social competencies with an instructor, social competencies with classmates, and communication competencies at .882, .874, .823, and .871, respectively.

Item SCC5 was deleted because it had a cross-loading of .521 on Factor 3 and a cross-loading of .413 on Factor 4, which is above than acceptable highest cross-loading suggested by Samuels (2017). The final four-factor structure in this study is composed of 19 items after deleting one item that cross-loaded on multiple factors. As shown in Table 5, six items for Factor 1 represent technical competencies, five items for Factor 2 represent social competencies with instructor, four items for Factor 3 represent social competencies with classmates, and four items for Factor 4 represent communication competencies.

Finally, this 19-item structure explained 69.355% of the variance in the pattern of relationships among the items. The percentages explained by each factor were 42.394% (technical competencies), 11.922% (social competencies with instructor), 8.241% (social competencies with classmates), and 6.798% (communication competencies).

Table 5.
Descriptive statistics of each item and four-factor structure of the Mon-SOLR instrument after factor reduction procedures

	Descriptive statistics		Factor			
	M	**SD**	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**
TC1	3.9877	.87239	.737			
TC2	3.6450	1.01694	.765			
TC3	3.9563	.95487	.766			
TC4	3.7032	.95078	.775			
TC5	3.9362	.84662	.776			
TC6	3.3371	1.13916	.595			
SCI1	3.5398	1.19502		.825		
SCI2	3.3807	1.16206		.744		
SCI3	3.5263	1.14559		.820		
SCI4	3.1310	1.29922		.708		
SCI5	3.7805	1.08546		.728		
SCC1	2.7480	1.32258			.824	
SCC2	2.9328	1.26702			.794	
SCC3	3.2777	1.18053			.752	
SCC4	3.0347	1.28806			.809	
SCC5	3.7604	1.12986			.521	.413
CC1	3.6573	1.09173				.797
CC2	3.9384	.88815				.737
CC3	3.5353	1.08399				.817
CC4	3.5465	.98947				.714

Reliability analysis

An item analysis was conducted to test the reliability of each competency and the reliability of the overall Mon-SOLR instrument. All four competencies in this instrument had good reliabilities. Cronbach's alpha coefficient for technical competencies was .862, social competencies with instructor was .896, social competencies with classmates was .904, and communication competencies was .846. Cronbach's alpha for the instrument overall was .923.

Confirmatory factor analysis

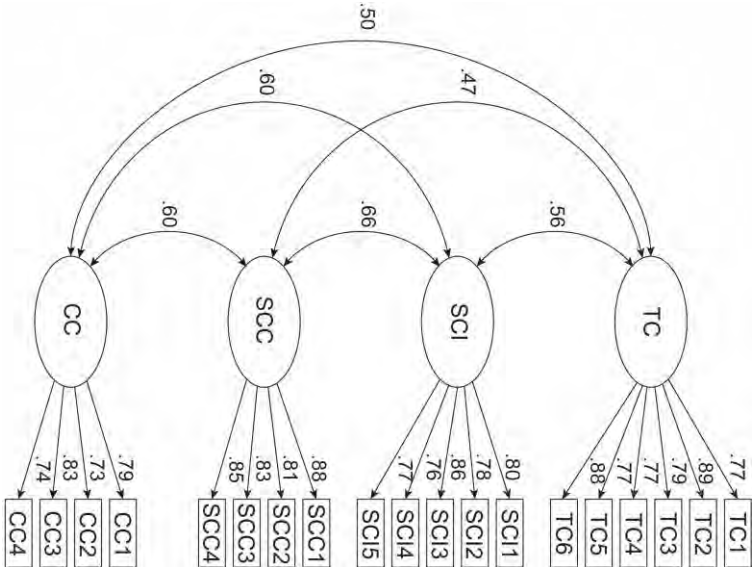
The CFA was conducted on the second sample (N = 893) using AMOS 26 to test the four-factor Mon-SOLR instrument produced by the EFA. A summary of CFA model fits of the Mon-SOLR instrument is presented in Table 6 that indicates that the original model fit six criteria and therefore was an acceptable model. Therefore, an additional covariance path between the error terms of items SCI1 and SCI2 that had the potential to improve the model fit was suggested by the modification index, and a minor improvement was observed after the error terms of items had been correlated (Table 5). Similarly, the modification index suggested another covariance path between the error terms of items SCC1 and SCC3, which are included under the same factor. The final model was run after these error terms of items were correlated. According to the final model, all models fit all criteria and had an acceptable model fit (Table 6).

Table 6.
Summary of CFA model of the Mon-SOLR instrument

	p	^{2} / *df*	RMSEA	TLI	CFI	IFI	NFI	GFI	AGFI
Acceptable value		2–5	< .08	> .9	> .9	> .9	> .9	>.9	>.9
Original model	.00	5.172	.068	.932	.942	.942	.929	.916	.890
Adjusted model	.00	4.830	.066	.937	.947	.947	.934	.921	.897
Final model	.00	4.417	.062	.944	.953	.953	.940	.928	.905

The CFA was verified as an excellent fit for the data (^{2} = 636.098, *df* = 144, *p* = .00, RMSEA = .062, TLI = .944, CFI = .953, IFI = .953, NFI = .940, GFI = .928, AGFI = .905). When the results related to the CFA given in Figure 2 were examined, the factor loadings of the items ranged from 0.71 to 0.86, which satisfies the common cut-off value suggested by Hair et al. (2010). Finally, the results of the CFA confirmed that the model fits between the proposed model and the observed data.

Figure 2.
Mon-SOLR instrument CFA results



Discussion

The objective of the present study was to test the reliability and validity of the SOLR instrument in the Mongolian version of an online learning setting. Cronbach's alpha was used to verify that the reliabilities of the SOLR instrument in Mongolian were good as a result of item analysis for the items associated with each of the four competencies. Also, this study proved the validity of the SOLR instrument in the Mongolian language version with a four-factor structure consisting of technical competencies, social competencies with an instructor, social competencies with classmates, and communication competencies.

Results of descriptive statistics analysis хувьд indicated that students had a high level of technical competencies, communication competencies, social competencies with the instructor, and a relatively low level of social competencies with classmates. The findings are consistent with the results of a previous study (Yu, 2015).

Furthermore, there is no gender difference in SOLR, since the independent-sample t-test result indicated there was no statistically significant difference between male and female students. However, future studies need to investigate the gender difference in online learning readiness. Moreover, the results of ANOVA test between the mean scores in grade levels and schools indicated that there were statistically significant differences respectively. According to a study which was carried out by NUM (2021), students' GPAs vary by grade level and school. As such, it can be implied that there might be a positive correlation between SOLR and GPA.

Cross-loading of the item SCC5 ("Socially interact with other students with respect") with Factor 3 and Factor 4 can be explained by Mongolian traditional and local knowledge. Notably, Urantsetseg (2013) pointed out that interacting with others with respect is associated with the characteristics of a group of students. Moreover, Erdene-Ochir (1998) stated that respecting one's peers is an essential social skill according to Mongolian tradition.

The results of the analysis in our study produced a Mongolian language version of the Mon-SOLR instrument with 19 items: six items for technical competencies, five for social competencies with an instructor, four for social competencies with classmates, and four for communication competencies. The reliabilities of all four competencies were good (Cronbach's alpha coefficients: overall, .923; technical competencies, .862; social competencies with the instructor, .896; social competencies with classmates, .904; and communication competencies = .846).

The results of our research had similar high ratings on three of the subscales in the Mon-SOLR instrument but had low ratings on the social competencies with classmates. This is similar to the results of the Yu (2018) study. Therefore, teachers and administrators in higher education should pay more attention to social competencies with classmates in students' online learning readiness.

Perhaps cultural or environmental differences between Mongolia and the U.S. explain this discrepancy. For instance, the type of delivery method for online courses involved various platforms at the National University of Mongolia in Mongolia, whereas the major type of delivery method for online courses was LMS in the U.S. study. Another reason for this discrepancy may be COVID-19. For instance, the study of the SOLR instrument was conducted in the U.S. before the COVID-19 pandemic, while online courses and surveys of SOLR instruments were conducted in Mongolia during the COVID-19 pandemic. The study explored the SOLR of students enrolled in one of the public sector universities in Mongolia; therefore, its results may not be generalized to

the students at other universities.

For future research, we recommend a study of the effect of students' previous online learning experiences on the results of the Mon-SOLR instrument. Another recommendation is to compare the differences between students' perceived competencies and their academic achievement. A final suggestion is to examine the effect of students' place of residence (e.g., rural, city centre, or capital) or gender on the results of the Mon-SOLR instrument.

Conclusion

The present study confirms the four-dimensional structure of the Mon-SOLR instrument. The Mongolian version of the 19-item Mon-SOLR instrument is a valid and reliable instrument to assess the online readiness status among students in Mongolia.

The Mongolian version of the 19-item Mon-SOLR instrument could be used as a tool to measure student readiness in online learning at the university level. Yu (2018) concluded that administrators or institutions could use the SOLR instrument to build a detailed profile of their students' online learning readiness and to create support structures for the success of their students in online courses. Hence, university students in Mongolia can assess online learning readiness using the 19-item Mon-SOLR instrument. This study used the data as a whole to examine the reliability and validity of the SOLR instrument in Mongolia.

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