

Development and Validation of Online Learning Adaptation Scale for College Students

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Keywords: Learning adaptation, online learning, scale

Abstract: In the post-pandemic era, the paradigm shift towards digitalization has brought about a transformation in the online learning landscape, from an individualized approach to a more standardized and largely disseminated format, thereby enhancing its accessibility to the masses. This shift has had a significant impact on learners, influencing their learning attitudes, motivations, and outcomes. In this regard, learners' adaptation levels to online learning can essentially determine the efficacy of the teaching-learning process. Therefore, this paper delves into the development and validation of a comprehensive online learning adaptation scale for college students, primarily in response to this paradigm shift. The scale's confection was carried out through a hybrid approach that involved bibliographic research and questionnaire surveys, and the data were further processed using item analysis and factor analysis techniques, validated by reliability and validity testing. Ultimately, the resultant online adaptation scale for college students comprised four unique dimensions, namely, learning attitudes, motivation, ability, and methods, reinforced by a total of 24 items. The results demonstrated the scale's excellent reliability and validity, making it a potent tool for measuring college students' online learning adaptation levels, especially in response to the post-pandemic situation.

1. Introduction

Online learning is a new teaching approach that emerged against the backdrop of information technology development. It refers to the use of the internet as a medium for delivering knowledge to learners. Online learning is an inevitable trend in the evolution of distance education, following correspondence education, radio and television education, and computer network education [1]. Especially in the current environment of the pandemic, the Ministry of Education has issued a mandate to "suspend classes but not learning". As a result, online learning has shifted from individualized to a more standardized and widely adopted format. The teaching methods for online learning have also become more mature [2].

However, for learners, this shift in teaching mode has resulted in significant changes in the learning environment, learning practices, and more. These changes can have noteworthy impacts on a learner's learning planning, motivation, and attitude, eventually affecting the overall learning outcomes. The ability of learners to maintain effective learning outcomes during this transition largely depends on their adaptation. Therefore, the primary focus of this paper is on developing and validating an adaptation scale for college students concerning online learning, in response to the above-stated

changes.

2. Literature Review

The concept of learning adaptation has been a significant area of inquiry in educational research in China. The notion was first explicitly introduced by scholars at East China Normal University, led by Zhou Bucheng et al., in their work *The Test for Learning Adaptation*. They defined learning adaptation as an individual's ability to overcome obstacles, enabling them to achieve optimal learning outcomes. Building on this definition, Tian Lan elaborated on the concept, proposing that it refers to the capacity of students to actively adjust, both physically and mentally, to changes in learning conditions, including attitudes, environments, and methods, in order to achieve a favorable development state of internal and external learning environment balance [3].

Initially, research on learning adaptation in China was mainly focused on primary and secondary school students. Since this population is in a critical stage of physical and mental development, their adaptation is still evolving, and this capacity has significant effects on their other characteristics. Gradually, scholars realized that the college years represent another important point in a person's life, marking the transition from youth to adulthood [4]. Scholars started investigating the learning adaptation of college students in the 1980s, including developing measurement tools. For example, the Minnesota Multiphasic Personality Inventory-2 College Maladjustment Scale (MMPI-2 CMS) was designed to measure college maladjustment (MMPI-2 CMS, 1989) [5] and The Student Adaptation to College Questionnaire (SACQ) [6]. Additionally, the Student Adaptation to College Questionnaire (SACQ), developed by Baker and Siryk [7], evaluated college students' adaptation from multiple angles, including learning, social, and emotional adaptation.

Since the start of the 21st century, research on the learning adaptation of college students in China has increasingly emerged. The Education Ministry's College Student Psychological Health Evaluation System research group developed the China College Student Adjustment Scale (CCSAS), a three-year project that collected data from 55,106 college students from 182 universities via multi-stage sampling, interviews, and pilot tests. This scale demonstrates excellent reliability and validity, meeting established psychological standards, and is applicable to all associate, undergraduate, and graduate students in China, effectively mitigating any cultural adaptation issues encountered by using foreign scales. To further probe the issue, Sun Chunhui, Zheng Richang, and others tested the Learning Adaptation Scale (LAS) devised by Taiwanese scholar Chen Yinghao in 1991 using confirmatory factor analysis, revealing good overall model fit, but weak internal structure [8]. Feng Tingyong and Li Hong conducted a survey on the main factors affecting contemporary college students' learning adaptation and developed the College Student Adaptation Scale (CSAS), a five-dimensional scale from learning motivation, teaching mode, learning ability, learning attitude, and environmental factors [9-10].

The aforementioned scholars have mainly considered students' adaptation to learning at different stages of their academic career. However, the outbreak of the COVID-19 pandemic in 2020 caused significant changes in the learning mode of students at all levels in China. Most regions in China have shifted from traditional face-to-face instruction to a blended teaching approach that combines both online and offline instruction. Additionally, online learning in the post-pandemic era has taken on a critical role, distinctively different from the past. In response, Chinese scholars have conducted related research. For instance, Wan Kun, Zheng Xudong, and Ren Youqun used a questionnaire survey to investigate the status quo of online learning among 3,148 students across the country during and after the pandemic. Other studies have shown that learning motivation is the most significant influence on college students' online learning. Stimulating and maintaining learning motivation is an essential approach to improve college students' engagement in online learning.

Indeed, the current college student adaptation scale in China focuses only on whether students adapt to the learning mode from high school to university. However, in the post-pandemic era, the transition from offline to online learning is also a factor that college students need to adapt to, and it affects their learning outcomes significantly. Although foreign universities have developed online learning adaptation -related scales, the different response strategies between China and other countries to the pandemic mean that foreign scales are not suitable for measuring online learning adaptation problems among Chinese college students in the post-pandemic era. Therefore, developing a set of online learning adaptation scales suitable for Chinese college students in the post-pandemic era is of great theoretical and practical significance for China's current education situation.

3. Methodology

3.1. Preparation of a Formal Scale

3.1.1. Preparation of the Initial Scale

The development of this scale was primarily informed by the College Student Adaptation Scale developed by scholars such as Feng Tingyong and Li Hong, the Study Adaptation Scale developed by Taiwanese scholars Chen Yinghao, Lin Zhengwen, and Li Kunchong, as well as factors affecting online learning identified by Wan Kun, Zheng Xudong, and Ren Youqun. Drawing upon these diverse sources of scholarship, as well as surveys conducted in relation to the current Chinese education context, the resulting scale comprises five dimensions and 30 associated questions.

3.1.2. Preparation of a Formal Scale

Based on the received suggestions, the initial scale has been adjusted and optimized, resulting in the final formal scale that comprises five dimensions: learning motivation, learning methods, learning ability, learning attitudes, and environmental factors, with 30 corresponding questions. The scale adopts a Likert 5-point scoring method, in which a score of 5 represents "Strongly Agree", 4 represents "Agree", 3 represents "Neutral", 2 represents "Disagree", and 1 represents "Strongly Disagree".

3.2. Participants

The participants in this study were all undergraduate students from Chinese colleges. A total of 153 questionnaires were collected, and after screening, 142 valid questionnaires were retained for analysis.

3.3. Design of Background Variables

This study measured online adaptation of college students through background variables, which include demographic variables such as gender and grade level, social variables such as major and home location, and individual variables such as duration of internet use, duration of online learning, average time spent on online learning per day, and academic performance. This study will analyze whether different variables have a significant impact on online adaptation under various backgrounds.

3.4. Statistical Treatment

All data were input and processed by SPSS 10.0.

4. Results and Analysis

4.1. Item Analysis

In the process of data preprocessing, reverse-scored items were first re-coded, followed by the calculation of the total score for each participant across the 30 items. Subsequently, the summed data were grouped based on a certain ratio, using the extreme-group method of grouping the top 27% as the high-scoring group and the bottom 27% as the low-scoring group.

The criteria used for item deletion in this project were based on the suggestions for item analysis by Wu Minglong (2009), which include six criteria for reference: the critical value for comparing extreme groups, correlation between individual items and total score, correlation between corrected items and total score, α value after deletion of homogeneous items, item commonality, and factor loading.

The analysis results showed that items 1, 9, 19, 23, 24, and 25 had unsatisfactory statistical values on more than four of the above indicators, and were thus deleted. After comprehensive evaluation, it was decided to retain 24 items in the scale.

4.2. Factor Analysis

To determine the scale structure, exploratory factor analysis was conducted. The results showed that the data passed the Bartlett's test of sphericity (approximate chi-square value of 1027.000, $p < .001$) and had a KMO value of 0.706, indicating that the data was suitable for factor analysis.

The factor analysis was conducted using principal component analysis, and factor rotation was performed using the maximum variance method. Four factors were extracted, and they accounted for 72.437% of the cumulative explained variance.

According to the meaning of the items included in each factor, items 8, 30, 12, 22, and 2 (five items) were grouped into the first dimension, named "Learning attitude"; items 3, 26, 27, 5, and 6 (five items) were grouped into the second dimension, named "Learning motivation"; items 10, 13, 15, 21, 7, and 28 (six items) were grouped into the third dimension, named "Learning ability"; and items 11, 20, 17, 18, 29, 16, 4, and 14 (eight items) were grouped into the fourth dimension, named "Learning method".

The first dimension, "Learning attitude", included items such as: (12) "I have become lazy in my learning after taking online courses." and other four items.

The second dimension, "Learning motivation", included items such as: (5) "I feel like I have lost my learning goals after taking online courses." and other four items.

The third dimension, "Learning ability", included items such as: (10) "I can apply the knowledge I learned in online courses to solve practical problems." and other five items.

The fourth dimension, "Learning method", included items such as: (11) "I can make full use of online resources for learning." and other seven items.

4.3. Reliability Test

For the questionnaire reliability analysis, this study used internal consistency coefficients (homogeneity reliability, also known as Cronbach's α coefficient) as an indicator. The Cronbach's α coefficient for the total scale was 0.865, indicating that the scale had a good overall reliability. As shown in Table 1, the internal consistency coefficients of the four dimensions of the Online Learning Adaptation Scale for college students ranged from 0.714 to 0.765, all reaching an acceptable level, indicating a good reliability of the scale.

Table 1: Reliability coefficient of “college students’ online learning adaptation”.

Dimensions	Items	Alpha Cronbach’s alpha
Global scale	24	.865
1	5	.765
2	5	.751
3	6	.714
4	8	.729

4.4. Validity Test

This study used the method of construct validity testing, which refers to the degree of correspondence between the measurement results and the structure reflected by the measurement items. Factor analysis was used to analyze the construct validity. Through exploratory factor analysis in section 4.2, it was found that the loadings of the items contained in each dimension of the Online Learning Adaptation Scale for college students ranged from 0.457 to 0.850, and the total variance explained (contribution rate of factors) reached 72.437%, which exceeded 70%. Therefore, it was concluded that the scale had a good construct validity.

4.5. Measurement of Online Learning Adaptation based on Background Variables

The adaptation of learning reflects the subjective judgment of learners, and the adaptation of learning of populations with different characteristics may differ. By measuring the above-mentioned scale for specific populations, differences in learning adaptation among college students in online learning can be explored. This study selected demographic variables, individual characteristics, and social characteristics to measure college students. The selected demographic variables included gender and age (grade level), and the selected social characteristics included major and home location. The selected individual characteristics included the duration of internet use, duration of online learning, average time spent on online learning per day, and academic performance.

4.5.1. Analysis of Demographic Characteristics Variables

Demographic variables include gender and grade level.

Independent sample T test was used to analyze the characteristics of gender variable, and the analysis results are shown in Table 2.

Regarding the learning attitude variable, the mean of males ($M=14.000$, $SD=12.239$) was higher than that of females ($M=12.239$, $SD=3.085$); Regarding the learning motivation variable, the mean of females ($M=16.696$, $SD=3.520$) was higher than that of males ($M=15.582$, $SD=3.447$); Regarding the learning ability variable, the mean of females ($M=20.739$, $SD=3.362$) was higher than that of males ($M=19.941$, $SD=3.399$); and regarding the learning method variable, the mean of females ($M=28.217$, $SD=4.136$) was higher than that of males ($M=26.294$, $SD=4.971$).

The t-statistics of the student gender variable in the dimensions of learning attitude, learning motivation, learning ability, and learning method did not reach a significant level, indicating that students of different genders did not have significant differences in each dimension.

A variance analysis was used to analyze the grade variable. The results showed that the grade variable had no significant differences on the overall online learning adaptation, and there were no significant differences in each dimension.

Table 2: Gender variable analysis of online learning adaptation dimension.

Testing variables	Gender	Number	Mean	Standard deviation	t value	Significance
Learning attitude	Male	17	14.000	4.518	1.764	.046
	Female	46	12.239	3.085		
Learning motivation	Male	17	15.582	3.447	-1.125	.842
	Female	46	16.696	3.520		
Learning ability	Male	17	19.941	3.399	-.834	.286
	Female	46	20.739	3.362		
Learning method	Male	17	26.294	4.971	-1.550	.458
	Female	46	28.217	4.136		

4.5.2. Analysis of Individual Characteristic Variable

The individual characteristic variables include duration of internet use, duration of online learning, average time spent on online learning per day, and academic performance. The duration of internet use was categorized into four levels: 0-4 years, 4-7 years, 7-10 years, and over 10 years. The duration of online learning was categorized into four levels: 0-1 year, 1-2 years, 2-3 years, and over 3 years. The average time spent on online learning per day was categorized into four levels: 0-1 hour, 1-3 hours, 3-5 hours, and over 5 hours. Academic performance was categorized into five levels: excellent, above-average, average, below-average, and poor.

A one-way ANOVA was conducted on the various dimensions of online learning adaptation, and it was found that the four individual characteristic variables had no significant differences in the overall online learning adaptation and in each dimension.

4.5.3. Analysis of Social Characteristic Variables

The social characteristic variables include major and home location. Major is divided into science and technology and liberal arts. Home location is divided into urban, county, and rural areas. A one-way ANOVA was conducted on the various dimensions of online learning adaptation, and it was found that these two social characteristic variables had no significant differences in the overall online learning adaptation and in each dimension.

In summary, the various individual, demographic, and social variables studied in relation to online learning adaptation suggest that there are no significant differences in online learning adaptation based on these variables.

5. Discussion

Compared to existing scales measuring adaptation of college students, this scale demonstrates two notable features relevant for the contemporary context: (1) The recommended scale was developed in response to the current pandemic, and the included items have been modified in accordance with the present-day circumstances. (2) Several extant scales focusing on adaptation primarily consider temporal dimensions, such as assessing whether a learner can adjust to academic transitions from middle to high school or high school to college. In contrast, this scale attends to adaptation from a spatial perspective, aiming to gauge learners' proficiency in adapting to the change from offline to online learning.

6. Conclusions

This study focused on item analysis and factor analysis to develop the Online Learning Adaptation

Scale for College Students in China, which encompasses four dimensions - learning attitude, learning motivation, learning ability, and learning method - composed of 24 items. The results of analysis on the collected data from college students confirm that the developed scale has good reliability and validity, and can effectively reflect the level of college students' adaptation to online learning in the post-pandemic era.

References

- [1] Zhong Zhixian & Yang Lei. (2002). *On Online Learning*. *Modern Distance Education*, 2002 (01), 30-34. <https://bitly.com> doi:10.15881/j.cnki.cn33-1304/g4. 2020. 03. 011.
- [2] Wan Kun, Zheng Xudong, and Ren Youqun. (2020). *Is Massive Online Learning Ready? — Reflections on Online Learning and Smart Technology Applications in the Post-Pandemic Era*. *Distance Education Journal*, (03), 105-112. doi:10.15881/j.cnki.cn33-1304/g4. 2020.03.011.
- [3] Tian Lan. (2004). *A Summary of Researches on Child and Teenager's Learning Adaptation in China*. *Journal of Psychological Science*, (02), 502-504. doi:10.16719/j.cnki.1671-6981.2004.02.077.
- [4] Fang Xiaoyi, Wo Jianzhong, and Lin Xiuyun. *The Project Group of College Students' Psychological Health Assessment System under the Ministry of Education*, (2005). *Compilation of the Chinese College Students' Adaptation Scale*. *Studies of Psychology and Behavior*, (02), 95-101. <https://bitly.com>
- [5] Bradley M. Merker and Janet V. Smith. (2001). *Validity of the MMPI-2 College Maladjustment Scale*. *Journal of College Counseling*, 2001, 4 (1):3-7. <https://bitly.com>
- [6] Gerdes H, Mallinckrodt B. *Emotional, social, and academic adjustment of college students: A longitudinal study of retention*. *Journal of Counseling and Development*, 1994, 72 (3): 281 ~ 284
- [7] Baker R W & Siryk B. (2004). *Measurement adjustment to college*. *Journal of Counseling Psychology*, 31: 179 ~ 189. <https://bitly.com>
- [8] Sun Chunhui and Zheng Richang. (2001). *Confirmatory Factor Analysis of Study Adaptation Scale*. *Psychology Exploration*, (02), 59-64. <https://bitly.com>
- [9] Feng Tingyong and Li Hong. (2002). *Primary Research about Study Adaptation of Undergraduate*. *Psychology Exploration*, (01), 44-48.
- [10] Feng Tingyong, Su Ti, Hu Xingwang, and Li Hong. (2006). *the Development of A Test about Learning Adjustment of Undergraduate*. *Acta Psychologica Sinica*, (05), 762-769. <https://bitly.com>