

Development of the Learning Outcome Assessment Self-Report Scale for Undergraduates in China

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Keywords: Academic competence, learning outcomes, SEM, Confirmatory factor analysis

Abstract: Learner-centered assessment of learning outcomes is crucial for ensuring the quality of talent cultivation in higher education. This paper constructed an academic competence self-report scale with 41 items across 7 dimensions by referencing the relevant rubrics of VALUE and the ACES-college's related items. Tests showed that the scale has good reliability and validity, and it can be used to articulate the learning outcomes of Chinese undergraduates in general education.

1. Introduction

In 2019, the total number of students in higher education in China reached 40.02 million, with a gross enrollment rate of 51.6%, indicating the popularization of higher education. By 2021, the gross enrollment rate had increased to 57.6%, which was 0.6 percentage points higher than the average level of OECD countries in 2019 [1]. Scott argues that improving the quality of talent training is a top priority for all stakeholders after the popularization of higher education, as it is a key issue that affects the development of higher education itself [2].

The Quality Assessment of Undergraduate Education (QAUE), a major quasi-governmental organization in China, focuses exclusively on undergraduate education. Newly established colleges and universities are required to participate in a qualification evaluation organized by QAUE. Students' learning outcomes, one of the seven aspects of evaluation that represent teaching quality, are inspected according to explicit standards set by the Ministry of Education (MOE). Colleges and universities that pass the qualification evaluation must participate in a 5-year rolling review conducted by QAUE or any other qualified third-party assessment entities.

The Ministry of Education (MOE) releases The Quality of Teaching Undergraduate in Common Colleges and Universities report every year, utilizing massive data mining, multidimensional case analysis, and large-scale questionnaire survey methods combined with the national data platform for higher education quality monitoring and the annual report of undergraduate teaching quality from more than 1,000 colleges and universities across the country. However, these reports provide limited information on students' personal cognitive and non-cognitive competencies [3]. Additionally, most colleges and universities in China assess undergraduate learning outcomes through summative evaluations, which do not facilitate the improvement of teaching and learning

due to the absence of bidirectional feedback between teachers and students. So, there is an urgent need to establish a learner-centered learning outcome evaluation model in China. In addition, it is important to develop learning outcome assessment tools that are suitable for this model. With this in mind, this paper aims to construct a student self-report scale that can assess Chinese undergraduates' learning outcomes from the perspective of academic competence, with reference to the VALUE rubrics [4], and the ACES-college [5].

In recent years, a few Chinese researchers have assessed the learning outcomes of college students. Zhu et al. developed a questionnaire with only two subscales: "knowledge and skills" and "communication and cooperation" [6], Shen et al. evaluated only critical thinking ability as a learning outcome [7], Wei et al. evaluated learning outcomes from five aspects: subject knowledge, practical ability, humanistic heritage, international vision, and innovative consciousness [8], and Guo et al. evaluated learning outcomes in terms of ability, emotional cognition, and course grades [9]. Chang et al. used the original ACES-college scale to assess learning outcomes without any adjustments in their study [10]. Compared with the studies mentioned above, the scale we build will be able to measure a construct that is more consistent with the connotation and denotation of the concept of academic competence, which has been widely accepted by international academia. Therefore, this uniformity is likely to result in more applicability for learning outcome assessment practice in China.

2. Compilation and Adjustment of Questionnaire Items

2.1. Development of the Pre-test Questionnaire

The VALUE rubrics articulate 15 fundamental criteria of learning outcomes with performance descriptors demonstrating progressively more sophisticated levels of attainment. The learning outcomes of written communication and reading are both summarized into five aspects, and the breakdown of each aspect is classified from benchmarks to milestones to capstone. This paper compiled 10 questionnaire items with reference to the capstone criteria of written and reading rubrics created in the VALUE project. In a similar way, we constructed a critical thinking subscale, which has nine items. However, there is no single VALUE rubric that articulates the same competence as the Mathematics/Science Skill questionnaire items in ACES-college measures. It involves the rubrics of Quantitative Analysis Ability, Problem Solving, and Inquiry & Analysis together to cover the construct that the Mathematics/Science Skill subscale in ACES-college gauges. The paper developed a Quantification and Scientific Skill subscale with eight items by selecting and using the capstone criteria in the aforementioned three VALUE rubrics that could measure similar aspects of competencies to the Mathematics/Science Skill questionnaire subscale in ACES-college.

Therefore, this paper constructs 27 items to measure academic skills. Each item is rated by a 5-point scale ranging from far below, below, at grade level, above to far above, requiring criterion-referenced ratings based on students' perception of grade-level expectations at their institution. And we borrow 32 items from ACES-college to assess academic enablers, using a 5-point frequency rating system ranging from never, seldom, sometimes, often to almost always, to detect how often the undergraduates exhibit a specific enabling behavior. So, altogether there are 59 positively worded items in our questionnaire, which means the higher the score, the greater the undergraduates' academic competence.

2.2. Generate the Formal Questionnaire

399 junior and senior college students were recruited in fall 2019 to complete a pre-test questionnaire. Junior and senior students were recruited because they had completed their general

education according to the undergraduate training mechanisms in most universities and colleges in China. After data cleaning, questionnaires with unanswered items were excluded, and data from 371 valid questionnaires were collected.

SPSS 20.0 was used to conduct the item analysis. A critical ratio test was performed using the top 27% and the bottom 27% of the sample. All *t* statistics were significantly greater than 2, indicating that the questionnaire has a good level of discrimination. Cronbach's α coefficients for the total scale and each subscale are 0.948, 0.827, 0.856, 0.866, 0.756, 0.825, 0.852, and 0.789, respectively, indicating good internal consistency. The item-total correlation coefficient and corrected item-total correlation coefficient for all items are above 0.4, except for items 29, 53, 54, and 59, which are considered for deletion.

The remaining 55 items were further analyzed by exploratory factor analysis method, in order to delete items inconsistent with the construct that each subscale meant to articulate and to explore and optimize the internal structure of the scale. Four criteria were considered while determining the retainability of each item: items that have more similarities with other items from the same subscale have a better chance of remaining in one factor, item loading must be greater than 0.4, dual-loading items will be assigned to the factor that is consistent with the content of the item, and each of the 7 subscales should have at least 4 items.

Finally, item 1, 6, 9, 11, 12, 14, 29, 39, 40, 42, 44, 49, 51, 52, 53, 54, 57 and 59, a total of 18 items were removed from the questionnaire and 41 items were retained, yielding 7 factors that match up 7 sub-constructs of academic competence. The rotated solution accounted for 57% of the total scale variance, the value of Kaiser-Meyer-Olkin Measure of sampling adequacy is 0.875, and factor loading of each item variable range from 0.483 to 0.771, and the overall Cronbach's α is still as high as 0.934. So far, a formal questionnaire has been completed.

3. Reliability and Validity of the Formal Questionnaire

3.1. Sample Demographics

We recruited 402 third-year college students in three distinct time periods to complete the formal questionnaire, using the same survey strategy that we employed for the pre-test questionnaire survey. 390 valid questionnaires were submitted by the respondents at the end of the survey. Of the respondents, 202 were male and 188 were female, 33.9% were recruited in fall 2019, 31.8% were recruited in fall 2020, and 34.3% were recruited in fall 2021.

3.2. Confirmatory Factor Analysis

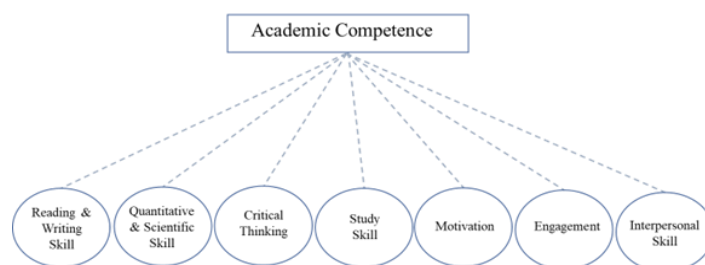


Figure 1: The one factor model of academic competence

The Cronbach's α coefficients of the total scale and its seven subscales, based on item-level data, ranged from 0.8 to 0.9, indicating good reliability of this self-report scale. Confirmatory factor analysis was then conducted using maximum likelihood method, as demonstrated in Figure 1, to assess the validity of the questionnaire.

The one-factor model had RMSEA and SRMR values of 0.072 and 0.084, respectively, and CFI and TLI values of 0.764 and 0.750, respectively, indicating an inadequate fit. Modifications were made based on the modification indices provided by Stata 16.0, but the CFI and TLI only showed slight improvement and did not meet the criteria for a good fit. Research has shown that high amounts of the item may cause inadequate fit and an unstable solution in structural equation modeling. However, this issue can be solved by using parceling techniques [11,12].

Therefore, 18 parcels were created, with the sum of 2 items whenever possible, and using 3 items only when necessary in each subscale. Parceled data were then used to run SEM using the maximum likelihood method. The SRMR improved to 0.072 while the RMSEA remained unchanged. Additionally, the CFI and TLI increased significantly to 0.918 and 0.900, respectively, demonstrating good validity of the questionnaire. Table 1 shows more detailed SEM parameter estimation results. From this, we can see that the path coefficient of each parceled item to its own dimension is between 0.47 and 0.75, and the path coefficient of each subscale to the total academic competence is between 0.55 and 0.84. This further proves that the questionnaire has good validity.

4. Conclusion and Discussion

Table 1: Structure equation model results

Concept	Sub scale	Item	Parcel	Path Coef. for parcel	Path Coef. for subscale	
Academic competence	Quantitative & Scientific Skill	QA7	NA1	0.7141	0.8872	
		QA8				
		QA4	NA2	0.8363		
		QA5				
		QC24				
		QA2	NA3	0.8232		
		QA3				
	QC25					
	Reading & Writing Skill	QB13 & QB15	QB13	NB4	0.7737	0.8695
			QB15			
			QB18			
		QB16	NB5	0.7094		
		QB17				
	Critical Thinking Skill	QC20 & QC22	QC20	NC6	0.8343	0.8612
			QC22			
			QC19			
		QC21				
		QC23	NC8	0.7894		
		QC26				
	QC27					
	Interpersonal Skill	QD30 & QD32	QD30	ND9	0.7564	0.5373
			QD32			
			QD33			
		QD28	ND10	0.7638		
		QD31				
	Engagement	QE37 & QE38	QE37	NE11	0.9269	0.6799
			QE38			
QE35		NE12	0.758			
QE36						
Motivation	QF46 & QF47	QF46	NF13	0.8044	0.6898	
		QF47				
		QF41				NF14
	QF48					
	QF43	NF15	0.7329			
	QF45					
Study Skill	QF50 & QG55	QF50	NG16	0.827	0.6251	
		QG55				
		QE34				NG17
	QG56					
	QB10	NG18	0.6408			
	QG58					

Based on VALUE rubrics and ACE-college, this paper constructed a self-report scale of academic competence that has 41 items divided into 7 subscales to articulate the learning outcomes of undergraduates in China. Empirical tests have shown that the scale has good reliability and validity and is certainly valuable for popularization and application. The authors believe that, in addition to external institutional and environmental regulations, the key to improving the quality of undergraduate training in higher education in China is for learners to have a full awareness of their own learning outcomes. This requires learners to have a certain ability for self-evaluation. The scale designed in this paper provides a useful tool that could foster the learning outcome self-evaluation ability of college students in China.

The use of this scale can create a new experience for Chinese undergraduates by recalling their learning processes and experiences to reflect on their deficiencies in learning while filling out the questionnaire. This can make their future learning more purposeful and efficient. Additionally, teachers can use this scale to identify students who have learning difficulties and improve their course design and teaching methods to address different concerns of students. Therefore, it can be said that the scale developed in this paper is a useful supplement to the current summative evaluation model in higher education that is dominated by standardized tests in China.

Acknowledgements

This work is supported by Anhui University of Finance and Economics' Teaching Research Project (acjydz2020004).

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