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Development and validation of a competence model for educational researcher in the Mongolian context

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ABSTRACT

In the 21st century, competences of educational researchers become increasingly complex and highly significant. Although various discussions and competencies have been for researchers in general, no frameworks have been devised specifically for educational researchers. This study aimed to establish a competence model for educational researcher (CMfER). The dimensions and items were created from a conceptual analysis of the literature, in-depth interviews, and focus interviews. Eight experts in the field of educational research evaluated the content validity. The reliability and validity of the CMfER were examined utilizing a sample of 240 Mongolian educational researchers. The 24-item four factor model was validated using confirmatory factor analysis (CFA), and the results showed adequate model fits. The factor loadings of the model were substantially significant, and Cronbach's alpha coefficient was well above the threshold value, suggesting that the items were internally consistent and reliable. Overall, the results shown that the CMfER can be used as a reliable and valid data collection tool in future studies in which educational researchers' competences are examined.

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1. INTRODUCTION

Researchers must engage in professional development since they are part of specialized workforce. Efficient job performance requires a researcher to learn and utilize various generalized and discipline-centric skills that enable them to conduct, manage, and disseminate research in highly specialized areas [1]. Consequently, individual researchers and organizations at both the national and international levels have been emphasizing researcher development. Researcher development refers to the process of improving research-related knowledge, skills, and competences [2]. However, there has been a lack of consensus on what constitutes the primary construct of researcher development. The models and frameworks for researcher development are quite diverse, making the role of a researcher even more complicated. Despite this, researchers need to incorporate specific competences that enable them to grow in their career. Apart from academic knowledge and research skills, researchers need to update themselves regularly by learning new competences to thrive and flourish in their professional lives [3].

Different institutions have introduced different frameworks for researchers' competences using a variety of names. Some examples include the Vitae Researcher Development Framework [4], principles for researcher training [5], and a model of professional competences for researchers [3]. The Organization for

Economic Cooperation and Development (OECD) [6] presented a framework by combining transferrable skills listed by the European Science Foundation [7] with other frameworks. Some of the transferrable skills are communication, problem-solving, teamwork and networking, and business and management. While some of these skills can be acquired during coursework, some also require formal and consistent training. These skills can be categorized into six broad categories: i) Interpersonal skills (mentoring, teamwork, networking, supervising, and negotiating); ii) Organizational skills (career planning skills and time-management skills); iii) Research competencies (research management and leadership, grant application writing skills, knowledge of research methodologies beyond the subject, and integrity and research ethics); iv) Cognitive skills (problem-solving and creativity); v) Communication skills (public engagement, oral and written communication skills, presentation skills, application of academic knowledge for policymaking, and teaching skills); and vi) Enterprise skills (innovation, entrepreneurship, and knowledge transfer).

Willison, O'Regan and Kuhn [8] included six facets of research: embarkation and clarifying, finding and generating, evaluation and reflection, organization and management, analysis and synthesis, and communication and application. Ravikumar, Mohan, and Ram [9] suggested nine categories of units: selection of research topic, conducting literature review, writing research proposal, establishing an appropriate research methodology, managing research funds, conducting research, formulating research report, publishing research results, and adhering to research ethics. The conceptual model of researcher development [10] consisted of three main factors: attitudinal, behavioral, and intellectual development.

The development of social science researchers has also been the focus of some studies. Evans [11] highlighted 13 characteristics of social science researchers, while Wray and Wallace [12] mainly focused on the skills that require a researcher to be a holistic learner. Although these various discussions, frameworks, and competencies have been for researchers in general, no frameworks have been devised specifically for educational researchers.

An integral component of education research is the development of educational researchers, which ultimately results in higher performance and quality of research [13]. An educational researcher generates new ideas, knowledge, methods, products, systems, and processes while also managing various projects within the education sector [13]. Competences for an educational researcher in Mongolia include subject knowledge, research methodology, skills, foreign languages, international cooperation, and information and communications technology (ICT) knowledge [14]. The roles and responsibilities of an educational researcher increase with the increased use of research as a tool for policy formulation and management in the education sector [15]. In light of such diversified models and frameworks, competences of educational researchers become increasingly complex and highly significant. Based on the discussion thus far, the present study aims to design and validate a competence model for educational researchers (CMfER) in the Mongolian context.

2. THEORETICAL FRAMEWORK

Kang, Chung, and Nam [16] stated that competence research in the management and human resource development field is approached using two different terms: 'competency' for an individual's behavioral approach and 'competence' for a task-related functional approach. However, another researchers [17] recommended using the term "competence" in human resource development to encapsulate both the behavioral and functional perspectives. Therefore, the present study also employs the term "competence".

According to Roe [18], an individual can develop competences by acquiring knowledge (e.g., cognitive theory, performance theory, job design theory, personality theory, and career theory), skills (e.g., observation skills, communication skills, oral and written skills, collaboration skills, and problem-solving skills), and attitudes (e.g., integrity, involvement, openness to criticism, and customer orientation). Based on Roe's discussion, Wilcox [19] defined competence as a combination of attitudes, knowledge, and skills gained through primary academic education and professional training and later refined through professional practice. The most cited model [17] in research about human resource development has two dimensions: occupational and personal. These dimensions are further divided into four competences: cognitive competence (CC), functional competence (FC), meta-competence (MC), and social competence (SC). This model is considered a holistic competence model (HCM) because both CC and FC (occupational dimensions) relate to the functional and task-oriented approach while MC and SC (personal dimensions) correspond to the behavioral approach that is person oriented. The current study adopts HCM [16], which was based on Le Deist and Winterton [17] as shown in Table 1.

In HCM, CC refers to acquiring knowledge related to work and its practical application. FC refers to the ability to carry out work-related tasks efficiently, while SC refers to communication skills and capabilities. In contrast, MC relates to attitude and values in personal and professional life. Table 1 depicts the HCM with its dimensions and competences.

Table 1. Educational researcher's competences adopted from holistic competence model

	Dimension	Competence	Characteristics
Holistic competence	Occupational dimension	Cognitive competence	Work-related knowledge and the ability to apply it efficiently
		Functional competence	Ability to carry out work-related tasks efficiently
	Personal dimension	Meta-competence	Personal and professional values and attitudes
		Social competence	Relational and communication skills and abilities

The competences in HCM (Table 1) required by educational researchers can be described by and are consistent with existing literature and frameworks related to researchers. Notably, the Vitae [4] framework comprises four domains, each domain reflective of the competences in Table 1. The first domain is the knowledge and intellectual abilities needed to conduct research, which can be characterized as CC. This is then further categorized into three competences: i) Knowledge base (knowledge about subject, theoretical knowledge, practical application of research methods, languages, literacy, and numeracy); ii) Cognitive abilities (analysis, critical thinking, synthesis, evaluation, and problem-solving); and iii) Creativity (inquisitive mind, logical argument, intellectual insight, and innovation), which is a prominent skill in rapidly changing and unpredictable society [20].

FC under the Vitae [4] framework covers the domain of personal effectiveness as a researcher. This domain is further divided into: i) Personal traits (perseverance, enthusiasm, responsibility, self-confidence, integrity, and self-reflection); ii) Self-management (commitment and preparation for research, responsiveness to change, time management, and work-life balance); and iii) Career and professional development (professional growth, career management, networking, seeking opportunities, self-esteem, and reputation). MC under the Vitae [4] framework covers the domain of research governance and organization, which is further categorized into three competences: i) Professional conduct (ethics, respect, confidentiality, fulfillment of legal requirements, safety, co-authorship, and appropriate conduct); ii) Research management (project planning, research strategy, risk management, and delivery); and iii) Finance, funding, and resources (generation of income, financial management, infrastructure, and resources). Similarly, SC under Vitae [4] includes engagement, influence, and impact of research, which is further categorized into three competences: i) Working with others (teamwork, management, supervision, mentoring, leadership, collaboration, equality, and diversity); ii) Communication and dissemination (communication methods, media, and publications); and iii) Engagement and impact (teaching, public engagement, policy, society and culture, enterprise, and global citizenship).

Finally, FC under the OECD [6] framework includes research management and leadership, and MC includes research ethics and integrity. In contrast, SC includes oral and written communication skills, presentation skills, communication skills with a non-technical audience, teaching skills, and the ability to engage with the public in general. In summary, HCM was designed to be conceptually consistent with researchers' competency frameworks.

3. RESEARCH METHOD

Lucia and Lepsinger [21] put forward two approaches to develop a competence model within the context of human resource development. The first approach is a start-from-scratch approach that constitutes observation and conducting in-depth interviews. The second is the pre-populated literature approach that relies on widely accepted and justified models. Although the first approach is helpful in depicting the characteristics of a particular domain, it is also quite time consuming and demands abundant resources. The second approach allows one to use a validated model while consuming minimum time and resources; however, it might not fully capture the distinctiveness of a specific aspect. The present study began with an existing model followed by in-depth interviews; hence, a combination of both approaches has been employed. The CMfER was developed in three steps [22]. The first step was based on item generation by conducting interviews and administering open-ended questionnaires for researchers. The second step involved testing of the content validity of the new items by experts. The last step aimed to do a psychometric analysis of the model (construct validity and reliability).

3.1. Step 1: Item generation

3.1.1. Participants

An in-depth interview was conducted with 14 participants, including three leading researchers, four established researchers of the institute for educational research, four full professors, and three associate professors at a university. According to Corbin and Strauss [23], the strategies of grounded theory are constructed to generate a well-integrated collection of ideas or concepts which postulate a comprehensive theoretical description of certain phenomena under observation. In grounded theory, theoretical sampling is

crucial as it selects most proficient participants who are knowledgeable about the phenomenon under the study to develop emerging theory [24]. In grounded theory, the number of respondents can be expanded until the data gathering provides no new information [24]. Although grounded theory is based on purposive sampling [25], some studies revealed that sample size of previously conducted one hundred studies, which employed grounded theory approach, ranged from 5 to 114 [24]. Hence, the number of participants in this step can be considered as appropriate for the purpose of this step. Focus interviews were conducted twice at professional seminars of the Mongolian National Institute for Educational Research: 33 researchers in Group 1 and 35 in Group 2. Detailed information of the respondents to the focus group is presented in Table 2 and detail information about the respondent is displayed in Table 3. An expert panel was recruited to assess the validity of generated items. The expert panel consisted of three persons: one expert with an ScD degree, one expert with a PhD degree, and one expert with a master's degree.

Table 2. Information of respondents to the focus group

		Total	Group 1	Group 2
Age	Number (*N*)	68	33	35
	Range	27–69	29–56	27–69
	Mean	44.46	43.82	45.05
	SD	9.02	7.69	10.20
Years of professional experience	Range	4–41	4–31	5–41
	Mean	18.96	18.42	19.57
	SD	8.56	7.55	9.32

Table 3. Demographic of respondent

		N	%	N	%	N	%
Gender	Male	31	45.6	15	45.5	16	45.7
	Female	37	54.4	18	54.5	19	54.3
Years of professional experience (blended)	3–5	3	4.4	2	6.1	1	2.9
	6–10	13	19.1	6	18.2	7	20.0
	11–15	6	8.8	2	6.1	4	11.4
	16–20	16	23.5	8	24.2	8	22.9
	21–25	18	26.5	10	30.3	8	22.9
	Above 26	12	17.6	5	15.2	7	20.0
Levels for researchers	Leading	8	11.8	3	9.1	5	14.3
	Established	27	39.7	13	39.4	14	40.0
	Recognized	25	36.8	14	42.4	11	31.4
	First stage	7	10.3	3	9.1	4	11.4
Total		68	100	33	100	35	100

3.1.2. Measures

Based on the holistic model of four competences and the related literature, an in-depth interview outline was formed. The following questions were asked for each competence: i) Please talk about your understanding of the competence; ii) What do you think is the content for this competence?; iii) What do you think are the questions or items of assessment for this competence?; iv) What do you think are the exercises or problems of evaluation for this competence? We then administered a first focus interview that included questions 1 and 2 in the in-depth interview and a second focus interview that included questions 3 and 4 in the in-depth interview.

3.1.3. Procedure

Each of the 14 interviewees was invited by phone and email to schedule a face-to-face interview that lasted 90 minutes. The data were analyzed using qualitative analysis based on the grounded theory approach [26]. The researchers conducted the in-depth interviews. Focus interviews were carried out using open-ended questionnaires.

3.1.4. Data analysis

The open-ended questionnaire was analyzed and compiled as: i) Deleting inappropriate items: Ambiguous items were removed; ii) Categorizing: Representative phrases and words were extracted for the competence, and the response items were summarized; iii) Abstracting: Items were then further abstracted. We obtained 63 items through literature analyses, in-depth interviews, and focus interviews. After data analysis, the initial model with 33 items was finally formed. The cognitive competence included nine items, functional competence included nine items, meta-competence included nine items, and social competence included six items.

3.2. Step 2: Content validity

3.2.1. Participants

The researchers requested 18 experts' collaboration. The inclusion criteria were to have completed a PhD and to have more than 20 years of experience in educational research. There were eight experts responded, and these eight determined the content validity in this study. The experts were four professors at a university and four researchers at a research institute with four men experts (50%) and four women (50%). Their mean age was 52.75 (SD=10.08). They were in their professions a mean of 28.63 years (SD=9.16). According to Lawshe [27], content validity should be evaluated by minimum five experts. Hence, the number of experts in this step is sufficient as it is above the suggested value.

3.2.2. Measures

There were two quantitative approaches to content validity, content validity ratio (CVR) [27] and Aiken's validity coefficient (V) [28], used to analyze the 33 items obtained in the previous study. Each item was presented in Mongolian and English. Each item was presented in the form of an assessment sheet that contained a column of statements (with three options: essential, useful but not essential, and not useful) and four items (1=unusable, 2=can be used with many improvements, 3=can be used with little improvement, and 4=can be used without any changes). Additionally, there was a final open-format question to receive comments for improvements for the proposed model.

3.2.3. Procedure

To obtain validity evidence based on test content, the questionnaire was sent by e-mail to 18 experts. The experts were asked to send their feedback within two weeks and eight of the experts gave their feedback within in the preferable time. The responses were further used to determine content validity.

3.2.4. Data analysis

The statement and score for each item are used to analyze the validity of the contents quantitatively using the formula Lawshe's content validity ratio [27] (CVR; the data from essentiality where the essential items get one score) and Aiken's validity coefficient [28] (V; from the score of items). The formula for calculating the content validity based on the CVR and V indexes are as in (1), (2).

$$CVR = \frac{2\text{ne}}{\text{n}} - 1 \quad (1)$$

Where:
ne=Number of expert(s) stating that an item was essential
n=Total number of experts who gave the statement

$$V = \frac{\Sigma s}{[\text{n}(\text{c}-1)]} \quad (2)$$

s= r–lo
r= The value given by an expert
lo= Lowest validity score
c= Highest validity score
n= Number of experts who provided the score

The validity was calculated using the formula CVR and V indexes. The minimum CVR for each item considered acceptable was .75 for a one-tailed test at the 95% confidence level if eight respondents were used for the study [27]. The value of validity coefficient V [28] was found from the table for eight experts, with four rating's categories. These significant values were V=.75, p=.40 for eight raters. The CVR analysis determined that seven items were invalid (Items 10, 18, 20, 24, 27, 30, and 32) and the CVR index on these items was also below 0.74. on the analysis based on Aiken's formula, there were two other items that were determined to be invalid: Items 5 and 23. Therefore out of the 33 items, nine items were considered invalid, with the remaining 24 items being valid. Consequently, the proposed model contained four dimensions and 24 items. The first dimension (CC) had eight items, second (FC) had seven items, the third (MC) had five items, and the fourth (SC) had four items as presented in Table 4.

Table 4. Competence model for educational researcher (CMfER)

Competence	Item code	Item content
Cognitive competence (CC)	cc_1	Subject knowledge
	cc_2	Knowledge of research methodology
	cc_3	Language skills
	cc_4	Critical thinking
	cc_5	Creative thinking
	cc_6	Problem solving
	cc_7	Project management skills
	cc_8	Time management
Functional competence (FC)	fc_1	Publication in the scientific journals and proceedings
	fc_2	Discussion and presentation skills
	fc_3	Skills in using ICT
	fc_4	National and global citizenship
	fc_5	Knowledge based society and culture
	fc_6	Teaching skills
	fc_7	Financial knowledge
Meta-competence (MC)	mc_1	Self-confidence
	mc_2	Self-reflection
	mc_3	Professional responsibility
	mc_4	Adapting skills to change
	mc_5	Career management
Social competence (SC)	sc_1	Working with others
	sc_2	Team working
	sc_3	Mentoring
	sc_4	Leadership skills

3.3. Step 3: Psychometric analysis

3.3.1. Participants

The initial sample comprised 259 educational researchers. Participants who provided repetitive answers (answering five on all questions; n=8) or incomplete data in their responses (n=11) were excluded. The final sample consisted of 240 participants, and their demographic information is shown in Table 5. Comrey [29] suggested that the number of cases for factor analysis should be 200. Thus, the number of participants in this step can be considered as sufficient for further analysis.

Table 5. Demographic information for sample (N=240)

		Sample	Percentage (%)
Gender	Male	124	51.6
	Female	116	48.3
Workplace	University	125	52.1
	Research institute	74	30.8
	Government organization	32	13.3
	Non-government organization	9	3.8
Degree of education	ScD	18	7.5
	PhD	187	77.9
	Master's	35	14.6
Experience (year)	Above 36	34	14.2
	31–35	21	8.8
	26–30	30	12.5
	21–25	48	20.0
	16–20	50	20.8
	11–15	32	13.3
	6–10	19	7.9
	3–5	6	2.5
Work position	Head of organization (rector, director, vice)	16	6.7
	Head department	33	13.8
	Academic staff	91	37.8
	Researcher	70	29.2
	Specialist	16	6.7

3.3.2. Instrument

The instrument consisted of a questionnaire with two sections: A and B. Section A collected information about gender, workplace, degree of education, experience (in number of years), and work position. Section B consisted of 24 items, each rated on a 5-point Likert scale as displayed in Table 6. The participant item ratio was to 10:1, which equaled the recommended ratio of 10:1 for CFA [30]. Thus, the sample size was appropriate to generate meaningful statistical power.

Table 6. Questionnaire to identify educational researcher's competence

No.	Domain	How influential are the following statements to educational researcher's development? Content	NI	SI	N	I	VI
1	Subject knowledge	Content knowledge of related subject areas and disciplines in education.					
2	Knowledge of research methodology	Understanding of research methodologies and techniques, and theories.					
3	Language skills	Knowledge of mother language and foreign languages, appropriate for research and career development.					
4	Critical thinking	Ability to recognize arguments in alternative ways and formulate solutions.					
5	Problem-solving	Ability to solve multi-faceted problems related to training, and research and information.					
6	Innovation and creativity	Ability to implement novel technologies, innovations, and creative initiatives in researching.					
7	Self-confidence	To be confident of own ideas and skills in researching.					
8	Self-reflection	To be reflective of own strength and weaknesses.					
9	Professional responsibility	To align own planning with organizational and unit objectives, and act responsibly and ethically.					
10	Time management	To manage own time effectively to deliver projects on schedule.					
11	Adapting skills to change	To be open and responsive to changes and adapt the changes quickly.					
12	Career management	To manage own career progression.					
13	Co-authorship	To collaborate with others and seek advice and support from appropriate professionals.					
14	Project planning and delivery	To design and implement research project in effective ways.					
15	Financial management	Knowledge of research funding sources, grants and fellowships.					
16	Team working	To appreciate and share comments and ideas of other team members, and collaborate creatively.					
17	Mentoring	To support, advise, guide, and encourage less experienced peers in researching.					
18	Influence and leadership	To influence and lead others with purpose and confidence.					
19	Communication methods	Ability to communicate, discuss and share knowledge and practice with colleagues and other researchers.					
20	Communication media	To expand research networking and disseminate research outputs using various media and interactive technologies.					
21	Publication	To publish in appropriate journals.					
22	Teaching	Knowledge of various forms and techniques of teaching strategy.					
23	Societal and cultural knowledge	Knowledge of social and cultural impact on researching.					
24	Global citizenship education	To train, advise and supervise other researchers in international research issues.					

NI=Not influential; SI=Somewhat influential; N=Neutral; I=Influential; VI=Very influential

3.3.3. Data collection procedures

A sample technique was chosen using multi-stage sampling. First, the organizations where the educational researchers worked were identified as university, research, administrative, and non-government. Second, the questionnaire was sent by e-mail to 365 educational researchers working in these organizations. There were 259 participants submitted questionnaires (63 by paper and 196 by e-mail). Third, the questionnaire filled out by each participant was coded. One numerical code was assigned to each participant.

3.3.4. Data analysis

Data analysis was organized into four phases: item analysis, confirmatory factor analysis (CFA), internal consistency reliability, and correlation analysis. Using SPSS 25.0 software, item analysis, correlation analysis, and internal consistency reliability were performed, and IBM SPSS Amos 25.0 software was used for CFA. In the first phase, descriptive statistics and correlation analyses between each item and dimension, and between each item and total score were conducted. In the second phase, we used CFA to verify the construct's underlying competences and, ultimately, obtain information about the model fit to the data. In the third phase, to evaluate the reliability of the model, the degree of internal consistency was calculated for the total scale and the competences. In the fourth phase, correlation analysis and competences of the model were calculated with the total score.

In item analysis, we calculated mean (M), standard deviation (SD), skewness (S), kurtosis (K), correlation between each two items, and item-total correlation (ITC) for all the items as presented in Table 7. The mean and standard deviation of variables was from 3.81 to 4.51 and from .66 to .91. Also, the data were subjected to tests of multivariate normality. Values of skewness less than 3 and kurtosis less than 7 by the module are assumed to be normal [31]. The skewness values and the kurtosis values ranged from –1.198 to –.122 and –.741 to 1.035, respectively, which satisfied the normal requirements. Correlations between

the 24 items and ITC were analyzed to identify and eliminate highly correlated items (r>.8) [32]. The results showed that items were moderately correlated with each other at .200–.699 (p<0.01), and ITC were .538–.773 (p<0.01).

Table 7. Descriptive statistics and item correlation

Item	N	M	SD	S	K	ITC
cc_1	240	4.1208	.83214	-.582	-.454	.648*
cc_2	240	4.2875	.79001	-.919	.276	.671*
cc_3	240	4.1333	.90033	-.856	.281	.679*
cc_4	240	4.2333	.73449	-.717	.235	.674*
cc_5	240	4.2875	.65699	-.382	-.741	.711*
cc_6	240	4.3792	.71005	-1.051	1.035	.675*
cc_7	240	4.0917	.72604	-.274	-.649	.721*
cc_8	240	4.1750	.76166	-.478	-.599	.718*
fc_1	240	4.0625	.90573	-.873	.576	.750*
fc_2	240	4.0708	.69606	-.171	-.673	.773*
fc_3	240	4.0167	.77604	-.679	.993	.754*
fc_4	240	3.8833	.83524	-.429	.106	.700*
fc_5	240	3.8542	.80244	-.122	-.694	.702*
fc_6	240	4.0458	.74456	-.442	-.089	.582*
fc_7	240	3.8125	.82473	-.316	-.173	.721*
mc_1	240	4.2042	.70561	-.528	-.084	.538*
mc_2	240	4.2375	.71289	-.451	-.680	.587*
mc_3	240	4.5083	.67217	-1.198	.868	.583*
mc_4	240	4.1583	.69662	-.300	-.640	.647*
mc_5	240	3.9208	.81691	-.596	.764	.573*
sc_1	240	4.2083	.69542	-.532	.022	.703*
sc_2	240	4.2875	.68199	-.593	-.073	.674*
sc_3	240	4.0667	.69947	-.240	-.456	.715*
sc_4	240	4.1208	.72463	-.454	-.148	.674*

* p<0.01 Correlation is significant at the 0.01 level (2-tailed)

4. RESULTS

4.1. Confirmatory factor analysis

The main purpose of CFA is to examine the relationships among the latent and observed variables supported by logic or theory [33]. CFA is used to confirm a conceptual structure [34]. CFA was performed using maximum likelihood estimation. Since the model was developed based on the holistic competence [17] and the grounded theory approach [26], we had robust hypotheses on factors, meaning that we decided to test it directly using CFA. Accordingly, the three theoretical models were tested. The first model is composed of one dimension (24 items). The second model had two dimensions: occupational dimension (CC and FC; 15 items) and personal dimension (MC and SC; 9 items). The third model had four dimensions: CC (8 items), FC (7 items), MC (5 items), and SC (4 items).

In order to investigate the models' goodness of fit, several fit indices were used: Chi-square (χ^2) statistical test, the ratio of Chi-square to its degrees of freedom (χ^2/df), standardized root mean square residual (SRMR), the comparative fit index (CFI), Tucker-Lewis index (TLI), incremental index of fit (IFI), parsimony comparative fit index (PCFI), and root mean square error of approximation (RMSEA). We considered the models acceptable if the following criteria are satisfied: These indices should have values for the χ^2 test, where the acceptance of the null hypothesis (p>0.05) [31], above [35] and of less than 5 [36] for the χ^2/df; below 0.08 for the SRMR [37], above 0.90 for the CFI and IFI, and above 0.60 for the PCFI [38]; and below 0.08 for the RMSEA [39].

Table 8 shows the acceptable fit values of the fit indices and the results in the degree of model fit indices of the three models. According to the fit statistics, Model 1 and Model 2 failed to satisfy some of the critical indices. Model 1 failed to satisfy CFI, IFI and RMSEA; however, it satisfied the indices including χ^2/df, SRMR and PCFI. Similarly, Model 2 failed to satisfy CFI, IFI and RMSEA, however, it fulfilled the suggested criteria for χ^2/df, SRMR and PCFI (Table 8). Hence, the models were rejected for further analysis. In contrast Model 3 satisfied suggested values for all critical indices. As shown in Table 8, Model 3 (four-dimension) had the best fit statistics. Consequently, Model 3 was selected as the best model for the further analysis.

Table 8. Model fit indices

Indices	Acceptable fit value	Model 1	Model 2	Model 3
χ^2		946.389	763.779	574.261
df		252	251	246
p value		0	0	0
χ^2/df	2–5	3.756	3.043	2.334
SRMR	< .08	.075	.066	.059
CFI	> .90	.789	.844	.901
IFI	> .90	.791	.846	.901
PCFI	> .60	.721	.639	.803
RMSEA	< .08	.107	.092	.075

As seen in Figure 1, the 4-factor correlated model for CMfER specifies the relations between observed variables and latent variables. The boxes and the ellipses represent the observed variables and the latent variables, respectively. Factor loadings provide evidence for the extent to which an item relates to the underlying latent factor. The factor loadings shown in Figure 1 were quite high, ranging from 0.57 to 0.82. The value of .40 is a common cut-off value that is typically used in any factor analyses, and the double-headed row represents the covariance, which also can be interpreted as correlation [40]. The four factors were highly correlated, with correlations ranging from 0.67 to 0.83.

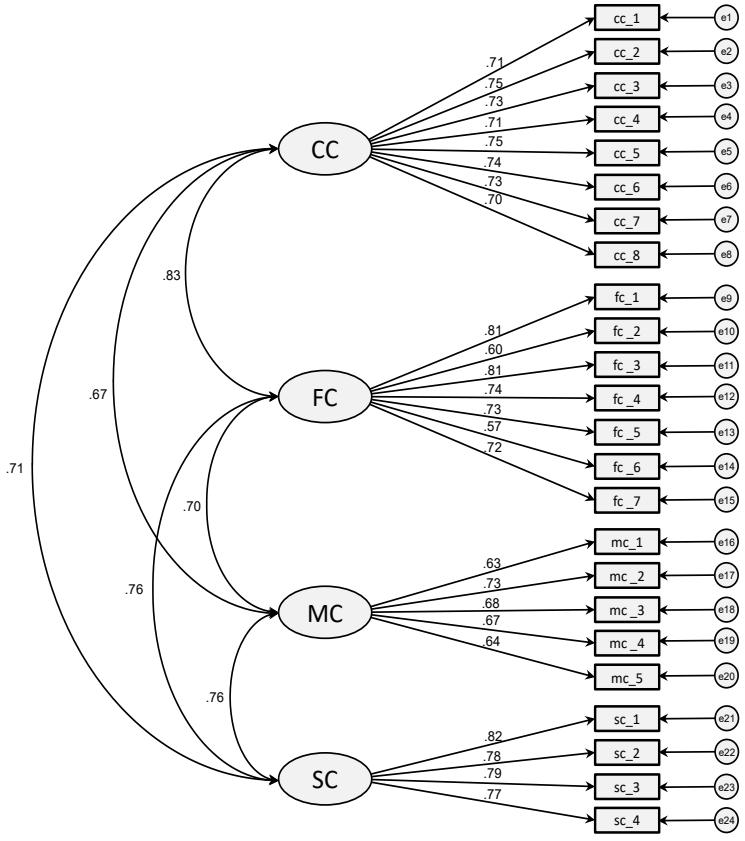

Figure 1. Four-factor correlated model for CmfER

4.2. Reliability analysis

Testing for reliability is important as it refers to stability and consistency across a measuring instrument [41]. When we evaluated the reliability of the four-dimensional model, Cronbach's alpha was calculated for the total and the factors (dimension). Cronbach's alpha for the total scale was found to be .947 and its value of the factors were .896 for CC, .893 for FC, .801 for MC and .866 for SC. Acceptable values of Cronbach's alpha ranged from 0.70 and above [40]. According to Taber [42], if $\alpha \geq 0.9$, the internal consistency is excellent, and if $0.7 \leq \alpha < 0.9$, it is good. Hence, it can be said that all factors are reliable at the good level and final model is reliable at the excellent level.

4.3. Correlation analysis

The correlation between each two of the four factors results is presented in Table 9. According to the table, the lowest correlation was found between MC and CC (.574), while the highest correlation was found between FC and CC (.749). If the correlation between factors is .50 to .80, it is considered a moderate correlation [43]. Hence, it was concluded that correlations between each set of two factors are moderate.

Table 9. Correlation matrix of two factors of the CMfER (N=240)

	CC	FC	MC
CC			
FC	.749*		
MC	.574*	.607*	
SC	.622*	.684*	.643*

*p<0.01 Correlation is significant at the 0.01 level (2-tailed)

5. DISCUSSION

The current study aimed to develop a competence model for educational researchers. This study is the first systematic research to identify and validate educational researcher's competencies in Mongolia; however, previous studies developed and validated subject specific teacher's competence model [44] and attempted to measure some relevant competencies Mongolia [45]. Based on the holistic competence model [17], we elaborated a scale consisting of four factors (CC, FC, MC, and SC) and 24 items, which presented evidence of reliability and validity based on item generation, test content, and psychometric analysis. The model was developed in three steps [22]: item generation, content validity, and psychometric analysis.

Thus, as a result, Step 1 (item generation) produced 33 items grouped into four dimensions, and an initial model was created. In Step 2 (content validity), nine items were considered invalid, with the remaining 24 being considered items valid. Finally, Step 3 (psychometric analysis) presented a four-factor model with adequate values for reliability and validity evidence.

In Step 1, when creating the item generation, we benefited from the items in the literature analysis and the opinions of researchers from institute for educational research and professors from universities. An item pool was collected that consisted of 63 items. After deleting inappropriate items and categorizing and abstracting the items, 33 items remained. Thus, as a result, Step 1 (item generation) produced the initial model with 33 items: nine items in each of the first three dimensions (CC, FC, and MC) and six in the last dimension (SC).

In Step 2, the initial model was examined by eight experts and two quantitative approaches, CVR [27] and V [28] were used to analyze content validity. At the end content validity analysis, nine items were considered invalid, and the remaining 24 items valid. A proposed model of 24 items with four dimensions was obtained: CC (8 items), FC (7 items), MC (5 items), and SC (4 items).

Step 3 was a psychometric analysis using item analysis, CFA, reliability, and correlation analysis. The final sample consisted of 240 participants. It was deemed that the data set of the proposed model at the descriptive statistics had a multivariate normal distribution. Since the model was developed based on the literature analysis and the grounded theory approach, we evaluated it directly using CFA, and three theoretical models were compared for construct validity. Each model evaluation used seven fit indices (χ^2, χ^2/df, SRMR, CFI, IFI, PCFI, and RMSEA). The results of these indices proved that Model 3 (four dimensional) was superior to Model 1 (one dimensional) and Model 2 (two dimensional). Finally, Model 3 was selected as a competence model for educational researchers (CMfER). This study used Cronbach's alpha coefficient to measure internal consistency, and the results showed that the CMfER had good and excellent reliability. The moderate correlation between the factors indicates that four factors are the components being measured in the CMfER.

6. CONCLUSION

In conclusion, the 24-item four factor CMfER was confirmed, as fit indices satisfied the criteria suggested in the literature. The factor loadings of the model were substantially significant, and Cronbach's alpha coefficients were well above the threshold value, suggesting that the items were internally consistent and reliable. Overall, the results shown that the CMfER can be used as a reliable and valid data collection tool in future studies in which educational researchers' competences are examined.

For a correct interpretation of our results, it is necessary to consider their limitations. Therefore, in this study, three limitations and future research suggestions should be recognized. One limitation of this study is criterion validity. However, we believe that this limitation does not significantly affect the results of

the current study. Second, researcher competence can vary by their experience. Therefore, educational researchers can be classified by level of competence. In this regard, it is essential to carry out research to develop the instrument for specific levels of researcher competence. Third, future studies should perform test-retest reliability, which was not possible to evaluate in this study.

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