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Primary School Teachers' Determinants of Integrated Teaching for Realistic Math Education

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Abstract: The purpose of this study was to explore the factor structure of a measurement and to evaluate its internal reliability. Overall, 525 math-majoring elementary school teachers volunteered to participate in this study by answering online survey questions via Google Form. These samples were randomly partitioned into 262 participants for exploratory factor analysis (EFA) and 263 observations for confirmatory factor analysis (CFA). The EFA tended to largely prefer a four-factor solution, which was proven to explain over 68% of the variation in the data. Awareness, effectiveness, engagement, and opportunity were the provisional labels for these hidden variables. The CFA results verified and validated the four-factor model, with all test measures exceeding the specified thresholds, suggesting an acceptable and excellent fit. The results of this study, on the one hand, provide four key areas for realistic math teachers, educators, and policymakers to discuss as opposed to examining individual indicators, and on the other hand, they serve as a foundation for interested researchers to conduct additional analyses, such as multivariate linear regression or complement for cluster analysis.

Keywords: *Exploratory factor analysis, confirmatory factor analysis, integrated teaching, practical setting, realistic math education.*

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Introduction

Since the 18th century, researchers have investigated the concept of integrating many disciplines in a single classroom environment. Although different studies have emphasized integrated teaching from a variety of perspectives, the idea, purpose, and meaning of integrated teaching were perceived in a surprising similar way across the globe. For example, Ciolan and Ciolan (2014) considered "integrated teaching" as the process of synthesizing diverse disciplines into a cohesive whole such that the value of the final outcome achieved by integration is much larger than the sum of its components (Tudor, 2014). Ghosh and Pandya (2008) and Drake (2012) identified an integrated curriculum for university students that combined several types of learning, such as across disciplines, between teaching content and practice, or between theory and knowledge and skills. Khan (2014) described integrated teaching as the organic and methodical connection of research and learning materials from several topic areas into a coherent curriculum, based on the theoretical and practical interconnections addressed in those disciplines. Many nations today see integrated teaching as a necessity for equipping their youth with the skills they'll need to succeed in the global economy and society at large (Huntley, 1999; Kim et al., 2004). This is especially true when it comes to preparing students to handle the types of challenging problems that call for expertise in multiple fields (Vashe et al., 2019). Thus, it is necessary to implement the integrated education approach in schools (Ghosh & Pandya, 2008) and to emphasize its importance in contemporary educational innovation (Kalpana Kumari et al., 2011).

With a growing interest in integrated teaching in education, several scholars have embraced this strategy in many subjects, including mathematics (Duyen & Loc, 2022; Tong et al., 2022). Although the integrated manifestation may take various forms, its defining feature is integration; it does not generate new content, and it often includes the following three types of manifestations. The first is called esoteric integration; the second is known as Science, Technology, Engineering, and Mathematics (or STEM) education; and the third is primarily transdisciplinary integration. As a result of the plethora of research relating to classroom and practice, the efficacy of mathematics education in schools has significantly increased in terms of theories, practices, and lessons learned (Hourigan & Leavy,

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2022; Toh et al., 2022). For example, den Heuvel-Panhuizen and Wijers (2005) developed a theory of mathematics education known as realistic mathematics education (RME). Ardiyani (2018) asserted that the educational approach to mathematics with practice had a positive influence on the results of students' learning activities. Arsaythamby and Zubainur (2014) also suggested that the approach to practical mathematics education positively affects the learning activities of primary school students. According to Ginting et al. (2018), in order to help students improve their reasoning abilities, instructors must give opportunities for primary students to engage in self-discovery activities under the supervision of teachers. Ciolan and Ciolan (2014) demonstrated that hands-on learning experiences best motivate their students. Malik and Malik (2011) provided 12 tips for developing an integrated curriculum. Kim et al. (2004) studied and evaluated the implementation of integrated teaching on the professional competence of university students. The National Council of Mathematics Teachers proposed a curriculum that "connects mathematics," meaning making connections between math topics and between mathematics and other sciences (Woodbury, 1998). Revina and Leung (2018) went to investigate the level of education associated with practice in the primary education programs of the Netherlands and Indonesia.

Prahmana et al. (2020) recently conducted a RME review and found that most earlier studies had concentrated on implementing RME in the classroom while dealing with numerical and operational concepts, and that design research (or curriculum development) was the main research method employed. These findings may be explained by the fact that RME was primarily implemented in elementary schools, where numerical and computational skills were stressed up until fifth grade (Van de Walle et al., 2016). This implies that little effort is devoted to investigating the determinants that explain primary teachers' inclination to continue RME, leaving a gap in the literature. Gaining insight into this phenomenon is crucial since the long-term success of mathematics education depends not only on the pedagogical approach and curriculum design but also on instructors' willingness to modify their teaching method to inspire students (Fredriksen, 2021; Khairunnisak et al., 2022). There are many similar studies in the literature investigating potential factors but in other subjects or topics (Sovey et al., 2022; Syah et al., 2022). As such, the purpose of this research is to make a contribution to the existing body of knowledge by investigating the potential factors that may explain primary teachers' inclination to continue RME. In particular, the purpose of this study is to investigate the following research questions:

- What are the potential factors that could influence primary school teachers to incorporate RME into their lessons?
- Are these factors dependable and validated so that they can be used in additional research?

Literature Review

As stated in the preceding section, prior publications on teachers' perspectives on RME integration were scarce owing to the popularity of curriculum development. Thus, this section only highlights similar work in secondary and high schools. For example, Turmudi (2012) conducted an exploratory factor analysis to uncover junior high school math teachers' perceptions toward math teaching reform innovation in Indonesia. They discovered three underlying factors in a set survey questionnaire, namely constructivist teaching, traditional teaching, and constructivist learning. In the same vein, Khairunnisak et al. (2022) investigated perceptions of junior high school RME teachers through a blended professional development workshop. After analyzing data from interviews, chats, and video recordings, they reported that teachers' understanding of RME was still limited, even in the notion of what constituted RME, at first. However, after the training, the level of understanding was increased. Trujillo-Torres et al. (2020) analyzed the profiles of 73 high school math instructors in order to determine their motivations for incorporating information and communication technologies into mathematics instruction. Their findings suggested that young educators are often more motivated by digital technologies, implying that age is an important variable for assessing trends in the modern era. In secondary schools, Do et al. (2021) attempted to validate the Theory of Planned Behavior (TPB) applied to RME. After analyzing data from 500 secondary math teachers, they confirmed the assumptions that attitude, behavioral control, and facilitating conditions were reliable predictors of RME continuance. On the other hand, subjective norm and autonomy seemed to not have an effect on RME continuance. In primary schools, Mariana et al. (2021) conducted a survey with 296 teachers to better understand teachers' confidence and challenges during RME implementation. Their results suggested that elementary school teachers had a good degree of RME knowledge and confidence. Moreover, many teachers had difficulty locating appropriate math-related materials. Shriki and Patkin (2016) evaluated the professional requirements of 84 primary school teachers, and their results indicated that instructors were more concerned with managing the emotional elements of their children than with enhancing their arithmetic skills, despite the fact that they lacked formal math education. This was evidenced by the poor math achievement of Israeli students.

The above studies indicated that teachers' perceptions of RME were investigated from various perspectives, and a large portion of research methods used were qualitative, in which information was gathered through interviews with participants. This result was also aligned with the systematic review of Prahmana et al. (2020), implying a lack of work that could enrich the current body of knowledge. In terms of research approach, the present study distinguishes itself from the vast majority of previous works on the same topic by focusing on the investigation of potential factors. As a consequence, it enriches and complements the existing body of knowledge, rather than competes with it. The only similar research was conducted by Turmudi (2012); however, our work differs in that we validated the obtained factors.

Methodology

Research Design

The current study employed quantitative research design methodology to better understand the underlying factors that may contribute to the preparedness of primary educational teachers in teaching realistic math. More specifically, the exploratory factor analysis (EFA) was utilized to extract latent variables from the questions posed. EFA is a statistical approach that has been frequently utilized in the literature to reveal hidden patterns within datasets (Hair, 2009). It was also known as the dimension reduction strategy since it condensed a large number of variables into a smaller set while maintaining the majority of the information. The uncovered factors will be further examined and validated by conducting confirmatory factor analysis (CFA; (Hair, 2009). To conduct the analysis for both EFA and CFA, the original dataset was randomly split into two halves, one for EFA and the other for CFA.

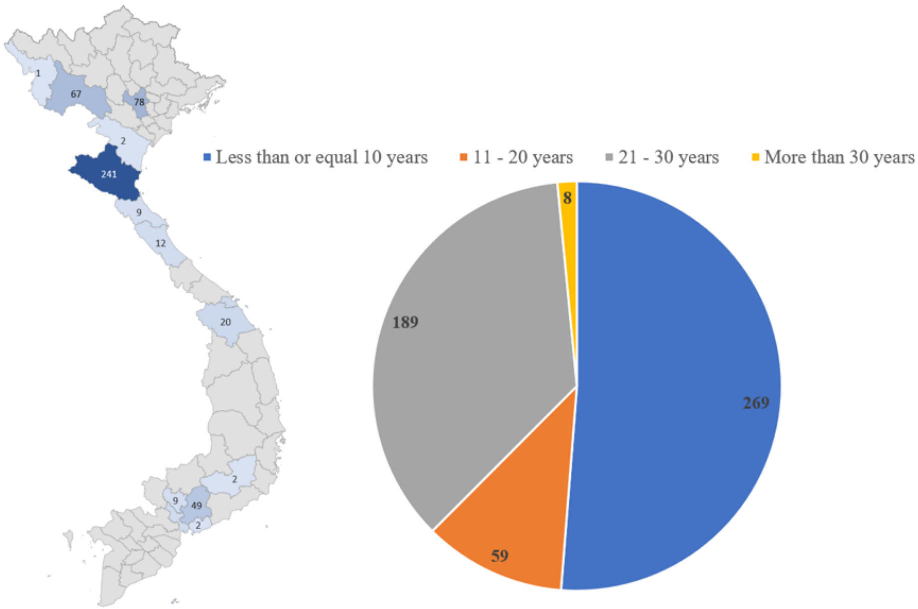
Sample and Data Collection

The primary school teachers who teach math are the study's target population. The accessible population is made up of the authors' members who live in the North, Central, and South Vietnam. This study employed the purposive sampling technique to reach participants from the accessible population. In this regard, an online survey (i.e., Google Form) was utilized as a means to administer and collect data. Before the actual survey was conducted, participants were informed about the purpose of the research, the type of data collected, how the data would be stored and distributed, and their ability to opt out at any time. The survey was carried out over three months, from June to August 2022. The questionnaire consists of two sections: the first section includes two demographic profiles of the respondents; the second section contains 12 questions asking about perceptions toward readiness for teaching math within a real-life context using the Likert scale (1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, and 5: Strongly Agree). The questions were adapted from existing work (Connelly, 2013; Smith, 1993) and justified to the current study's context. Listwise deletion was used to exclude the entire record if any single value was missing. Before administering the questionnaires to respondents, the questions were examined for reliability and face validity by two experts in the field.

Overall, 594 responses were received after three months of administering the survey. Of these responses, 69 items (11.62%) were removed due to incomplete answers, leaving 525 items for data analysis (88.38%). The remaining items were divided into 262 for EFA and 263 for CFA.

Figure 1 provides the visual representation of participants' profiles, including demographic information and years of experience in teaching. Figure 1(a) highlights that most respondents reside in Nghe An province (45.9%), followed by Ha Noi, Son La, and Dong Nai with the distribution of 78 (14.86), 67 (12.76%), and 49 (9.33%), respectively. The rest is distributed from the North to the South. In terms of years of teaching experience, Figure 1(b) illustrates that more than half of the participants (54.24%) have been teaching the math subject in primary schools less than or equal to 10 years, followed by teachers in the field from 21 to 30 years (36%). The remaining subjects are distributed in the categories of 11–20 years (11.24%) and more than 30 years (1.52%).

Area of Living	Count
Nghe An	241
Ha Noi	78
Son La	67
Dong Nai	49
Quang Nam	20
Ho Chi Minh City	15
Da Nang	18
Quang Binh	12
Binh Duong	9
Ha Tinh	9
Thanh Hoá	2
Ba Ria – Vung Tau	2
Lam Dong	2
Dien Bien	1



(a) (b)

Figure 1. Participants' Profiles Include (A) Demographic Information and (B) Years of Experience

Analysis of Data

The EFA statistical method was used for the first part of the analysis to find hidden structures or factors. Examining separate correlations between 12 variables could be a time-consuming task because it yields 78 numbers to be examined; therefore, by reducing the dimensions and then stimulating in the stages of factor understanding, researchers would be able to see the big picture in terms of understanding primary math teachers and what facets the teachers think about in this field. Furthermore, if the 12 variables can be expressed in fewer composite indicators, the other multidimensional methods could be performed more parsimoniously.

The current study has a sample size of 262/12, or a 23:1 observation-to-variable ratio. Several criteria are available in the literature to help researchers identify the samples needed for EFA. For example, Hair (2009) suggested that sample sizes of 5:1, 10:1, and 20:1 be considered acceptable, moderate, and excellent, respectively. Other researchers (Bujang et al., 2018) suggested sample size by a specific number (e.g., 50, 100, 500, or more than 1000). The current study used a commonly used criterion introduced by Hair (2009); hence, it was classified as excellent criteria.

The EFA method derives from the assumption that there are some correlations between variables, thus an examination of these correlations is needed. The current study employed two indicators for this purpose. The first indication is the Kaiser-Meyer-Olkin Measure of Sampling Adequacy presenting the strength of the partial correlation. Most scholars suggested that KMO levels near 1.0 are considered desirable, whereas values less than 0.5 are considered unsatisfactory (Aktas & Tabak, 2018; Hair, 2009). The second indication is the Bartlett's Test of Sphericity, which examines whether correlations among variables exist. A statistically significant Bartlett's Test of Sphericity (sig. <.05) implies that there are adequate correlations between the variables to progress (Hair, 2009).

The obtained data was analyzed with IBM SPSS (v25.0). The Principal Components method was used for extraction, and the Varimax technique was employed for rotation. Here, the authors were not constrained by presumptions about the number of retained factors, but given the 12 variables to be studied, practical concerns of appropriate multiple measurements per factor (at least two, preferably three) suggest that four to six factors would be desirable (Hair, 2009). Indications such as Kaiser, scree plot, and variance explained criterion that were employed to justify the number of retained factors.

Following the completion of EFA, CFA was conducted to verify the obtained factors. Before performing CFA, reliability and validity of the scale were examined utilizing two indicators: Construct Reliability (CR) and Average Variance Extracted (AVE). These alternatives have been generally embraced as Cronbach's Alpha complement in CFA. CR and AVE were suggested to be greater than .7 and .5, respectively. Several measures were used to analyze results from CFA including Chi-square divided by Degree of Freedom (CMIN/DF), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Normed Fit Index (NFI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and PCLOSE. In general, if CMIN/DF ≤ 3, the fit between the sample data and the proposed model is acceptable; if it is ≤ 5, the fit is reasonable. GFI, AGFI, NFI, and CFI are considered a reasonable fit with values ≥ 0.9 and an excellent fit of values ≥ 0.95 (Hu & Bentler, 1999). RMSEA threshold values of less than .01, .05, and .08 indicate excellent, good, and mediocre fit, respectively. A PCLOSE ≥ .05 indicates an excellent fit, and PCLOSE ≥ .01 implies an acceptable fit (Hair, 2009). The CFA was conducted by using IBM Amos (v20.0) software.

Findings / Results

Descriptive analysis

Table 1 reports the mean, standard deviation, skewness, and kurtosis of the data obtained from the survey results. Overall, all mean values are above the midpoint of 2.5 (ranging from 3.01 to 4.44), standard deviation varies between .766 and 1.112, skewness falls between -1.427 and 1.216, and kurtosis values are within the range of -.797 and 2.150.

Table 1. Mean, Standard Deviation, Skewness, and Kurtosis of the Obtained Survey Data

Variable	Mean	Std. Deviation	Skewness	Kurtosis
V1	4.44	.766	-1.427	2.150
V2	4.22	.793	-.961	1.191
V3	4.29	.796	-1.185	1.838
V4	3.32	1.055	-.502	-.218
V5	3.01	1.122	-.283	-.684
V6	3.08	1.216	-.255	-.797
V7	3.53	1.001	-.707	.303
V8	3.69	.896	-1.015	1.401
V9	3.80	.940	-.911	1.010
V10	3.77	.948	-1.049	1.341
V11	3.68	.939	-.799	.813
V12	3.67	1.011	-.749	.334

Table 2 reports the Kaiser-Meyer-Olkin (KMO) and Bartlett's Test results of this study indicated that the KMO is adequate (.740). In addition, the Bartlett's test is significant, $\chi2$ (66) = 967.327, $\rho < 0.000$.

Table 2. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**0.740**
Bartlett's Test of Sphericity	Approx. Chi-Square	967.327
	df	66
	Sig.	.000

Exploratory Factor Analysis

Table 3 reports the extracted factors along with their eigenvalue, variance explained, and cumulative amount of variance. Using the Kaiser criterion (i.e., factors retained in the model if their eigenvalues are greater than one), the result indicated that there are four factors revealed. This number was also aligned with the expectation (four to six factors). These four factors explained 68.087% of variance in the data obtained from 262 primary school teachers. The rest of variance is due to other factors. Although there is no consensus about the threshold of total variance explained, the current finding was aligned with the recommendation in the social sciences (around 60%) or other findings (Aktas & Tabak, 2018; Korkmaz & Unsal, 2016). In Table 3, factors 1, 2, 3, and 4 contribute to 26.398%, 20.427%, 11.720%, and 9.002% amount of variance explained, respectively.

Table 3. Results for the Extraction of Component Factors

Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	3.233	26.938	26.938	3.233	26.938	26.938
2	2.451	20.427	47.365	2.451	20.427	47.365
3	1.406	11.720	59.085	1.406	11.720	59.085
4	1.080	9.002	68.087	1.080	9.002	68.087
5	.754	6.283	74.370			
6	.596	4.966	79.336			
7	.563	4.694	84.029			
8	.492	4.100	88.129			
9	.444	3.697	91.825			
10	.370	3.080	94.905			

The scree plot in Figure 2 illustrates that four factors may be reasonable when examining changes in eigenvalues (i.e., recognizing the "elbow" in the plot). When the eigenvalue for the fifth factor was assessed to the latent root criteria value of 1.0, its value (.754) impeded its inclusion (Hair, 2009). If the eigenvalue was near to 1.0, it may be thought to be included as well. All these criteria lead to the conclusion that four factors should be retained for future investigation.

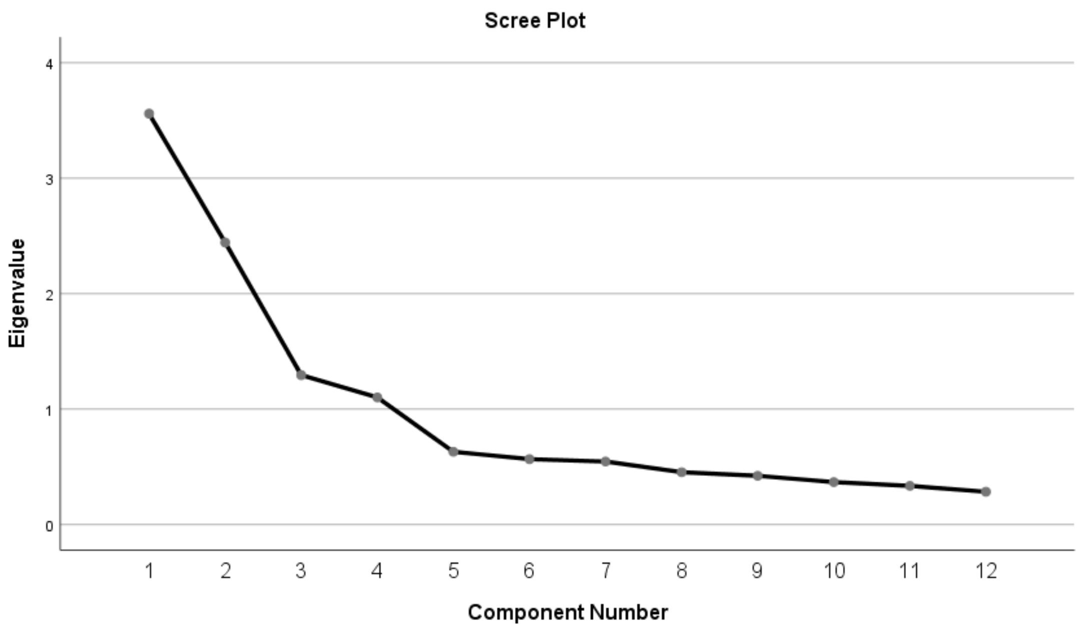


Figure 2. Scree Plot

Table 4 provides information about the factor loadings. The minimum and the maximum of factor loadings are .497 and .869, respectively. Hair (2009) suggested that for a sample size of 200 or more, a factor loading of .40 and above are significant, thus all items are retained. In addition, Table 4 shows that all four factors are desirable with three variables per factor that are above .40.

Table 4. Varimax-Rotated Component Analysis Factor Matrix

Variable	Component			
	1	2	3	4
V2	.869			
V1	.849			
V3	.774			
V10		.837		
V11		.805		
V12		.785		
V5			.846	
V6			.779	
V4			.764	
V9				.826
V8				.824
V7				.497

Table 5 presents the final result of EFA with respect to factor's name, Cronbach's alpha, and factor loading of each item. Overall, the reliability of the scale in each factor is acceptable as recommended by Hair (2009) with a cutoff value of 0.7. Since the three items that loaded most heavily on Factor 1 were all conceptually connected to the utilization of integrated teaching, Factor 1 was given the name "Awareness." The three items that loaded most heavily on Factor 2 were all related to concerns about expanding one's knowledge into other fields; consequently, Factor 2 was provisionally dubbed the "Opportunity" factor. Because the three items that loaded most heavily on Factor 3 were all associated with motivation in a way that was deemed to be favorable by the primary teachers, Factor 3 was given the name "Engagement." Last but not least, the three items that loaded onto Factor 4 were all associated with abilities that primary teachers are capable of managing during the integrated teaching process. As a result, Factor 4 was provisionally given the label "Effectiveness."

Table 5. Final Result for Exploratory Factor Analysis

Variable	Items	Factor loadings
Factor 1. Awareness (Cronbach's alpha α = 0.790)		
V2	I often analyze different approaches in teaching concept formation (for example, the concept of decimals) in elementary school.	.869
V1	I often analyze the scientific basis of teaching certain content (for example, the content of teaching fractions) shown in the Math Program in primary school.	.849
V3	I think the activities of calculating, measuring, estimating, and statistics in real life will be integrated in teaching math activities in primary school.	.774
Factor 2. Opportunity (Cronbach's alpha α = 0.795)		
V10	I put practical situations with familiar and close-to-student elements into the teaching content.	.837
V11	I am interested in integrating practice into the process of teaching math.	.805
V12	Students are understanding of the different areas of science and life in the lesson.	.785
Factor 3. Engagement (Cronbach's alpha α = 0.795)		
V5	I see students are actively asking during the math class lessons.	.846
V6	I see students' interest in learning when organizing integrated teaching in math through practical situations with real contexts.	.779
V4	Students will feel excited when real-world situations contain integrated elements of math.	.764
Factor 4. Effectiveness (Cronbach's alpha α = 0.779)		
V9	It is very convenient to determine the organizational process when implementing integrated lessons.	.826
V8	I find that determining the process of organizing integrated teaching in math through practical situations with real contexts affects the lesson objectives.	.824
V7	I often define the process of organizing integrated teaching in mathematics through practical situations with real contexts.	.497

Confirmatory Factor Analysis

Table 6 reports the reliability and validity of the scale used in CFA analysis. In general, all Cronbach's alpha values are greater than the recommended value of 0.7. Similarly, CR > .7 and AVE > .5, indicating that the construct is reliable and validated.

Table 6. Cronbach's Alpha, Construct Reliability (CR) and Average Variance Extracted (AVE) of the Four Factors

Factor	Items	Cronbach's alpha	CR	AVE
Awareness	3	.793	.732	.564
Opportunity	3	.713	.740	.510
Engagement	3	.710	.796	.505
Effectiveness	3	.745	.756	.511

Table 7 reports the model fit summary of the CFA. Results from the table provide information that yields CMIN/DF = 1.153, indicating an excellent criterion. Similarly, GFI had a value of .956, which is higher than the excellent criterion (≥ .95). Moreover, AGFI and NFI were considered an acceptable fit with values of .929 and .920, respectively. CFI = .791, which was more than the threshold of excellent criterion. RMSEA showed an acceptable measure where its value (.044) was less than .05. Finally, PCLOSE was considered an excellent fit where its estimate was much greater than the threshold value.

Table 7. Model Fit Summary

No.	Measure	Estimate	Threshold	Interpretation
1	CMIN/DF	1.153	< 3	Excellent
2	GFI	.956	≥ .95	Excellent
3	AGFI	.929	≥ .90	Acceptable
4	NFI	.920	≥ .90	Acceptable
5	CFI	.971	≥ .95	Excellent
6	RMSEA	.044	≤ .05	Acceptable
7	PCLOSE	.660	≥ .05	Excellent

Figure 3 shows the finalized measurement model of primary school teacher preparedness in the subject of math after considering all statistical fit index tests. Items with factor loadings greater than .50 are prioritized for retention in the model. All factor loadings on the figure are more than .50, suggesting that items were retained in the model. This result was consistent with EFA.

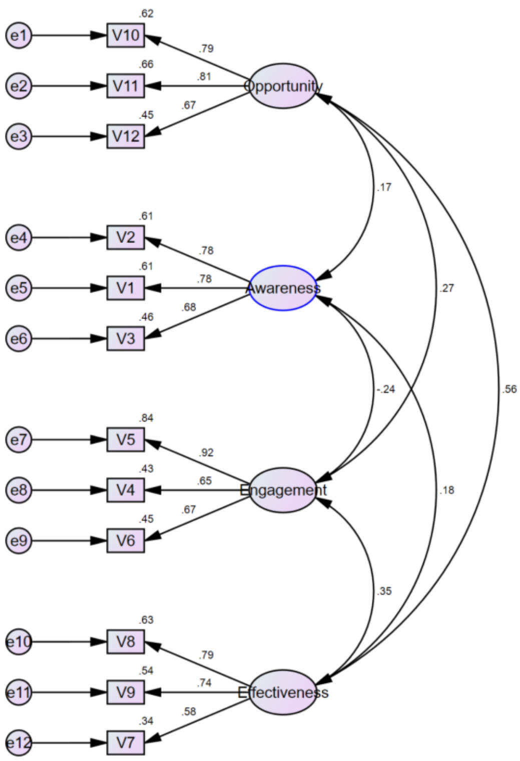


Figure 3. Factor Model for the Primary Teacher Preparedness Evaluation Questionnaire

Discussion

The current study sought to investigate the factorial structure of 12 survey items in a cross-sectional sample of primary educational math teachers using EFA and CFA. The findings of the EFA indicate that the 262 research samples are adequate because KMO is greater than the threshold of .50, which means that the research can proceed with further analysis. As a result, the EFA tended to largely prefer a four-factor solution, which was proven to explain over 68% of the variation. The formation of factors from questions indicated that there existed strong correlations between these questions. For example, Trigwell et al. (1999) showed that there was a correlation between teachers' perceptions of subjects and teaching approaches, which was presented in factor 1 (V1 and V2). The explanation for the relationship is similar in other factors. Component and common factor analyses give the researcher crucial insights into the structure of the variables and data reduction possibilities. First, regarding the structure of the variables, it is evident that RME teachers' perceptions employs four unique assessment dimensions. These dimensions can span a wide variety of teacher competences, from the existence of integrated teaching (Awareness) to the relationship with the learning outcomes (Effectiveness) to the motivation of students (Engagement) and even RME outreach teachers' perceptions efforts (Opportunity). Instead of addressing each component individually, policymakers and educators within RME teachers' perceptions may now discuss strategies centering around these four areas. Second, these four factors might be utilized as a complement to cluster analysis to determine whether or not they share one or more additional features, which would allow for more in-depth research. And finally, in a future study, interested researchers may use one representative question from each factor in conjunction with additional scale measurements to investigate another relationship.

Factor analysis also offers the foundation for data reduction by means of scale summated or factor scores. Now that the scholar has a mechanism for synthesizing the variables inside each component into a single score, the original set of variables may be replaced with four different aggregate indicators. These new composite variables allow us to focus on variations between groups or areas rather than analyzing each variable separately. This makes it possible to narrow the focus of the investigation. Multivariate linear regression, for instance, could be used to predict yet another view of primary education teacher competencies based on summed scores.

The four-factor model revealed by EFA was then validated using CFA. The findings of CFA analysis supported the hidden structure extracted from EFA with all above acceptable criterion. It is essential to take into consideration the criteria of the various model fit indices whenever one is in a discussion about how well the CFA model fits the data. If the value of the RMSEA is less than 0.01, then it is regarded as excellent; if it is between 0.01 and 0.05, then it is considered to be satisfactory; if it is between 0.08 and 0.1, then it is perceived to be a mediocre fit. The RMSEA for this particular sample is 0.044, which indicates that the fit is satisfactory. The GFI and AGFI values of this sample, which come in at 0.956 and.929, respectively, are both higher than the cutoffs of .95 and .90, which indicates that the fits are excellent and acceptable, respectively. The CFI value is higher than 0.95, which indicates that the model fits the data very well.

Overall, the current study findings were in line with previous research in the literature. In terms of engagement and effectiveness factors, the current result coincides with the findings of Hidayat et al. (2018) and Ciolan and Ciolan (2014), in which the authors highlighted the important roles of engagement and accomplishment factors. Similarly, the opportunity dimension revealed in EFA and confirmed in CFA was aligned with the assertion of Ginting et al. (2018). Last but not least, the awareness factor was also found to be consistent with previous work (Papadakis et al., 2021; Widjaja, 2011; Wubbels et al., 1997).

Conclusion

The current study aimed to investigate the underlying factors hidden in the structure of 12 questions. A total of 525 primary teachers who majored in math voluntarily participated in this research. Of these samples, 262 subjects were randomly partitioned for EFA, and the remaining observations (263) were set aside for CFA. Results from the EFA experiment revealed that there were four dimensions hidden in the data that accounted more than 68% of the amount of variance, and the rest were due to other factors. These latent variables were tentatively labelled Awareness, Effectiveness, Engagement, and Opportunity. Findings from the CFA confirmed and validated the four-factor model with all the test measures falling above the recommended values, indicating an acceptable and excellent fit. The uncovering of these factors was in line with the recommendations of previous studies found in the aforementioned literature. Thus, these factors, on one hand, provide RME educators and policymakers key areas to discuss instead of examining individual indicators. On the other hand, they were laid as a foundation for interested researchers to conduct further analysis such as multivariate linear regression or complement for cluster analysis.

Recommendations

There are several recommendations derived from this study that could be used for further investigation by interested researchers and practitioners. First, from primary teachers' perspectives, they should be aware of realistic math in real-world context settings. This awareness is important for not only teachers themselves but also for primary students as it allows learners to connect tangible objects with intangible theory. The effective dimension implies that realistic primary math teachers should continue to foster integrated teaching methods into their educational context as it has been proven effective in many similar studies or regional similarities. The engagement factor illustrated that educators should make extra effort to develop students' motivation. Only when children feel excited about the math subject and start asking questions is the mission of educating young generations fulfilled. The final factor paves the way for young learners to be prepared in an increasingly complicated world, especially in the era of industrial 4.0. Thus, primary teachers are encouraged to enrich their knowledge by exploring other domains or disciplinaries. This is a difficult task that requires time and effort, but it has promising payoffs because it aids in the retention of primary school teachers.

Second, when viewed from the perspective of practitioners, the underlying four-factor model indicates that they should be able to discuss and emphasize high-level abstraction of these areas and justify their policies accordingly. From the perspective of interested researchers, item factor loadings justify which indicator will be included in subsequent studies. Despite the fact that all items were retained in the model due to the recommended cutoff value being based on the sample size, scholars should not rely too heavily on these criteria for decision-making; therefore, future researchers are encouraged to investigate other indicators that can better explain the underlying factors posed in this study. In addition, for future research utilizing these factors to comprehend other perceptions, such as learning outcomes, the adoption of integrated teaching, or actual teaching process, is suggested.

Limitations

Although the current research yielded some promising findings for primary realistic math teachers, practitioners, and future researchers, it was limited by a number of constraints. First, only 12 survey questions were examined and distributed to primary school teachers, so it is possible that additional factors were not uncovered. This issue necessitates additional research because it provides researchers in this field with a rigid investigational framework. Second, scholars should consider is a review of the literature on the factors that influence teachers' perceptions of the need to integrate realistic math into primary education. Third, the Cronbach's alpha value of the scale was barely adequate (approximately 0.70), necessitating additional research in other regions to confirm the findings. Fourth, other statistical techniques such as multivariate linear regression, cluster analysis, and qualitative analysis were not employed in the current study, which may not provide a complete picture of teaching realistic math in elementary schools.

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Authorship Contribution Statement

Giang: Concept and design, data acquisition, data analysis/interpretation, securing funding, final approval. Chau: Drafting manuscript, statistical analysis, admin, technical and material support. Chung and Bich: Data acquisition, data analysis/interpretation, critical revision of manuscript, supervision.

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