DIMENSION OF MOTIVATION AND ENGAGEMENT OF SCIENCE CURRICULUM HIGH SCHOOL STUDENTS TAKING HOME ECONOMICS CLASS: DEVELOPMENT OF MEASUREMENT SCALE THROUGH EXPLORATORY FACTOR ANALYSIS

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ABSTRACT: *Different disciplines require different levels of motivation and engagement in learning. In the case of the high school students enrolled in a science curriculum taking Home Economics class, there is no available measurement scale that will determine the level of motivation and engagement in the subject. To address this research gap, the researcher developed 99 question items for motivation and engagement in learning Home Economics during online class from FGD, a thorough review of previous studies and theories relating to the level of motivation and engagement of students. The 99 question items that were developed were utilized in an online survey among Grade seven and eight science curriculum high school students. One hundred eighty-one (181) students responded to the survey via Google Form. The data collected were analyzed using Exploratory Factor Analysis to evaluate the factor scales and to examine the appropriateness of the items included in the measurement scale. Results from the data analysis revealed three factors bearing an Eigenvalue of one or higher. These three factors have an explained variance of 37.90%. The factors were labeled as social engagements for factor one, academic goals for factor 2, and challenges in learning online modality for factor 3. The findings provided a shred of solid evidence that students who are enrolled in a science curriculum have the willingness to achieve with social interactions and an effort in doing the activities despite the challenges posed by the online learning modality. Recommendations for further studies are discussed in this study.*

Keywords*:* EFA, Engagement, Home Economics Class, Measurement Scale Development, Motivation, Science Curriculum.

INTRODUCTION

The MSU – IIT is known for its excellence in science and technology and ranked 1 in the Philippines for the year 2022 by the AD Scientific Index (Alper-Doger Scientific Index) [1]. It has a laboratory school in the College of Education, the Integrated Developmental School. This school is a science curriculum high school offering Home Economics subjects, particularly in Grades 7 and 8 only [2]. Home Economics is one of the strands in a big umbrella called the Technical Vocational Livelihood Education of the K-12 curriculum [3]. Students from these grade levels earn skills in different components such as food and nutrition, home management, child development, and others [4], ensuring that the graduates produced are holistic and excel in their chosen career pathways [5].

Unfortunately, COVID 19 pandemic happened, and the so-called new normal [6] brought about by the pandemic had heavily disrupted the education sector all over the world. Educators face difficulty motivating students to continue learning during the COVID-19 pandemic [7]. Students believe online education reduces motivation due to a lack of social interaction, a mismatch between expectations and content, organizational issues, and learning environment organization [8]. In the study of Saeed, motivation and engagement are very important in high achiever students [9]. Students have different levels of motivation and engagement in different disciplines [10].

The need for different motivation scales in different subjects stems from the fact that different subject areas have their discipline structure and mode of inquiry [11]. Furthermore, the motivation level of students in learning a subject is unique to that subject [12]. The Academic Motivation Scale by Ryan and Deci [13] is relevantly used by scholars as the basis for further studies on the level of motivation of the students. It also led to the development of scales for a specific subjects such as Science and Mathematics. A great example is the Motivation Scale towards Physics Learning (MSPL), developed by Ince, Cagap, and Deneri is used to measure the motivation of pre-service science teachers in learning Physics in Turkey [14]. Another scale was developed for the subjects English, Mathematics, and Science by Green, Martin, and Marsh to evaluate the multidimensional motivation and engagement of students' cognition and behaviors of high school students in these subjects [15].

In the case of the Integrated Developmental School (IDS), which is a science curriculum, and which students are expected to excel in the STEM (Science Technology, Engineering, and Mathematics) track, learning Home Economics subject may demand a different level of motivation and engagement. Therefore, this study aims to develop a measurement scale that will subsequently assess the level of motivation and engagement of students who are learning Home Economics in an online modality in a science curriculum. Specifically, this study will seek to determine the underlying factors that influence the student's motivation and engagement of students in a Science Curriculum learning Home Economics in an online modality.

METHODOLOGY

Research Design

This study employed the exploratory sequential mixed-method research design. An initial qualitative data collection and analysis is done through a Focus Group Discussion (FGD) and a thorough literature review of published articles and theories related to the level of motivation and engagement towards learning in an online modality. Items for the measurement scale were then developed by following the Scale Development Process by Hinkin [16].

Sample of the Study

This study is conducted at the IDS, the laboratory school of the College of Education (CED) of MSU-IIT during the academic year 2021-2022. The target populations are the 268

Grades seven and eight students of IDS. The sampling procedure and sample size for the qualitative and quantitative phases were done differently. For the qualitative phase, the researcher followed the proportionate stratified random sampling technique in conducting the FGD. Six (6) participants from each of the eight sections of Grades seven and eight students, for a total of 54 students, participated in the FGD. Meanwhile, eight students from each Grade seven and eight were chosen for the pre-testing.

The sampling procedure for the quantitative phase is random sampling. There were 181 Grades seven and eight students who completed the survey. The researcher utilized Google Forms and sent the link to all Grade seven and eight students' email addresses, excluding the participants of the FGD and pre-testing. It is important to note that the participants of the Focus Group Discussion are excluded from the online survey [17]. N=181 respondents satisfy the sampling size recommended in the literature [18-20]

Measurement Scale Development

The items developed in this study are anchored in the methodology suggested by Prof. Kabilan [21]. These items were generated from the Focus Group Discussion (FOTEM), review of the literature (LITEM), and theories (THEOTEM). Thirty-two items were derived from the Focus Group Discussion. Moreover, thirty-four items were from the articles related to the level of motivation and engagement of the students learning in an online modality [22-25]. Finally, 33 items were derived from the different theories on motivation and engagement in learning in an online modality [27-30]. The development of the measurement scale followed the guidelines set by Hinkin [31]. All in all, the researcher came up with 99 items. The items developed from FOTEM. LITEM, and THEOTEM were subjected to content validity by three experts in Home Economics. After the items were validated, the items were subjected to pre-testing. The purpose of pre-assessment is to ensure that actual participants understand the question items [32].

. Data Collection Method

The measurement scale that was developed served as the research instrument in this study. The survey was administered using Google Forms. To ensure that only qualified students would answer the survey, a filtering question was asked at the beginning of the survey. The data collection was done in the whole month of June 2022. Each item was measured with a Five-point Likert Scale (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree.

Data Analysis

The data collected in this study was analyzed through Exploratory Factor Analysis [6] using SPSS [33]. Before the data were subjected to EFA, the researcher conducted data cleaning. Data cleaning is a process to ensure that data are free of irrelevant and incorrect information, also known as "dirty data" [7]. The data cleaning consisted of checking for missing data, coding of data, and recoding of negative statements. Furthermore, statistical assumptions for EFA were satisfied first before running the data using the Principal Component Analysis and Varimax Rotation [34].

In this study, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy test and Bartlett's Test of Sphericity were used to assess the suitability and adequacy of the sample data for EFA. The KMO test yielded 0.741 which is greater than 0.50, signifying that the sample size to run EFA is adequate [8]. In addition, Bartlett's test of sphericity is 0.000 which means lower than the significant ($p < 0.05$), hence, the variables in this study were related. With these assumptions met, the data analysis proceeded with the Exploratory Factor Analysis [35].

During the data analysis, it was found that there were no statistical outliers in this study. It is noted that the data collection was done through Google Forms, and the respondents were restricted to answer only one to five as indicative of the Likert Scale. This prevented the introduction of outliers in the data collected.

Following the item analysis, EFA was conducted using the principal component analysis method to explore the structure of the questionnaire [36]. Results from the EFA showed that factors with less than 0.40 were removed, as suggested by Watkins [37]. Varimax rotation was used to interpret the results easily and maximizes the variances of the retained components so that the total amount of variance attributed to is redistributed over the established three extracted components [38]. The researcher rerun the data to EFA to ensure that all items bearing the low communalities were removed until there was no item that had a communality value below (<.40). With 99 input variables, Principal Component Analysis (PCA) initially extracted 29 factors (or "components") bearing Eigenvalue higher than 1 [37].

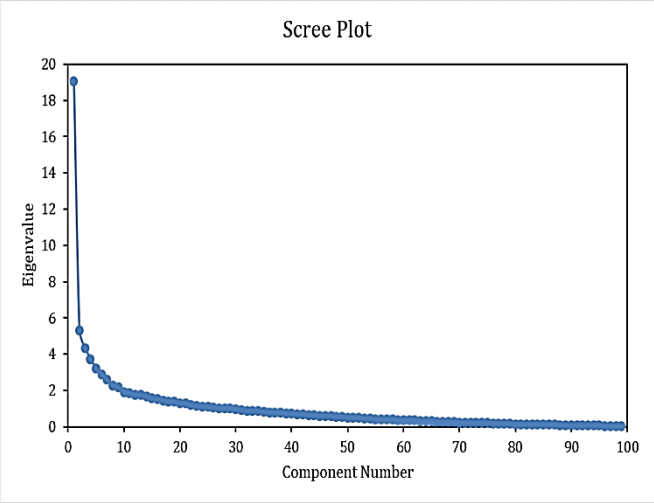

Figure 1. Scree plot for the Measurement Scale of Factors that Influence Motivation and Engagement of high school students in a Science Curriculum in learning online Home Economics

The researcher examined the content of the items with high loadings from each factor to see if they fit together conceptually and could be named. Items with low loadings and cross-loadings were subjected to elimination. Eliminating items should always be followed by a rerun of the EFA to ascertain that the factor structure is retained [39]).

RESULTS

From the initial 99 inputs, the PCA extracted 29 components or factors with Eigenvalues 1 and higher. However, from this factor loadings, the researcher observed cross-loading of items which became indicative of deletion. After the deletion of items with cross-loadings, the components to be considered dropped from 29 to 3. Table 1 presents the factor analysis using three (3) components, a total of 57 items were found to have low loadings and cross-loadings leaving only 42 items for the final structure. It was found to account for 37.91% of the total variance

Table 1. The Factors That Explained the Motivation and Engagement of Science Curriculum Students Learning Home Economics

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.22	26.10	26.10	11.22	26.10	26.10	11.01	25.61	25.61
2	2.92	6.78	32.88	2.916	6.78	32.88	3.11	7.24	32.85
3	2.16	5.03	37.91	2.161	5.026	37.91	2.18	5.06	37.91

Note: Extraction Method: Principal Component Analysis

This can be supported by the screen presented in Figure 1 that showed a sharp drop (elbow) on factor 3 [37]. With this evidence, the researcher considered these 3 components as the factors that shaped the level of motivation and engagement of high school students in a Science Curriculum in learning online Home Economics class.

On the first factor analysis using three (3) components, 57 items were found to have low loadings and cross-loadings and were deleted leaving only 42 items for the final structure. The 3 factors that shaped the level of motivation and engagement of high school students in a science curriculum in learning online Home Economics class. Table 1 shows the sample items for each factor. Based on the results of this study, components labeled as (a) Social Engagements; (b) Academic Goals; and (c) Challenges in Online Learning are the factors that influence of motivation and engagement of high school students in a science curriculum in learning online Home Economics class.

Table 2. Sample question statements for each factor that emerged during EFA

Factor 1 Social Engagement	Factor 2 Academic Goals	Factor 3 Challenges in Online Learning
Q12. I like to participate in the activities of my online Home Economics class.	Q8. I prefer studying Home Economics at home than in the classroom.	Q35. There are competencies that I want to learn but our online class in Home Economics hinders them.
Q22. My teachers in my online Home Economics class inspired me to perform well in my class.	Q9. Studying Home Economics in an online setup is preferable for me to avoid procrastination.	Q36. My motivation to study Home Economics class depends on the topics being discussed.
Q29. If I am a group member, I will do the assigned tasks promptly in my online Home Economics.	Q11. Learning topics about Home Economics is easier online than face-to-face.	Q76. I find it difficult to understand our discussion during our online class in Home Economics

Factor 1: Social Engagement

For factor 1 (Social Engagements), twenty-eight items emerged. The items on this factor embody the importance of social interactions to the motivation and engagement of the students in learning Home Economics in an online modality.

Factor 2: Academic Goals

Factor 2 (Academic Goals) has six items that describe students' motivation to achieve high academic progress, as stated in the study of Monteagudo-Martinez et al. [40]. These items were also in consonance with the Theory of Reasoned Action by Fishbein and Ajzen[41], which stated that when the individual has a strong desire, more effort will be exerted to learn. Students of MSU-IIT IDS are considered high achievers, and given that getting a final grade of below 75 in any subject or component is grounds for expulsion, it is no wonder that academic competence is also part of their motivation in their Home Economics class.

Factor 3: Challenges in Online Learning

Factor 3 (Challenges in Online Learning) has four items that indicate that there are competencies and lessons that students struggle to learn despite their willingness to learn due to the online modality. Despite being "digital natives" and high achievers, students of IDS are not immune to the obstacles faced by students around the globe during online learning – unstable internet connection, poor learning environment, and need for technology support [42, 43].

CONCLUSION

With no definite date as to when the pandemic will end (WHO, 2022), most educational institutions have already incorporated online learning in their educational systems. As such, it is already assured that online learning modality on its own or incorporated as blended learning will continue to reshape the educational system. As Home Economics in the

Philippines is taken up by early adolescent learners who are still new to the physical and psychological changes they experience, a continued shift in the educational set-up will most definitely be an added strain to them. The result of this study has confirmed that the biggest factor that influences the motivation and engagement of students in the science-based curriculum is social engagement. This means that for successful integration of online learning in education, schools must be sensitive in ensuring that social interaction and communication between teachers and students, and among students is maximized and embedded in the curriculum. Furthermore, since academic goals are the second biggest factor affecting the motivation and engagement of students in the science-based curriculum, learners must also be scaffolded by teachers for them to be adept in self-directed and self-regulated learning. Part of being self-directed learners, they must also be given support in navigating online learning by providing them access to digital tools and resources and teaching them how to use them efficiently and effectively. These supports, hand-in-hand, will benefit the students in motivating and engaging them in their classes, especially in-Home Economics. Additionally, the instrument scale developed in this study can be used to assess students and provide meaningful insights as to which support can be given to students enrolled in an online class.

RECOMMENDATION

It is recommended that the measurement scale developed in this study will be conducted on students from other high schools following the K-12 curriculum to capture a broader picture of the motivation and engagement of learners enrolled under the aforementioned curriculum. More work can also be done to examine the factor structure of the measurement scale presented and develop a better-revised version considering the low loading of factors academic goals and challenges in online learning and an unequal number of items under each factor. Though it is not necessary for each factor to have an equal number of items, a more balanced distribution of items among factors may produce a more efficient instrument. As some schools are transitioning into blended learning, combining face-to-face and online learning modalities, this can also be a field of research wherein a similar study presented in this paper can be done.

This initial measurement scale can be confirmed in other situations or if this is true in all situations. With the factors from the measurement scale, further investigation should be done on the factors from the result of this study. Furthermore, following the recommendation of [37], Confirmatory Factor Analysis should follow to verify the factor structure of the developed measurement scale. With CFA, it can further establish the relationship between the observed variables and their underlying latent constructs [44], specify the number of factors required, and these can be used to confirm or reject the measurement theory.

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