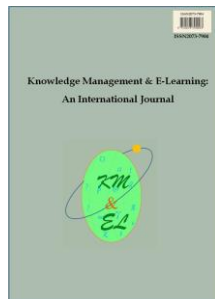

**Transactional distance in a flexible learning environment:
Scale development and validation in the Philippine context**

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Transactional distance in a flexible learning environment: Scale development and validation in the Philippine context

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Abstract: The aim of this paper is to develop a reliable and valid transactional distance scale in a flexible learning environment from the perspectives of students of a higher education institution in the Philippines. To achieve this goal, the researcher assessed the construct validity and reliability of the scale by using the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Additionally, Cronbach alpha was used to test the internal consistency of the items. The model revealed three-factor structure anchored on Moore's Transactional Distance theory namely structure, learner autonomy and dialogue. The model validates the previously extracted factors along with the items. The findings of this study revealed that the implementation of flexible learning in the Philippine context is a multidimensional construct and serves as a critical success factors. The proposed transactional distance scale in a flexible learning environment may serve to facilitate the implementation of flexible learning in higher education institutions thereby implementing flexible learning effectively and efficiently. Little literature and studies exist on the implementation of flexible learning anchored on transactional distance theory. Thus, this attempts to bridge this gap in the existing literature and studies. This three-factor model of flexible learning in a higher education institution anchored on Transactional Distance Theory would be a useful tool to assess the perception of students towards the implementation of flexible learning in a new normal environment.

Keywords: Flexible learning; Transactional distance; Exploratory factor analysis; Confirmatory factor analysis; Higher education

Biographical notes: Dr. Tria currently serves as the Director for Research and Development Services and faculty member of the College of Education at Catanduanes State University in Virac, Catanduanes, Philippines. He holds a Ph.D. in educational management and is recognized for his extensive contributions to the field. His scholarly work includes numerous published papers that have garnered international recognition and citations. Dr. Tria actively engages in both local and international conferences, presenting his research findings and insights. His expertise has been acknowledged by his appointment as an Associate Member of the National Research Council of the Philippines (NRCP). Dr. Tria has been honored as one of the Most Inspiring Teachers in the Philippines and has received the prestigious Professor Ad Honorem Vitasta Ambassador Distinction Honoris Causa. He remains an active member of various local and international education-related organizations, further contributing to the advancement of the field.

1. Introduction

“There is no going back. Flexible learning will be the new norm.” - Prospero de Vera III, Chair, Commission on Higher Education (Hernando-Malipot, 2021).

The volatility of the state of the globe is increasing in the 21st century, bringing sudden and unexpected issues such as the pandemic, economic regression, and climate change which also brought short-term and long-term domino effects to different sectors of the society particularly along politics, education and the society as a whole.

With the outbreak of the pandemic, every aspect of human life is faced with numerous challenges that were not present for the past 100 years when the world was hit with influenza, a similar situation to the COVID-19 pandemic (Matta et al., 2020). Moreover, the present pandemic has severely impacted mobility, economy and workforce, food and agriculture, academic institutions, and healthcare capacities (Shrestha et al., 2020). Such challenges demand creativity and innovativeness on how the human race will continue living with the virus.

As much as COVID-19 has contributed to the emergence of different new practices and shifts in education, it has also provided innovative ways of adapting to the new situation (Al Lily et al., 2020; Pokhrel & Chhetri, 2021). Educational leaders around the globe took immediate steps and decisions to develop and implement strategies and alternatives to mitigate the abrupt impact of the pandemic. Various countries around the world responded to the call to continue education amidst the pandemic. Schools shifted to distance learning, mostly online distance learning, and utilized various learning platforms such as, but not limited to, learning management systems (LMS), digital library, YouTube, open educational resources (OER), technology tools for collaboration, and synchronous and asynchronous broadcast. Some schools mixed the aspects of digital and non-digital tools and face-to-face and distance learning. Other education institutions were encouraged to use tools such as Facebook, Messenger, Google apps, Zoom, and many others (World Bank, 2020).

With this migration, students and teachers became temporarily physically detached, introducing the faceless teacher in times of pandemic, learning at home and social interaction have been deprived physically (Kaur & Bhatt, 2020). The pandemic has blurred the boundaries between student and teacher. Responding to this call, every government educational body formulated principles and guidelines in the delivery of education amidst pandemic to prevent learning loss and to repeat schooling (CMO, 2020; Department of Education, 2020; Schleicher, 2020, 2021).

Regardless of the continuity of schooling among students, it is a challenge for the poor sectors of the society, mainly living in the remote areas where they are deprived of online learning, blended learning, and digital access in terms of engaging themselves to promote independent learning (Schleicher, 2020). Inadequacies and inequities of the educational sectors have been exposed by several literature and studies in the local and international contexts at all levels emphasizing higher education ranging from access, learning modality, resources, support, student autonomy to learn, and many more (Alea et al., 2020; Baloran, 2020; Barrot et al., 2021; Dizon et al., 2020; Landicho, 2021; Moralista & Oducado, 2021; Toquero, 2020; Tria, 2020; Tugano et al., 2022). In addition, higher education institutions (HEIs) are challenged to reinvent learning environments, expand online networking, and complement student-teacher relationships (Mishra et al., 2020). Furthermore, administrators and teachers need to adapt to the new policies and the modes of learning schools used for which they may not have been professionally trained.

Hence, institutions need to ensure adequate and relevant training for both teaching and non-teaching personnel and students.

Throughout this crisis, education should remain immune and resistant. The reopening of schools to continue to provide educational services remains a sudden decision for everyone, from administrators to faculty and students. Despite the debate on the growth of different learning modalities offered by each educational sector, everyone must inevitably become resilient. Notwithstanding, the success and effectiveness of implementing the new normal education depend upon how its client – the students perceive such a situation.

1.1. Flexible learning in the Philippines

The COVID-19 pandemic has disrupted the traditional learning modality of Philippine higher education which primarily relies on face-to-face classes. As a result, flexible learning has emerged as an alternative modality that allows students to continue their education despite various restrictions imposed by the pandemic. Flexible learning, generally is a learning approach that provides students maximum flexibility and choice on how and when they learn, using the available technological tools. It may be synchronous or asynchronous; online, blended or face-to-face; or modular; or a combination.

This has necessitated the implementation of flexible learning and transactional distance, as its anchor. Flexible learning is a choice, not a learning modality. Focusing on its flexibility, eight (8) key dimensions were identified: 1) when and where learning occurs; 2) what and how students learn; 3) how to deliver instruction; 4) strategies for teaching and learning; 5) types of learning resources to be provided; 6) technology integration to teaching and learning; 7) assessment strategies; and 8) support and services provided (Huang et al., 2020). In addition to the dimensions mentioned above of flexible learning, Li and Wong (2018) also identified components of flexible learning. These are time, content, entry requirement, delivery, instructional approach, assessment, resource and support, orientation, and goal.

Flexible learning is the delivery of learning in a flexible manner, built around the geographical, social and time constraints of individual learners, rather than those of an educational institution. In the present situation, time constraints may refer to COVID-19 pandemic where HEIs of the Philippines offering mostly face-to-face classes before are implementing flexible learning today. The Commission on Higher Education (CHED) introduced flexible learning as a learning modality to continue teaching and learning beyond the traditional face-to-face classroom interaction. From the literature review, it was unanimously agreed that flexible learning is learner-centered. However, CHED stressed that flexible learning can be with or without the aid of technology which is in contrast with previous definitions. More specifically, flexible learning is “a pedagogical approach allowing flexibility of time, place and audience including, but not solely focused on the use of technology.” It uses delivery methods of distance education and facilities of information and communication technology (ICT), and the delivery may vary depending on the level of technology, availability of technological devices, internet connectivity, level of digital literacy, and teaching and learning approaches to ensure continuity of inclusive and accessible education when face-to-face-modality is not feasible in times of pandemic (CMO, 2020).

This indicates that flexible learning is not online in nature within the study context, as it may deploy and implement all learning modes of delivery based on

students' needs and appropriate to every HEI's situation. Thus, Commissioner Prospero de Vera said that flexible learning is the new norm, and there would be no going back to traditional face-to-face modality. Flexible learning for higher education institutions would involve a combination of digital and non-digital technology that does not necessarily require internet connectivity (Magsambol, 2021).

The Catanduanes State University (CatSU) is the only public University in the province "mandated to provide higher professional and technical instruction and training in business education and commerce; and for special purposes, to promote research, advance studies, and progressive leadership in the field of education, business education and commerce" (Congress of the Philippines, 1994, 2012). Throughout the years, the University has been adopting mostly the traditional face-to-face (f2f) instruction to students until 2020, when the pandemic suddenly and severely disrupted educational institutions, from school closures to resumption – implementing distance learning, in general. Thus, the University resorted to its learning modality exercising academic freedom to flexible learning, where generally its modality is mostly modular learning approach, due to its low level of technology in lieu of face-to-face classroom instruction (CMO, 2020). This has also reshaped the educational landscape, introducing opportunities and challenges for flexible learning implementation in most universities (Landicho, 2021; Toquero, 2020; Tria, 2020). Furthermore, the delivery may vary depending on the level of technology, availability of technological devices, internet connectivity, level of digital literacy, and teaching and learning approaches to ensure continuity of inclusive and accessible education when face-to-face modality is not feasible in times of pandemic (CMO, 2020). This study reports findings from a case of one of the higher education institutions in the Philippines implementing flexible learning.

1.2. Transactional distance theory

Transactional distance is the "psychological and communications space of potential misunderstanding between the inputs of the teacher and those of the learners." In addition, it is the "gap between the understanding of the teacher and learner," and distance education is the methodology of structuring courses and managing dialogue between the teacher and learner to bridge that gap through communications technology (Moore & Diehl, 2018).

Transactional Distance Variables refers to the elements, components or factors of transactional distance theory which include structure, learner autonomy and dialogue.

Dialogue pertains to the interaction between teacher and learners, including the amount and quality of the interaction along the teaching and learning process (Delgaty, 2018; Moore & Anderson, 2003; Moore & Diehl, 2018; Moore & Kearsley, 2005). It includes communicating either between students and faculty, among student themselves through consultation, providing immediate feedback and communicating status of class performance.

Learner Autonomy is the degree to which students control the teaching and learning process along with learning outcomes, learning experiences, and assessment of learning. It can be measured by looking at students' resourcefulness, self-directedness, independence, and reflective of their own learning (Delgaty, 2018; Moore & Anderson, 2003; Moore & Diehl, 2018; Moore & Kearsley, 2005). Within the context of flexible learning, the autonomous learner is a student who can find additional learning resources to answer their questions, synthesize information, and process their learning without the teacher's help.

Structure is the rigidity or flexibility of the program's educational objectives, teaching strategies, and evaluation methods. It is also described as how the educational program can accommodate or be responsive to the student's needs (Delgaty, 2018; Moore & Anderson, 2003; Moore & Diehl, 2018; Moore & Kearsley, 2005). In addition, it is also the overall design and quality of the program, courses, and learning intervention strategies to address learners' unique needs covering both digital and non-digital technology (CMO, 2020).

The implementation of flexible learning shares previous distance learning models, particularly the Transactional Distance Theory. Since flexible teaching and learning today is being implemented in schools due to the challenges brought by the pandemic, it is undoubtedly that the use of technology in teaching and learning is vital in order for the students and teachers to communicate and interact despite physical distance. Moore (1997) described the term "transactional distance" as the separation between the teacher and student, not only physically but also separated psychologically and sociologically. Thus, this separation termed as "transactional distance" described the relationship among three factors, namely structure, learner autonomy and dialogue. Even in traditional face-to-face education, there is transactional distance and therefore this theory is a subset of all teaching and learning modalities (e.g., face-to-face, blended, online, distance, flexible, synchronous and asynchronous) (Delgaty, 2019).

Transactional Distance Theory is applicable in the flexible teaching and learning implementation in the new normal. It also allows a unique and relatively unexplored application of the theory in the flexible learning environment. Most of the related studies reviewed anchoring on transactional distance theory were a major effort to verify the theory from various learning environments and situations. Pre-pandemic studies focused mainly on the development of the research instrument on transactional distance (Zhang, 2003; Horzum, 2011; Goel et al., 2012; Larkin & Jamieson-Proctor, 2015; Lane, 2017; Weidlich & Bastiaens, 2018), linked the theory to competencies (Abdulla, 2004), satisfaction (Burgess, 2006), self-efficacy (Falloon, 2011), uncovering student perceptions (Ustati & Hassan, 2013) and engagement and outcomes (Bolliger & Halupa, 2018). Amidst the pandemic, studies were conducted to describe and explore transactional distance (Cahapay, 2020; Ilagan, 2020; Lindner et al., 2020; Davis et al., 2021; Kegley et al., 2021; Talikan, 2021), to examine dimensions of transactional distance in an online learning environment (Gavrilis et al., 2020; Talikan, 2021) and to investigate perceptions towards transactional distance (Kara, 2021).

The exploration of transactional distance variables applied to different learning environments revealed that most of these studies focused on the development and validation of an instrument to measure transactional distance, which is similar to the present study (Zhang, 2003; Horzum, 2011; Goel et al., 2012; Larkin & Jamieson-Proctor, 2015; Lane, 2017; Weidlich & Bastiaens, 2018). However, differences can be argued since the present focuses on the flexible learning environment and not on other learning environments as conducted by the said studies. It is noteworthy that these studies reviewed were conducted mostly from foreign countries, and not in the Philippine context. Other studies linked the theory to competencies (Abdulla, 2004), technology (Casey, 2008), satisfaction (Burgess, 2006), self-efficacy (Falloon, 2011), uncovering student perceptions (Ustati & Hassan, 2013) and engagement and outcomes (Bolliger & Halupa, 2018). Correlations of transactional distance variables were also identified on these studies, which is not mainly the focus of the present study. Anchored to transactional distance theory, studies reviewed were mostly quantitative and some studies were qualitative. In addition, survey questionnaires were mostly used as a research instrument in measuring transactional distance variables.

Measuring transactional distance variables from different learning environments amidst pandemic were also reviewed since the present study was conducted amidst pandemic anchored on the same theory. These studies found significant bearing to the present study since all of them examined transactional distance amidst the pandemic (Cahapay, 2020; Gavrilis et al., 2020; Ilagan, 2020; Kara, 2021; Lindner et al., 2020; Loose & Ryan, 2020; Davis et al., 2021; Kegley et al., 2021; Iyer & Chapman, 2021; Talikan, 2021).

Several studies have suggested several limitations and that result depends upon how the transactional distance theory is being applied to various learning environments. In case of the Philippine setting, flexible learning is yet to evolve in its fullest manner. Therefore, the objective of this study is to study existing theoretical framework – the Transactional Distance Theory and develop a reliable and valid scale for ensuring effective and efficient implementation of flexible learning in the Philippines.

Assessing the effectiveness of implementing flexible learning in higher education within the context of the Philippines is crucial and essential. Moreover, examining transactional distance variables as significant constructs in the implementation of such a learning modality during a pandemic context is equally important. Hence, the author aimed to develop and validate a transactional distance scale from students' perspectives in a flexible learning environment. A survey instrument was distributed among students who were experiencing firsthand the implementation of flexible learning. This survey will provide higher education institutions, particularly in the Philippines, with important factors and constructs to focus on during the implementation of flexible learning, ensuring its effectiveness.

2. Research methods

The study involved 350 college students who were randomly selected from different year levels and colleges of the University. The data collection process involved a survey administered for over a period of three weeks, resulting in 336 returned questionnaires (96% retrieval rate). Subsequently, thirteen cases were excluded from the analysis due to incomplete surveys or the presence of multivariate outliers. The remaining 323 cases (92%) were utilized for both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

Among the 323 respondents, a greater number of females ($n = 189$, 58.5%) than males ($n = 134$, 41.5%) participated in the study. The age range of the respondents was 18 to 23 years old, with 60% falling between 19 to 21 years old. The distribution of respondents across year levels was as follows: 104 (32.2%) first-year students, 80 (24.8%) second-year students, 74 (22.9%) third-year students, and 65 (20.1%) fourth-year students. Additionally, the respondents were drawn from diverse colleges of the University, including agriculture, arts and sciences, business and accountancy, health sciences, industrial technology, information and communications technology, engineering, and education, ensuring adequate representation from various academic disciplines.

2.1. Ethical considerations

Before the distribution of research questionnaires, approval from the University Vice President for Academic Affairs (VPAA) was sought by the researcher. Participation of the respondents in this study was considered to be anonymous and voluntary. In addition, informed consent was sought from the respondents before answering the research

questionnaire. The informed consent is an important aspect of the ethical considerations for this study. The informed consent explained the researcher's affiliation with the institution, the purpose of the research and the duration of the respondent's participation, a description of procedures, voluntary nature of participation and explanation of how the data were treated with confidentiality and maintained securely.

2.2. *Data gathering procedure*

Multiple modes of data gathering procedure were employed in this study to improve response rates in the quantitative survey questionnaire. These are the following: distribution of hard-copy questionnaires to students and faculty, Google Forms, and via e-mail. To further facilitate the distribution, the research questionnaire was cascaded to each college with accompanying approved letter and attached questionnaire received by each college.

2.3. *Design and development of research instrument*

The research literature and studies guided the researcher in the design, development, and validation of the research instrument. It is also consistent with previously developed research instruments, deductive analysis of the conceptual framework, transactional distance theory, characteristics, and contextualization to flexible learning amidst pandemic. The research instrument was developed and validated following three stages of scale development from the procedures of DeVellis (2017) and Morgado et al. (2018), namely: a) item generation; b) theoretical analysis; and c) psychometric analysis.

2.3.1. *First phase: Item generation*

The present study underwent a rigorous process of item generation to ensure its content validity. The first phase of the process involved the generation of the pool of items that are reflective of the theoretical and empirical dimensions of the study. Deductive methods of item generation were employed, drawing from the extensive literature review and pre-existing scales, as described by DeVellis (2017) and Morgado et al. (2018). These pre-existing scales came from the studies of Zhang (2003), Horzum, (2011), Goel et al. (2012), Larkin and Jamieson-Proctor (2015), Lane (2017) and Weidlich and Bastiaens (2018). The researcher also considered the implementation of flexible learning based from the policies and guidelines set by the Commission on Higher Education. Additionally, the researcher ensured that all terms used in the study were conceptually and operationally defined.

The initial pool of items comprised of seventy-five (75) items (please see Appendix I; Items Inventory for the Survey Questionnaire) intended to measure the implementation of flexible learning in a higher education institution anchored on Transactional Distance Theory. The survey instrument consisted of two parts: demographic profile section which captured the respondent's information along year level and college of the student, and the flexible learning scale. The flexible learning scale comprised of items that are intended to capture various dimensions of flexible learning, anchored on transactional distance theory.

The use of pre-existing scales and rigorous literature review strengthens the validity of the research instrument and provided robust foundation for subsequent data analysis and interpretation. Thus, the study's findings can be confidently used to inform

policy and practice in higher education institution seeking to implement successful flexible learning modality.

2.3.2. *Second phase: Theoretical analysis*

Theoretical analysis was employed in the next phase of development and validation. This phase ensures that the instrument is theoretically appropriate to the study (Morgado et al., 2018). Quantitative survey research questionnaires and semi-structured interview questions were validated by a panel of experts (10), faculty (10), and students (10). During this phase, the researcher asked a small group of experts chosen based on their knowledge of transactional distance theory and flexible learning in higher education. The experts included a researcher of transactional distance theory, a professor of educational technology, faculty members, and students in a flexible learning environment.

The panel of experts were provided with theoretical and conceptual definitions of terms used in the present study and were requested 1) to evaluate each item with respect to its critical factors, namely: a) clarity; b) comprehensiveness; and c) acceptability using a five-point Likert-type scale ranging from 1 – Very weak (0-25% strength), 2 – Weak (26-50% strength), 3 – Strong (51-75% strength) and 4 – Very Strong (76-100% strength); 2) to give comments on the items; and 3) to suggest other items that are deemed relevant to the study as used by Rea and Parker (2014). Table 1 shows the result of the validation of the items in the questionnaire along with the critical factors, namely: a) clarity; b) comprehensiveness; and c) acceptability, with its equivalent quantitative and qualitative description in Table 2.

Table 1
Research questionnaire’s validity based on clarity, comprehensiveness and acceptability

Transactional distance variables	Clarity WM	Comprehensiveness WM	Acceptability WM
Structure	3.73 (VS)	3.73 (VS)	3.75 (VS)
Learner autonomy	3.63 (VS)	3.66 (VS)	3.66 (VS)
Dialogue	3.74 (VS)	3.76 (VS)	3.79 (VS)

Note. WM = Weighted Mean; Source: Rea and Parker (2014)

Table 2
Legend

Scale	Quantitative Description	Qualitative Description
4	76% to 100% strength	Very Strong (VS)
3	51% to 75% strength	Strong (S)
2	26% to 50% strength	Weak (W)
1	0% to 25% strength	Very Weak (VW)

2.3.3. *Psychometric analysis*

The third phase which is the psychometric analysis allowed the researcher to assess the questionnaire’s construct validity and reliability. Thus, the researcher pilot-tested the research instrument to generate data of the study for psychometric analysis purposes. The respondents were asked to respond to the survey items by making their agreement level on each item using a five-point Likert scale (from 5 = strongly agree to 1 – strongly

disagree). This analysis was also guided by the studies of Agariya and Singh (2012), Ejubović and Puška (2019), Kang et al. (2020), and Tikoria and Agariya (2017) along scale development and validation.

3. Analysis and results

The researcher assessed the construct validity and reliability of the research instrument. Construct validity is concerned with the question of what the instrument is in fact measuring (Morgado et al., 2018). Construct validity was assessed using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). In addition, Cronbach alpha was used to test the internal consistency of the items in the research instrument. The data generated in the survey were tested using EFA, CFA and Cronbach alpha. It is a rule of thumb that there should be at least 300 respondents which is ideal for CFA (Tabachnick & Fidell, 2007).

3.1. Exploratory factor analysis

The factor analysis is one of the most common procedures in the development and validation of psychological constructs. Exploratory factor analysis (EFA) is used to reduce the set of variables into a smaller, more meaningful set of factors by looking for clusters of variables that appear to be related to one another and therefore may be tapping into the same underlying factor. EFA is one of most popular statistical tools in assessing theories, exploring scale's validity and for reducing dimensionality of sets of variables for further statistical analyses (Teo, 2013).

In this study, EFA was applied using IBM-SPSS. Several iterative cycles of factor analysis were conducted on the data set. The total variance explained and number of factors extracted were examined after each iteration. Kaiser-Meyer-Olkin (KMO) and Bartlett Sphericity test were applied to determine whether the 75-item scale fit the factor analysis or not. The Kaiser-Meyer-Olkin (KMO) value, which is used to determine whether the data and the sampling size are appropriate for factorization and the value was found to be 0.950. In addition, Bartlett Sphericity test, which is used to check whether the data come from multi-variate normal distribution or not, was applied and the result (Chi-square = 30832.526, $df = 2775$, $p < .01$) was found to be significant. It is necessary that the KMO measurement test result is 0.60 and over and the result of the Bartlett Sphericity Test is statistically significant, minimum acceptable coefficient is 0.60 according to Tabachnick and Fidell (2007). Since the values obtained as a result of the above-mentioned analysis fit the basic hypotheses at good level, it was decided that factor analysis could be conducted. Seventy-five items relating to the implementation of flexible learning anchored on Transactional Distance Theory were factor analyzed using principal components factor analysis with varimax rotation. Rotation was employed to make the factor loadings more meaningful in terms of clearly associating the variable to its factors (Sass & Schmitt, 2010). Varimax rotation is one of the most widely used methods for factor rotation and the most reasonably effective rotation technique under study after reiteration and comparison with other rotation (e.g., oblique rotation) (Teo, 2013).

Since the factor loads show the correlation between the item to be measured and the main structure, the relevant dimensions that appeared as a result of the principal components analysis and the factor loads were examined. In addition, communalities were also carefully examined in order to understand the quality of the factor solution. The rotated components matrix, which was converted with Varimax method, and which was

obtained as a result of exploratory factor analysis. Varimax method is one of the vertical rotating methods. It was used to ensure that factor variances would have high value with a few variables or items in the scale. The factor analysis revealed three factor structure, explaining 67.109% of the variance, and all items above 0.70 are considered acceptable item loading (Teo, 2013).

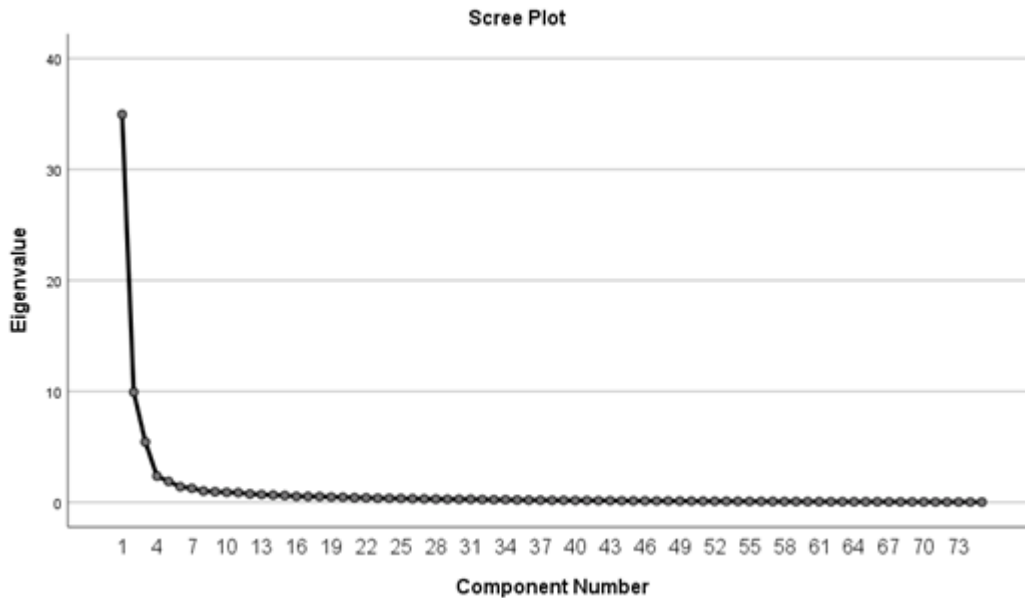


Fig. 1. Scree plot of 75 items analysed for exploratory factor analysis

Since the goal of employing EFA is to reduce our set of variables down, it would be useful to have a criterion for selecting the optimal number of components that are of course smaller than the total number of items. One criterion is to choose components that have eigenvalues greater than 1. As shown in the scree plot, we see the first three components have an eigenvalue greater than 1 (34.96 – first factor, 9.93 – second factor and 5.44 – third factor respectively). This can be confirmed by the Scree Plot which plots the eigenvalue (total variance explained) by the component number.

Using both the scree plot and eigenvalues > 1 to determine the underlying components or factors (Teo, 2013), the analysis yielded three factors as shown in Fig. 1 and was confirmed during the final repetition of test. At least three measured variables are needed for statistical identification of a factor although more indicators are preferable and recommended four to six indicators per factor (Watkins, 2018). Since the EFA revealed a three-factor solution, another repetition of test selecting the ten items in each factor with the topmost initial regression weights was saliently loaded using EFA.

To determine the factors, the eigenvalue represents the total amount of variance that can be explained by a given principal component. Therefore, the first component explains the most variance (structure), and the last component explains the least (dialogue). Thus, the order of the variables in the Transactional Distance Theory were changed from dialogue, structure and learner autonomy to structure, learner autonomy and dialogue based from the Eigenvalue. After several tests, the structure (15.09) explains the most variance in this study, next to it is the learner autonomy (4.97) and

dialogue (2.94). This implies that the change in the order of the transactional distance variables is evident in this study in the present context which is flexible teaching and learning amidst pandemic and deals with Filipino students, particularly students from CatSU compared to Moore's seminal theory which involved foreign students in a different teaching and learning environment.

The first factor consisted of items associated to structure, second factor associated to learner autonomy and the third factor associated to dialogue. Items were significantly reduced to ten items in each factor considering the largest values in their standardized regression weights or factor loadings in EFA (Teo, 2013; Watkins, 2018). Thus, items with the smallest values for factor one (Structure - Items 10, 7, 5, 12, 19, 21, 14, 4, 24, 3, 11, 25, 2, 23 and 1); for factor two (Learner autonomy - Items 16, 14, 4, 20, 8, 15, 3, 10, 18, 2, 7, 1, 9, 25 and 24) and factor three (Dialogue - Items 20, 10, 18, 19, 7, 3, 24, 9, 23, 25, 2, 1, 6, 5 and 4) were deleted.

On the other hand, items with the largest values for factor one (Structure - Items 17, 22, 8, 18, 13, 15, 9, 16, 6 and 20); for factor two (Learner autonomy - Items 13, 17, 22, 6, 23, 19, 12, 11 and 21) and for factor three (Dialogue - Items 14, 12, 13, 11, 8, 21, 15, 16, 17 and 22) were retained. These items were further analyzed using confirmatory factor analysis (CFA). After the repetition of tests with the remaining 10-item in a 3-factor model, Table 3 presents the retained items with their factor loadings in the proposed (75-items) and modified (30-items) flexible learning implementation scale. It is noted that after the reduction of the items, the factor loadings in most of the items increased.

3.2. Confirmatory factor analysis

In addition, confirmatory factor analysis (CFA) was also employed to assess whether a pre-defined factor model fits the data. It is a common practice in educational research that CFA is used in terms of scale validation, construct validation and evaluating measurement invariance of a newly developed measure. After the evaluation of the initial pool of item using EFA, the research moved to CFA to provide a more rigorous evaluation of how the theoretical model (Transactional Distance Theory), with factors structure, learner autonomy and dialogue and its items represents the observed data.

According to Tabachnick and Fidell (2007), a sample size is optimal for CFA if there are at least 10 cases per parameters estimated. As this analysis included 30 parameters estimated, the sample size is optimal with at least 300 cases with actual 323 cases. There was minimal missing data on the items (2%), these missing values were replaced with median.

As reflected on Fig.2, the hypothesized three factor model which includes structure, learner autonomy and dialogue as latent factors, and ten items in each factor were hypothesized to serve as indicators. The three latent factors were hypothesized to covary with each other. The hypothesized model was then tested, and indicators of model fit were examined. There are many measures of overall model fit which have been developed and used by other researchers. Using multiple measures, the researcher employed the following model fit measures: Chi-square goodness test (CMIN/DF), Goodness of Fit Index (GFI), Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA) were examined for CFA. In these goodness of fit indices, CMIN/DF between 1 and 3, CFI > 0.95, GFI > 0.90, SRMR < 0.08 and RMSEA < 0.06 are considered fit (Hu & Bentler, 1999).

Table 3
Factor loadings of the flexible learning implementation scale (proposed and modified)

Item code	Description	Factor loading (proposed 75-item scale)	Factor loading (modified 30-item scale) *
Component 1: Structure			
S_6	The curriculum/learning materials provided are based on the most essential competencies needed in flexible learning.	.799	.786
S_8	The learning materials provided are outcomes-based.	.818	.801
S_9	The learning materials provided are complete, as to what is indicated in the Outcomes-based Education (OBE) course syllabus.	.802	.813
S_13	Learning contents are up-to-date and relevant.	.814	.837
S_15	Objectives of the course matched with assessment tools (e.g., Midterm and Final Exams).	.806	.836
S_16	Directions in the learning materials are clearly given.	.800	.840
S_17	Adequate course contents are provided.	.841	.870
S_18	Learning materials are written in a conversational way promoting communication between me and the learning material.	.817	.832
S_20	The learning content and activities are given with flexibility based on the availability of technology (e.g., hard-copy, soft-copy, online, etc.).	.788	.808
S_22	Learning activities and assessment tasks promote worthy effort of the students to do their best.	.820	.832
Component 2: Learner autonomy			
LA_5	I can easily understand the parts and contents of the learning material on my own.	.789	.748
LA_6	I can provide constant reminder to myself whenever activities and tasks are needed to be submitted to the teacher.	.814	.798
LA_11	I can decide on my own, the best learning platform I want to learn.	.793	.815
LA_12	I can use the same technological tools similar to my classmates.	.796	.808
LA_13	I know multiple ways on how to communicate with my teacher and classmates.	.833	.850
LA_17	I can synthesize information and create new knowledge by myself.	.829	.815
LA_19	I know my weaknesses and strengths in learning.	.806	.856
LA_21	I can regulate my own learning.	.792	.847
LA_22	I enjoy discovering things on my own.	.825	.877
LA_23	I am responsible for my own learning.	.806	.866
Component 3: Dialogue			
D_8	My teacher automatically responds to my academic concerns.	.787	.762
D_11	I seek advice from my classmates regarding the content, learning activities, assignments and assessment tasks given by the teacher.	.804	.813
D_12	My classmates seek advice from me regarding the content, learning activities, assignments and assessment tasks given by the teacher.	.830	.832
D_13	I seek advice/consultation with my teacher regarding my learning progress.	.818	.849
D_14	My learning progress is communicated by my teacher (e.g., assessment scores, room for improvement, etc.).	.832	.862
D_15	My teacher provides feedback on my work.	.786	.839
D_16	My teacher provides feedback on the class performance.	.777	.804
D_17	I provide feedback to my teacher.	.776	.824
D_21	The extent of communication between me and my teacher is frequent.	.786	.782
D_22	The extent of communication between me and my classmates are frequent.	.765	.730

Note. *The factor analysis for the modified scale revealed three factor structure, explaining 76.629% of the variance

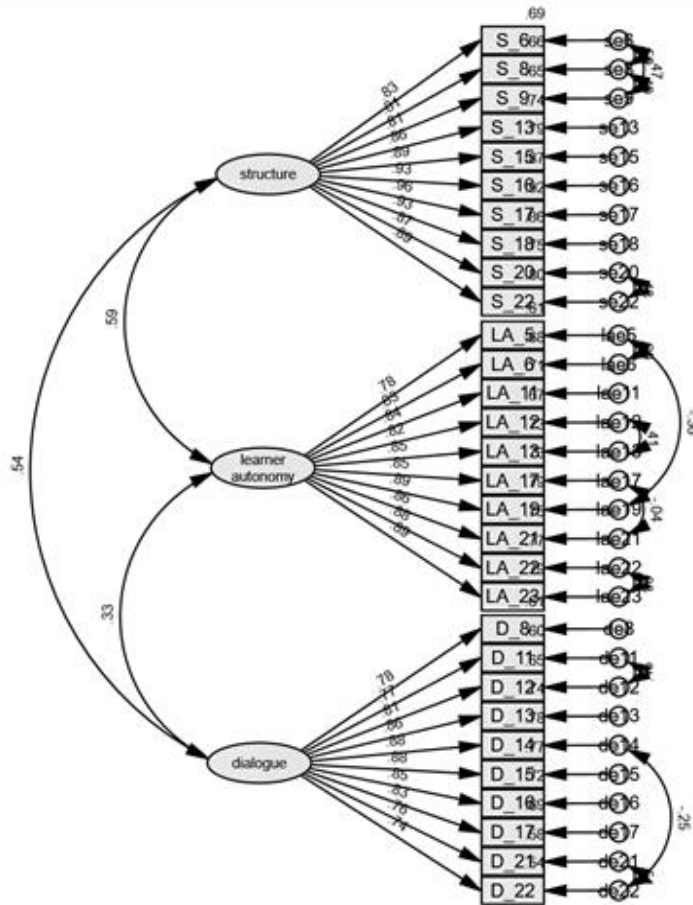


Fig. 2. Confirmatory factor analysis model of modified flexible learning scale

CFA was applied using IBM-SPSS AMOS version 20 to three factors extracted in the exploratory factor analysis namely structure, learner autonomy and dialogue. The structure of the flexible learning scale, which consisted of 10 items in each factor, was further tested using CFA. The findings obtained as a result of analyzing the model with confirmatory factor analysis are as follows.

Most of the fit indices employed meet the requirements for analysis even though GFI did not exceed 0.90 threshold, they still meet the requirement as suggested by Baumgartner and Homburg (1996) and Doll et al. (1994) if its value is above 0.80. Goodness of fit statistics indicated that the model was found to be acceptable fit for the data, presented in Table 4. CMIN/DF, CFI, GFI and RMSEA values for the model are acceptable, while RMSEA values was found to be excellent. Thus, these measures are evidences of a good fit model. The table below shows the measure employed, estimate, threshold and its interpretation (Hu & Bentler, 1999).

It is noteworthy that the factor-solution in the CFA resulted in a uniform ten-items in each factor which met the requirements of the goodness of fit statistics. Although, the

research estimated to add and delete some acceptable items in each factor in the model, the goodness of fit statistics resulted to “terrible” and needed modification of the model and resulted to a ten-item, three-factor model. However, one of its limitations is that the hypothesized model did not achieve an excellent fit (mostly acceptable) to all the measures employed. Thus, a replication of the development and validation from different set of respondents is recommended to further strengthen its construct validity.

Table 4
Summary of model fit measures

Measure	Estimate	Threshold	Interpretation
CMIN	1239.415	--	--
DF	390.000	--	--
CMIN/DF	3.178	Between 1 and 3	Acceptable
CFI	0.931	> 0.95	Acceptable
GFI	0.806	> 0.90	Acceptable
SRMR	0.056	< 0.08	Excellent
RMSEA	0.079	< 0.06	Acceptable

Note. Measure, threshold and interpretation from Hu and Bentler (1999)

Generally, all the standard fit indices showed that the factor structure of the model is acceptable. The theoretical model has several interesting features worth noting. First, it contains both latent (unobserved) and manifest (observed) variables, ten items in each of the factors. These latent variables are structure, learner autonomy and dialogue. The observed variables are the different items in the modified scale. Second, it contains correlational relationships among latent variables and some of the residuals. These are represented by the double-headed arrows. The correlations between the residuals account for the additional shared variance. Modifications were made to improve the model fit as well as to make the research instrument practical and efficient by reducing the number of items using EFA and CFA.

3.3. Internal consistency test (Cronbach alpha)

The alpha coefficient is regularly used in measuring the internal consistency of the scale. Thus, reliability was measured by interpreting the value of Cronbach alpha. A coefficient greater than 0.70 shows that each statement of the survey questionnaire passes the internal consistency test. Cronbach alpha results ranged from 0.953 to 0.982, as shown in the Table 5 below (for each variable) with its corresponding interpretation. Hence, structure, learner autonomy and dialogue indicated a high internal consistency.

Table 5
Cronbach alpha reliability index (modified scale); *N* = 323

Variable	Num of items	Cronbach alpha value (Implementation Scale)	Interpretation	Cronbach alpha value (Importance Scale)	Interpretation
Structure	10	0.973	Excellent	0.982	Excellent
Learner autonomy	10	0.963	Excellent	0.973	Excellent
Dialogue	10	0.953	Excellent	0.971	Excellent

In summary, all the 30 items loaded successfully on their intended constructs. This showed that the scale does measure what is intended to be measured. Stronger loadings were all on the items to measure flexible teaching and learning along structure, dialogue and learner autonomy. Results of the exploratory factor analysis and confirmatory factor analysis is in keeping with the studies of Zhang (2003), Horzum, (2011), Goel et al. (2012), Larkin and Jamieson-Proctor (2015), Lane (2017) and Weidlich and Bastiaens (2018) which also developed and validated a research instrument to measure transactional distance in other learning environment (e.g., online and blended).

4. Conclusions and policy recommendations

The validity and reliability of the research instrument was substantiated using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), confirming acceptable model fit. In this study EFA indicated three factors along the implementation of flexible learning, these being: structure, learner autonomy and dialogue. Through CFA, the model was tested using indices such as Chi-square goodness test (CMIN/DF), Goodness of Fit Index (GFI), Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA) for goodness of fit which indicated a good fit.

Therefore, transactional distance variables such as structure, learner autonomy and dialogue are very relevant and timely in order to improve the implementation of flexible learning in a higher education institution. Thus, strengthening these variables may provide effective and efficient implementation of flexible learning in the new normal environment.

The COVID-19 pandemic has brought significant changes to the education sector, particularly in the way we deliver and receive instruction. With the adoption of flexible learning modalities in Philippine higher education institutions, it has become clear that we cannot go back to the previous traditional classroom setting as we have been changed by the pandemic. Even if we were to return to a sense of normalcy, schooling would be a series of changes and integration to the new technological advancements that have been introduced, which this theory could be applicable. The lessons learned during the pandemic have highlighted the importance of flexibility and adaptability in education, and as such, traditional classroom settings may no longer be enough. Rather, education must continue to evolve to meet the changing needs of the students and the new realities of the world we live in, to ensure sustainable and quality education.

The advancement made by Zhang (2003), Horzum, (2011), Goel et al. (2012), Larkin and Jamieson-Proctor (2015), Lane (2017) and Weidlich and Bastiaens (2018) are an excellent study of measuring transactional distance from different learning environments (e.g. web-based and online) covering Transactional Distance Theory. The study of transactional distance is becoming complex and dynamic in the new normal education (Cahapay, 2020; Gavrilis et al., 2020; Ilagan, 2020; Kara, 2021; Lindner et al., 2020; Loose & Ryan, 2020; Davis et al., 2021; Kegley et al., 2021; Iyer & Chapman, 2021; Talikan, 2021).

The results of this study could give policy makers a measure on the implementation of flexible learning, thus improving teaching and learning practices in a higher education institution. It is also recommended to ensure students and faculty to consider the three factors in the teaching and learning process – the curriculum, structure, the student's independence of learning and the interaction between students and faculty. This three-factor model of flexible learning in a higher education institution anchored on

Transactional Distance Theory would be a useful tool to assess the perception of students towards the implementation of flexible learning in a new normal environment.

Contribution of the paper:

- The study used the exploratory factor analysis and confirmatory factor analysis to develop flexible learning scale implementation anchored on transactional distance theory;
- The paper highlights the aspects of structure, learner autonomy and dialogue in a flexible learning environment;
- The methodology used in this study would guide future researchers in the development and validation of research instruments; and
- The three-factor model would be a useful tool to assess the perception of students towards the implementation of flexible learning in a new normal environment.

Author Statement

The author declares that there is no conflict of interest.

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Appendix I

Items Inventory for the Survey Questionnaire

1. Adequate assessment tools are provided.
2. Adequate course contents are provided.
3. Assessment tools in the learning material promote flexibility.
4. Communication tools (e.g., Messenger, Hangouts, etc.) are sufficiently available and accessible for me to communicate with my classmates.
5. Communication tools (e.g., Messenger, Hangouts, etc.) are sufficiently available and accessible for me to communicate with my teacher.
6. Directions in the learning materials are clearly given.
7. I am motivated to learn by myself even without my teacher's intervention.
8. I am responsible for my own learning.
9. I answer my teacher's concerns and queries.
10. I automatically respond to my academic concerns.
11. I can decide on my own, the best learning platform I want to learn.
12. I can easily follow to the flow of the learning materials given to me.
13. I can easily understand the parts and contents of the learning material on my own.
14. I can effectively and efficiently manage academic and non-academic-related tasks.
15. I can effectively and efficiently manage my time in learning at a flexible learning environment.
16. I can find additional learning resources not given by my teacher.
17. I can finish the course exactly based on the number of hours/units needed in a semester (e.g., a 3-unit course requires 54 hours to finish the course).
18. I can learn by myself with minimal supervision of my teacher.
19. I can provide constant reminder to myself whenever activities and tasks are needed to be submitted to the teacher.
20. I can regulate my own learning.
21. I can submit all the learning activities and assessment tasks on or before the specified deadline.
22. I can synthesize information and create new knowledge by myself.
23. I can use a variety of communication tools (e.g., Messenger, Zoom, Google Meet, etc.) in learning.
24. I can use a variety of digital media (e.g., Facebook, YouTube, etc.) in learning.
25. I can use a variety of software applications (e.g., Microsoft Word, PPT and excel) in learning.
26. I can use the same technological tools similar to my classmates.
27. I collaborate with my classmates whenever there are group work, activities and assignments.
28. I communicate with my teacher about my personal problems that may affect my study.
29. I communicate with my teacher personally (via private message-pm) whenever I need help.
30. I communicate with my teacher together with my classmates (e.g., Group Chats) whenever I need help.
31. I communicate with my teacher together with my classmates about the course (e.g., content, activities, and assessment tasks).
32. I do not need an instructor/professor in my study.
33. I enjoy discovering things on my own.
34. I enjoy learning by myself.
35. I enjoy learning with my classmates.
36. I feel I belong in the class.
37. I know multiple ways on how to communicate with my teacher and classmates.
38. I know my weaknesses and strengths in learning.
39. I personally think I do not need to take courses in a formal-institutionalized manner (e.g., enrolling courses) in order for me to learn.
40. I provide feedback to my teacher.

41. I seek advice from my classmates regarding the content, learning activities, assignments and assessment tasks given by the teacher.
42. I seek advice/consultation with my teacher regarding my learning progress.
43. I share ideas/opinions/learning inputs in the class (group chats).
44. Learning activities and assessment tasks promote worthy effort of the students to do their best.
45. Learning activities and assignments are provided meaningfully.
46. Learning contents are up-to-date and relevant.
47. Learning materials are not overwhelming for me.
48. Learning materials are written in a conversational way promoting communication between me and the learning material.
49. Learning materials provided in all of the courses I am taking in a semester are balanced according to quality and quantity.
50. My classmates seek advice from me regarding the content, learning activities, assignments and assessment tasks given by the teacher.
51. My grades reflect my own performance.
52. My learning progress is communicated by my teacher (e.g., assessment scores, room for improvement, etc.).
53. My teacher automatically responds to my academic concerns.
54. My teacher provides constructive feedback on my work.
55. My teacher provides constructive feedback on the class performance.
56. My teacher responds to my concerns and queries.
57. Objectives in the course learning materials are SMART (specific, measurable, attainable, results-oriented and time-bound).
58. Objectives of the course matched with assessment tools (e.g., Midterm and Final Exams).
59. Others listen to what I share in the class.
60. Technical problems and the type of technology I am using in learning do not affect my academic performance.
61. The communication between me and my classmates is positive.
62. The communication between me and my teacher is positive.
63. The curriculum content and activities are provided, however, are changed on a case-to-case basis (if intervention is needed based on the student's needs).
64. The curriculum structure promotes high interest for me to learn as a student.
65. The curriculum/learning materials provided are based on the most essential competencies needed in flexible learning.
66. The extent of communication between me and my classmates are frequent.
67. The extent of communication between me and my teacher is frequent.
68. The learning content and activities are given with flexibility based on the availability of technology (e.g., hard-copy, soft-copy, online, etc.).
69. The learning materials (e.g., OBE syllabus, modules, handouts, PowerPoint, etc.) provided in the implementation of flexible teaching and learning are comprehensive.
70. The learning materials given are easy to comply with.
71. The learning materials provided are complete, as to what is indicated in the Outcomes-based Education (OBE) course syllabus.
72. The learning materials provided are outcomes-based.
73. The learning materials provided promotes independent learning.
74. The overall curriculum provided in flexible learning is responsive to my needs as a student.
75. The overall design and quality of the course promotes interaction between me and the content.