A CONFIRMATORY FACTOR ANALYSIS OF THE STUDENT BUOYANCY INVENTORY AMONG THE STUDENT TEACHERS

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Abstract

The Student Buoyancy Inventory is a self-report survey instrument that measures the students' ability of navigating the academic challenges, setbacks and pressures of their everyday school life. The original scale to measure the academic buoyancy of the students had been developed by Martin and Marsh (2006) and it has 4 items only. Based on the Martin and Marsh (2010) theoretical framework, Comerford (2017) developed the revised scale. It contains 5 factors and 39 items according to the results of the exploratory factor analysis. The objective of the study is to validate the factor structure of the student buoyancy inventory in a sample of education degree college student teachers by using confirmatory factor analysis. The scale has five-factors involving 39-items with 4-point Likert scale. Data from 400 student teachers from the Education Degree Colleges were subjected to examine the psychometric properties of the scale. The results of the confirmatory factor analysis on the re-specified 30-items scale showed that the model fits with the five factors structure of the student buoyancy inventory (RMSEA = 0.50, TLI = 0.87, CFI = 0.90, p = 0.00). Besides, the convergent and discriminant validity and internal consistency supports the accuracy of the 30-items student academic buoyancy inventory to use in Myanmar Education Degree College Student Teachers.

Keywords: Academic Buoyancy, Student Buoyancy Inventory, Student Teachers, Confirmatory Factor Analysis

Introduction

Today, according to the social necessity, education system is one of the great and complex social organizations in every country. The very basic functionalities training institutions in each country play a very important role in the development and progress of the various communities. Among the primary institutions, teaching institution is a well-known organization and includes training human resources efficiently and effectively by considering the main tasks of the education.

To attain the goals of the training program, the education system must be empowered. According to the predetermined educational purposes, the desired changes and academic achievement can be found in three forms; cognitive, emotional and psychological impact on students and also cause a change in the behaviors of the students. Educational institutions have to change and to bring the learners on a societal context that will inspire and make them involved as they grow (Espejo, 2018). With the complex array of the academic demands in various educational institutions, the professional requirements of the younger generations were remained to be a challenging task for principals, teachers, counselors and psychologists.

As the student teachers, they are being trained to expose with a diverse set of performance requirements for the development of the education. In this process, they have to pursue goals to different extents and to gain broaden professional competences. Moreover, with the changing world, they need to try to fulfill their qualities, especially the 21st century skills. An emphasis on students' cognitive development and achievement has become the focus of the education system. Then, the state-holders were important to aware of the importance of education for examining their development.

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Academic environment is one of the environments that require conformity and compatibility. Academic life is among the most important periods of life that plays a role in the effective and successful education and learning of people. During this period, the students will be able to obtain merits and capabilities and achieve scientific progress. However, in everyday academic life, students face with different challenges, obstructions, and period-specific pressures including poor grades, levels of stress, threats to self-confidence and consequently threats to performance, and reduction in motivation and interactions (Reisy, Dehghani, Javanmard, Shojaei, & Monfared, 2014).

Therefore, some research programs focused on assessing the role of positive psychological constructs and pay attention to the numerous factors affecting the students' academic progress. Moreover, the school sites are places where the students can face academic challenges, setbacks and pressures. Academic buoyancy has been described as one factor that assists students to deal with academic risk (Martin & Marsh, 2009), particularly risk that occurs relatively frequently and on an ongoing and 'everyday' basis. Hence, academic buoyancy has been suggested to be a factor that practitioners might consider sustaining on an ongoing basis to help students deal with relatively ongoing academic difficulty.

Accordingly, effective investigation about the issues highlighted above requires a valid and reliable measure of academic buoyancy of the student teachers. The present study reports the result of a confirmatory factor analysis to validate the facture structure of the academic buoyancy.

Purpose of the Study

The main purpose of the study is to validate the factor structure of the Student Buoyancy Inventory among the student teachers of Education Degree Colleges.

Definition of Key Terms

Buoyancy: Buoyancy was defined as the individuals' ability to successfully response with setbacks, pressures and challenges that are typical of the ordinary course of life (Martin & Marsh, 2008).

Academic Buoyancy: Academic buoyancy is defined as students' capacity to successfully overcome difficulties and challenges that are typical of the ordinary course of everyday academic life (Putwain, Connorsa, Symesb, & Douglas-Osbornc, 2011).

Student Teacher: Student teacher is a college or university student who is studying under the supervision of a certified teacher in order to qualify for a degree in education (Princeton University, 2007).

Confirmatory Factor Analysis: Confirmatory factor analysis is a hypothesis testing method which tests whether the obtained the data set is suitable for a model (Schriesheim, Hurley, & Scandura, 1997).

Review of Related Literature

As important as it is to understand the many ways in which people's lives are adversely affected by unfavorable circumstances, it is just as important to try to learn from the experiences of those who succeed despite such circumstances. Such people are resilient to their adversity. The concept of resilience has its origins over forty years ago in psychology, founded on

studies of schizophrenia. The rationale for examining resilience is that in understanding the challenges which some people recover, mechanisms of adaptation and coping will be revealed that can be used to guide interventions with others at risk (Comerford, 2017).

While the major adversities are the essential factors on academic resilience concept, there is an important new term in education area, called the academic buoyancy (Collie, 2016). It is also a relatively new psychological construct grounded in the resilience literature and originating in the work of Martin and Marsh. Martin and Marsh (2009) argued that because resilience typically refers to the person's capacity for responding constructively to major challenges and setbacks, ''academic buoyancy is limited the ability of everyday academic difficulties and challenges and the which is consistent with most of the students. Martin and Marsh (2009) therefore proposed the concept of buoyancy as the student's response to the academic setbacks, challenges, and pressures which are distinct from resilience in difference of kind (i.e., are relevant to most students) and difference of degree (i.e., found in typical rather than extreme circumstances) (Putwain, Connorsa, Symesb, & Douglas-Osbornc, 2011).

Academic buoyancy also refers to individual differences in the ability to withstand and respond successfully to the types of challenges and setbacks associated with routine school life, such as competing deadlines, examination pressure and poor grades (Putwain, Daly, Chamberlain, & Sadreddini, 2015). More exactly, buoyancy refers to the considerations of feelings to the everyday adversities (Collie, Martin, Bottrell, Armstrong, Ungar, & Liebenberg, 2016).

In contrast to academic resilience, which refers to students' ability to successfully deal with chronic and acute academic adversities in their school settings, academic buoyancy primarily focuses on bouncing back from daily, somewhat low, and mild adversities (Martin & Marsh, 2006). Thus, academic buoyancy applies to a greater number of students who may experience relatively frequent and ongoing frustrations and challenges on a daily basis compared to fewer students who may have more severe, chronic issues of underachievement (e.g., frequent academic failures, test stress, difficult school tasks etc.).

Martin and Marsh (2009) have identified numerous examples of academic buoyancy including the capacity to deal with patches of poor performance and isolated poor grades, recovering from dips in motivation and engagement, resolving minor or infrequent negative interactions with teachers, dealing with study pressure and stress, and effectively responding to clashing deadlines (Martin & Marsh, 2009). Martin and Marsh also contended that academic buoyancy gives rise to a capacity to deal with more major academic setback and adversity and Martin has demonstrated this to be the case.

As important as motivation is to academic life, if students cannot respond successfully to their everyday pressures, stress, and difficulties related to their academic settings, the progress will be declined. Therefore, the students must need to have both motives and resilience; especially a suitable level of buoyancy (Strickland, 2015). Although there is no formal theorizing about the relative roles of buoyancy, Martin's research led to the development of the factors of academic buoyancy. Several theories and constructs were developed to highlight the foundations for the academic buoyancy construct. Self-worth, self-efficacy, expectancy-value, motivation orientation, and self-determination theory were included as the foundational constructs of the academic buoyancy (Martin, 2012). These foundational motivation theories provide considerations about how and why students do what they do and also provide insights about students' efficacy to bounce back after challenges (Martin, 2012).

Previous recommendations for intervention with academic buoyancy have been driven by research identifying factors that predict students' capacity to bounce back from academic

setback. One line of research by Martin and Marsh (2006) and subsequently validated in longitudinal research identified five psycho-educational factors underpinning buoyancy construct. In consistence with the foundational motivation theories, the constructs for academic buoyancy were identified as the "5Cs," these factors have been shown to express the academic buoyancy:

1. confidence,

2. coordination,

3. commitment,

4. composure, and

5. control.

The factors have been assumed to predict the motivational sets of academic buoyancy ability and each of these factors is psychologically important in nature.

It was found that the academic buoyancy was assessed using various types of academic buoyancy measures with different reliabilities through the systematic review on academic buoyancy and most of these were constructed on the basis of Martin and Marsh's Theoretical Framework. The most recent psychometric evaluation and only exploratory factor analysis of Academic Buoyancy Scale was undertaken by Comerford (2015 & 2017).

Guided by the competencies (5Cs), existing literature on resilience and academic buoyancy (Martin et al., 2006, 2008, 2009, & 2014), Comerford and colleagues (2015) and Comerford (2017) assembled the items and developed the instrument to measure the students' academic buoyancy following principal component analysis. The results of the administration were that 44.71% of the total variance was observed in five factors. The names of the factors and the variance observed for each factor were as follows: Confidence (18.64%), Composure (9.42%), Planning (7.115%), Control (5.144%) and Persistence (4.397%). By using a Spearman's Rho analysis, the convergent validity between the items in each scale was also examined and then it was found to be significant at the 0.01 level (Comerford et al., 2015). In 2017, they conducted to examine the extent which items in the factors related to each other. The values of Cronbach's Alpha and variance for each factor were observed as followed: Confidence (0.802 & variance accounted for 18.64%), Composure (0.708 & 9.42%), Planning (0.734 & 7.115%), Control (0.67 & 5.144%) and Persistence (0.79 & 4.397%) (Comerford, 2017). By their administration, the results were found to be acceptable.

For the construct validity of the personality questionnaire, the researchers often make use of confirmatory factor analysis, especially when the test are supposed to be multidimensional (Prudon, 2015). Therefore, in this study, the researcher will report the confirmatory factor analysis results of the Student Buoyancy Inventory which is originally developed by Comerford (2015 & 2017). The exploratory factor analysis has been done by the developer in their study. Therefore, the purpose of the study has been to cross validate the factor structure of this scale on a new and larger sample in consistence with Myanmar student teachers.

Method

Design of this study is cross sectional in nature and descriptive survey method.

Participants of the Study

Student teachers from Education Degree Colleges were selected as the participants of the study. Due to the Pandemic situation, the participants who involved in online survey were selected as the sample of the study. There were 400 student teachers (124 males and 276

females) from 17 Education Degree Colleges. Tabachnick and Fidell (1996) offered a guideline for sample size in conducting the factor analysis that a data set must include at least 300 cases to return a reliable factor (Mertler & Vannatta, 2002). Therefore, the sample size of the study was sufficiently large for confirmatory factor analysis.

Instrument

The 39 items Student Buoyancy Inventory is an instrument developed by Comerford (2017) and designed to assess the academic buoyancy of the students. It consists of five factors: (1) Confidence (9 items), (2) Coordination (8 items), (3) Commitment (8 items), (4) Control (8 items), and (5) Composure (6 items). The items were rated on four-point Likert Scale (1 = strongly disagree to 4 = strongly agree). It took students approximately 10 minutes to complete all the items.

Data Collection Procedure

After the approval of the 14 experts in the field of educational psychology for the expert validity, the items were prepared as a google form for online survey. The respondents were invited through email to participate in the study. Data were collected from May 2020 to December 2020. Then, to investigate the facture structure of 39-items Student Buoyancy Inventory, confirmatory factor analysis was undertaken to test the model data fit by using SPSS-AMOS software (version 24).

Findings

Criteria for Confirmatory Factor Analysis

With CFA, the researchers use a variety of fit indices to determine whether the model fit is acceptable or not. These indices include measures of global fit, or fit of the entire model to the data, such as the Goodness of Fit Index (GFI), chi-square, Tucker-Lewis Index (TLI) which is the same as Non-normed Fit Index (NNFI), Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR) and Comparative Fit Index (CFI). Hu and Bentler (1999) recommended that the maximum cutoff value of 0.08 for RMSEA and the cutoff value of 0.6 for SRMR and the minimum cutoff value of 0.95 for TLI and CFI and a *p*-value for the Chi-square less than 0.05 can be considered as the model is a goof fit.

Further assessment of construct validity involved an assessment of construct validity: convergent validity and discriminant validity. Convergent Validity for the subscales was assessed by estimating the composite reliability (construct reliability) for each subscale and an assessment of the factors' average variance extracted (AVE). Hair, Black, Babin, and Anderson (2009) stated that an item factor loading ≥ 0.5 and $p < .05$, AVE ≥ 0.5, and CR ≥ 0.7 show the evidence of convergent validity and discriminant validity (Fornell & Larcker, 1981).

Model Fit Statistics

The maximum likelihood confirmatory factor analysis was conducted to examine the underlying the latent variable structure of 39 items Student Buoyancy Inventory (SBI). The data fit indices of the models of academic buoyancy were examined in Table 1.

Table 1 Model Fit Statistics for the 39 items Student Buoyancy Inventory

Model	χ^2	*p*-value	RMSEA	CFI	TLI
Five factors 39-items Student Buoyancy Inventory	952.41	0.000	0.061	0.67	0.65

According to Table 1, the results obtained the fit model with χ^2 = 952.41; *p* < 0.001; RMSEA = 0.061; CFI = 0.67 and TLI = 0.65. These results show that the model fit indices were highlighting a poor fit between the hypothesized model and the model data. Based on the Table 1, CFI and TLI did not reach adequate value. So, the model was re-specified.

For a model to have acceptable fit, the standardized regression weights (R^2) on each item were greater than 0.4. Moreover, Hooper, Cough and Mullen (2008) expressed that it is a good to remove the items with low R^2 values (less than 0.2) from the analysis to remove the better model fit. In the present analysis, the R^2 values of nine items were less than 0.2. Therefore, these items were removed from this study.

Moreover, according to Gerbing and Anderson (1984), another way of improving model fit is through the correlation of error terms. The correlated error terms showed that there is additional information in the data that has not exploited in the current model. It also means that the observed covariation between a given pair of indicators has not been adequately accounted for by the factors present in the model. Positive values of correlated error terms mean that the model under predicts the particular indicator covariance whereas negative values mean that the model over predicts this covariance. Then, after checking the correlated error terms, the analysis was run again to get a perfect model fit. The final model for academic buoyancy with 30 items was shown in Table 2.

Table 2 Model Fit Indices for the 30 items Student Buoyancy Inventory

Model	χ^2	*p*-value	RMSEA	CFI	TLI
Five factors 30-items Student Buoyancy Inventory	938.04	0.000	0.05	0.90	0.87

Based on the data presented in Table 2, a new confirmatory factor analysis with changes yielded the fit indices as a *p*-value = 0.000, CFI =0.90, TLI = 0.87, and RMSEA = 0.05. The TLI value is close to 0.9, which shows a relatively good fit. The results indicated that the model fit indices were acceptable and the revised model fits to the data.

Convergent Validity and Reliability

Convergent validity is also an evidence to test construct validity. To establish convergent validity, factor loading of the indicator variables, composite reliability (CR) and average variance extracted (AVE) should be used. AVE and CR values were computed by the formula using Microsoft Excel. Table 3 shows that the results of AVE and CR of academic buoyancy scale.

Table 3 Composite Reliability (CR) and Average Variance Extracted (AVE) of Student
   Buoyancy Inventory

Factors	CR	AVE
Confidence	0.77	0.49
Coordination	0.78	0.52
Commitment	0.77	0.49
Control	0.71	0.48
Composure	0.70	0.59

According to Table 3, the composite reliability or construct reliability for each factor, which indicated whether items within the same factor measured the same construct were greater than 0.7: CR(Confidence) = 0.77, CR(Coordination) = 0.78, CR(Commitment) = 0.77, CR (Control) = 0.71 and CR(Composure) = 0.70. Moreover, the values of AVE were also around 0.5. The results showed that the five factor 30-items SBI demonstrated convergent validity.

Discriminant Validity

Discriminant validity was used to show that the construct is actually differing from one another empirically. Discriminant validity was evaluated by the correlation coefficients of the factors and the square root of AVE. The results were shown in Table 4.

Table 4 Factor Correlation Metrix with Square Root of the AVE on the Diagonal

Factors	Confidence	Coordination	Commitment	Control	Composure
Confidence	**0.70**				
Coordination	0.54	**0.72**			
Commitment	0.55	0.58	**0.70**		
Control	0.26	0.51	0.51	**0.69**	
Composure	0.18	0.27	0.27	0.36	**0.78**

Note: The diagonal numbers in bold letters are the square root of AVE values.

In the table, the square root of average variance extracted values were greater than the correlation coefficients of the factors. The results show the sufficient discriminant validity of the scale.

Internal Consistency Reliability

One of the most popular estimates of internal consistency is Cronbach's alpha. Therefore, the researcher assessed the internal consistency of the SBI with Cronbach's alpha. The results in Table 5 showed that reliability coefficient of each factor ranged from 0.59 to

0.73 and the reliability coefficient of the whole scale was 0.85. Thus, SBI was considered to be reliable to measure academic buoyancy of the student teachers.

Table 5 Number of Items Retained and Reliability Coefficient for each Subscale of SBI

Factors	Number of items	Cronbach's Alpha
Confidence	7	0.67
Coordination	7	0.73
Commitment	7	0.68
Control	5	0.59
Composure	4	0.66
SBI	30	0.85

Discussions

This study was mainly a measurement study and the findings demonstrated that the instrument has adequate psychometric properties (valid and reliable). The finding of this present study has expanded the existing body of knowledge on the development of a measurement scale to evaluate the academic buoyancy of student teachers. Hence, the model reported here might be useful in the psychology context and may be interested in assessing the students' buoyancy to academic learning, providing feedback and training to the ability improving. In summary, it is expected that there will be a great value for the teachers and the counselors to know the ability of students' academic buoyancy and provide feedback to improving their learning.

Conclusion

In this study, the first confirmatory analysis did not support the model fit indices and the overall construct validity of the original 39-item version of Student Buoyancy Inventory. Therefore, the original 39 items scale was re-specified as 30 items SBI according to the standard regression weights less than 0.4 and error items. The psychometric properties of a new SBI for assessing academic buoyancy presented that the scale can be said that to be successfully cross-validated. All the model fit indices (RMSEA=0.50, CFI=0.90, TLI=0.87, p=0.00) indicated a good fit between the measurement model tested and the data. The convergent validity of SBI was indicated by high composite reliability values and acceptable AVE values. The discriminant validity of the model was also indicated by the AVE values. As for the internal consistency reliability, the values of Cronbach's alpha pointed out the satisfactory results for reliability of Student Buoyancy Inventory.

Acknowledgements

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