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Original Article Research

Advancing physical education: The validation of Adventure-based Mental Toughness Model (AbMTM) for outdoor education

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Abstract

In Malaysia, the implementation of physical education includes an outdoor education syllabus. Outdoor education is found to be a medium for individual development at various levels of educational institutions, including schools. Mental toughness is one of the major aspects of the psychological development of an individual. There are now numerous studies linking mental toughness with academic performance. One of the mediums for this development is the implementation of outdoor education. The nature of outdoor education is found to have a very high potential to support the development of mental toughness among students. However, a lack of specific adventure-based mental toughness models has been developed. This study attempted to develop the Adventure-based Mental Toughness Model (AbMTM) and was guided based on the modified Design and Development Research (Saedah, Muhammad, & Rozaine, 2020). A total of 507 (N=507) respondents from several educational institutions in Malaysia were involved as respondents for the validity examination through the Structural Equation Modelling (SEM) approach. As a result, AbMTM recorded significant Goodness of Fit (GoF) ($\chi 2$ = 1.904; p =.000; GFI=.839; AGFI=.792; NFI=.815; TLI=.924; CFI=.931; RMSEA= .050). This study's findings are considered a new horizon of outdoor education implementation and advancing the current practice in Malaysia.

Keywords: Outdoor education, mental toughness, structural equation modeling

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1. INTRODUCTION

Outdoor education is carried out comprehensively in education institutions from the primary to the higher education institutions (Md Taff, Shafie, Zakaria, Yasim & Rahman, 2012). Through the subject of physical education, outdoor recreation has evolved and provided exposure to students to the concept of outdoor education. Moreover, the syllabus and co-curricular activities, outdoor education is seen to have great potential in the development of psychological aspects of students, including mental toughness. This is evidenced by findings by many studies that have successfully proven outdoor education contributes to the development of mental toughness (Mackenzie, Son, & Eitel, 2018; Shafie & Che Mat, 2014). The nature of outdoor education, which is very close to the element of challenge and difficulties in terms of mental and physical, is seen as the main catalyst for this development (Ewert & Yoshino, 2008). However, it is unknown to what extent outdoor education was implemented the focus on mental toughness development. It is difficult to get a specific adventure-based mental toughness model.

The fact is most utilized mental toughness' models and concepts are developed based on sports competition and athletes' performance contexts (Crust & Azadi, 2010; Crust & Clough, 2011). This is one of the factors for the limitations faced by physical education teachers for the outdoor education syllabus. Since the beginning the term mental toughness began to gain a place among researchers, it is focused on sporting performance context. For example, Loehr's Model of Mental Toughness (1982) known as the earliest model developed and related to mental toughness. This model is very influential and widely used in studies related to mental toughness from a sports perspective in the following year (Tripathi & Singh, 2009). Yet this model is criticized for its failure to reveal how the seven (7) psychological factors are developed (Crust & Swann, 2011).

While this issue is still debated, various other concepts and models of mental toughness have been introduced. There are many studies that try to prove and relate the components for the development of mental toughness. Among them, a study by Fourie and Potgieter (2001) identified and highlighted 12 components of mental toughness. The same is true of the study by Jones, Hanton, and Connaughton (2002) also mentions 12 components for the development of mental toughness and considers these factors as essential attributes of mental toughness. In fact, there are studies that reveal more components such as studies by Middleton, Marsh, Martin, Richards, and Perry (2004) highlighted 13 components of mental toughness in their efforts to develop mental toughness measurement instruments. These studies have revealed various concepts and flaws in understanding related to mental toughness. Findings from previous studies also indicate that there are deficiencies in identifying key components in the development of mental toughness.

Besides, there are also several studies conducted specifically to identify aspects of mental toughness in specific sports. There are several focuses in studies related to mental toughness such as specific to the type of game (e.g., football, cricket, rugby), and sports categories (e.g., combat sports, team/ individual sports). Bull, Shambrook, James, and Brooks (2005) conducted a sport-specific study among English cricketers and highlighted four themes on the development of mental toughness (e.g., environmental influences, tough character, tough attitude, and tough thinking). In another specific-sport study, Gucciardi and Gordon (2008)

carried out a study and found eleven (11) components of mental toughness associated with Australian football. Additionally, Connole (2009) conducted a study among basketball athletes and found that mentally tough athletes possessed positive attributes in seven (7) components to tap mental toughness. From the beginning of the discussion, numerous components have been revealed by many researchers to tap mental toughness. However, through a detailed study, it was found that there are seven (7) components that are clearly repeated in various studies. These seven (7) common constructs are self-confidence, motivation, coping skill, focus, challenge, control, and commitment (Shafie, Mat, Taff, Johanis, Said, Hashim, and Rahman, (2022). However, there are limited studies that look at this similarity.

The efforts to link common components with the development of mental toughness are very important to ensure that an accurate model can be produced to tap adventure-based mental toughness. Yet that is not the case at this time because it is found that most developed mental toughness models and concepts are based on sport's competition and athletes' performance contexts. In addition, several constructs from utilized models such as visualization and imagery control (Loehr, 1982); future potential (Middleton et. al., 2004); sports intelligence (Connole, 2009) and competition's behavior (Guciardi & Gordon, 2008) are based on competition influences and are seen as irrelevant hence the nature of adventure-based programs is generally less stressed on competitive elements (Shafie et al., 2022). These gaps possibly contribute to misconception in designing appropriate outdoor education programs.

As the invention of the solution, the main purpose of this study is to develop and validate a specific model regarding adventure-based programs and mental toughness namely Adventure-based Mental Toughness (AbMTM). For this purpose, this study uses a complex and detailed design study starting from the modified Design and Development Research (DDR), Delphi technique and the Structural Equation Modeling (SEM) as the final validation analysis.

2. METHOD

The study was conducted based on the modified Design and Development Research (DDR; Saedah et. al., 2020). Modified DDR employed 3 stages, which are the Need Analysis, Design and Development, the final stage is Evaluation. Each stage involved different processes and analyses. For the first stage, need analysis was conducted among selected physical education and outdoor practitioners in Malaysia. The main purpose of this stage is to obtain data related to the extent of the need for model development for adventure-based mental toughness.

In the second stage (Design and Development), several expert panels have been selected to obtain statistical data to obtain consensus values on the development of this model. Seven (7) components have been proposed namely self-confidence, motivation, coping skill, focus, challenge, control, and commitment. In the final assessment, a significant consensus value has been reached for the design and development of this model.

The last stage is Evaluation. At this stage, a total of 507 respondents among students who have experienced outdoor education were involved. The analysis was conducted through Structural Equation Modeling-AMOS (SEM). The process and analysis in this stage aims to obtain the validity value of the developed model.

In sum, the study employed modified DDR based on several considerations. First,

modified DDR is considerably very flexible especially in the process of obtaining expert consensus for the design and development of AbMTM (Norlidah, 2010). Moreover, the modified DDR also applied for this study because it was proven reliable in establishing the development products in many fields (Zainuddin, Yusuff, & Samy, 2018).

2.1 Participants

A total of 507 respondents were involved. They are among five (5) education institutions students in Malaysia and have been involved in outdoor education programs. Their selection is based on several predetermined criteria to avoid biases. A purposive sampling was selected as the method of the selection.

2.2 Research Design

The quantitative study was conducted based on the modified DDR and is considerably very flexible especially in the process of obtaining expert consensus for the design and development of AbMTI. Experts are allowed to reconsider and revise their first responses. Secondly, modified DDR also adaptable to the situation during the Movement Control Order (MCO) implementation all around Malaysia. The modified DDR approach assists the researcher to achieve study objectives despite the restriction of movement. Also, due to the RMO implementation DDR was also selected because of the factor of time frame allocated to conduct this study. Through the medium of Google form to obtain expert consensus, the time consumed for this study considerably is very effective.

Moreover, the modified DDR also applied for this study because it was proven reliable in establishing the development products in many fields (Zainuddin, Yusuff, & Samy, 2018). The statistical analysis employed to fit each stage of DDR is also considerably clear and meets the study needs (Table 3.2). The researcher believed modified DDR are the best study design to be adapted as well as to face the challenges in the study timeframe during COVID-19.

2.3 Instruments

This quantitative study involves a series of questionnaires that have been developed and reviewed by the language and field experts. Each stage of modified DDR employed developed instruments.5-likert scale was employed. The developed questionnaires have achieved reliability and validity (α=.≥70). Each of the questionnaires undergo reliability tests and have been reviewed by the field and language expert to ensure the items accurately tap the developed constructs.

Table 1.

Cronbach Alpha coefficient values

Stage	**Total Item**	$\bar{x}$	α
Stage 1: Need Analysis	24	4.133	.89
Stage 2:	67	4 .325	.86

Design & Development			
Stage 3 Evaluation	38	4.228	.87

2.4 Procedures

The data for Stage 1, 2, and 3 of modified DDR was conducted and collected through Google Form (online). The respondents are also equipped with the manual booklet as the instruction and guidance to answer the questions. This procedure was implemented to all stages of modified DDR. The rationale of the procedure, due to the series of Restriction of Movement Control Order (MCO) by the Malaysian government on the matter of COVID-19 outbreak in 2019-2022.

2.5 Data Analysis

The final validation of the AbMTM was conducted through Structural Equation Modeling (SEM) and AMOS for the analysis of Goodness of Fit as to examine the model fitness. The two (2) rounds of CFA were conducted. The round 1 of CFA focused on the validation based on statistical suggestions for measurement model fit (GFI; $\chi 2$; p value; AGFI; NFI; TLI; CFI; and RMSEA) and were measured separately. The round 2 of CFA are focusing on validation of the reliability based on Cronbach Alpha (α), factor loading, construct reliability (CR), and average variance extracted (AVE). This approach has been widely accepted and adopted in many previous studies (Saidon, 2012). In addition, 2 stages of CFA are best to be implemented to avoid issues related to interaction between measurement and structural model.

3. RESULTS

Overall result of round 1 and 2 of CFA indicates AbMTI achieved significant validity and reliability value. The 2 rounds of CFA implemented were based on recommendations by Saidon (2012) who stated that this method is the best to avoid interaction between measurement models. In detail, a total of 7 constructs and 81 items were carried from the EFA to undergo CFA analysis. Throughout this process, several items were iteratively eliminated based on statistical analysis suggestions of standardized residual covariance. Round 1 indicates 67 items were retained and the final validation (round 2) analysis retained 38-items to represent AbMTI. AbMTI was validated as the reliable instrument to tap adventure-based mental toughness. The details of the process discussed as follows.

There are various goodness-of-fit indices to determine the fit of the model. Henseler, Ringle, and Sarstedt (2015), and Gaskin and Lim (2019) recommended the use of at least three fit indices: 1) absolute fit indices; 2) incremental fit indices; and 3) parsimonious fit indices. An absolute fit index includes chi-square, goodness of fit (GFI=>.90), and root mean square error (RMSEA=<.0.08). Absolute fit indices measure how well the model accounts for observed covariance in the data. The incremental fit indices include comparative fit index (CFI=>.90) and normed fit index (NFI=>.90). Incremental compare how well the proposed model fits the data. Lastly, parsimonious fit indices are measured by normed chi-square. Based on this evidence, the analysis strongly suggests achieving AbMTM as a fit model.

In the focus of Stage 3, the validation of AbMTM was performed using SEM. In detail,

AMOS analysis is applied to obtain values for each item and constructs built. The main analysis for this validated model is Goodness of Fit (GoF). In the focus of this study, SEM-AMOS goodness of fit analysis also plays a very important role in determining the discrepancy between the observed values and producing an expected model based on suggestion analysis (Behjati, Pandya, & Kumar, 2012). The overall Goodness of Fit (GoF) analysis of final AbMTM also recorded very significant data (Gaskin & James & Lim, 2019; Malhotra, 2011). Referred to Figure 4.14.3a, the final examination on AbMTM provides greater fit to the data (X2 = 1.904, p = .000). The GFI is .839 AGFI = .792, NFI = .815, TLI = .924, CFI = .931 and RMSEA = .050. (See Figure 1.0).

Furthermore, each component of AbMTM also recorded significant correlation values in the range of .70 to .85. According to Saidon (2012) the correlation of each factor in the measurement model should not exceed than .85. The result also indicates each of the items recorded significant standardized loading ($\geq$.70), as been suggested by Gaskin, James and Lim (2019) and Malhotra (2011). After all, it can be concluded that the analysis indicates that the measurement model has achieved a great fit value (GoF) for validity of AbMTM. This result also implies that the AbMTM has achieved the validity and reliability confirmation based on the statistical evidence from the detailed processes of SEM-AMOS.

Figure 1.

AbMTM-Goodness of Fit

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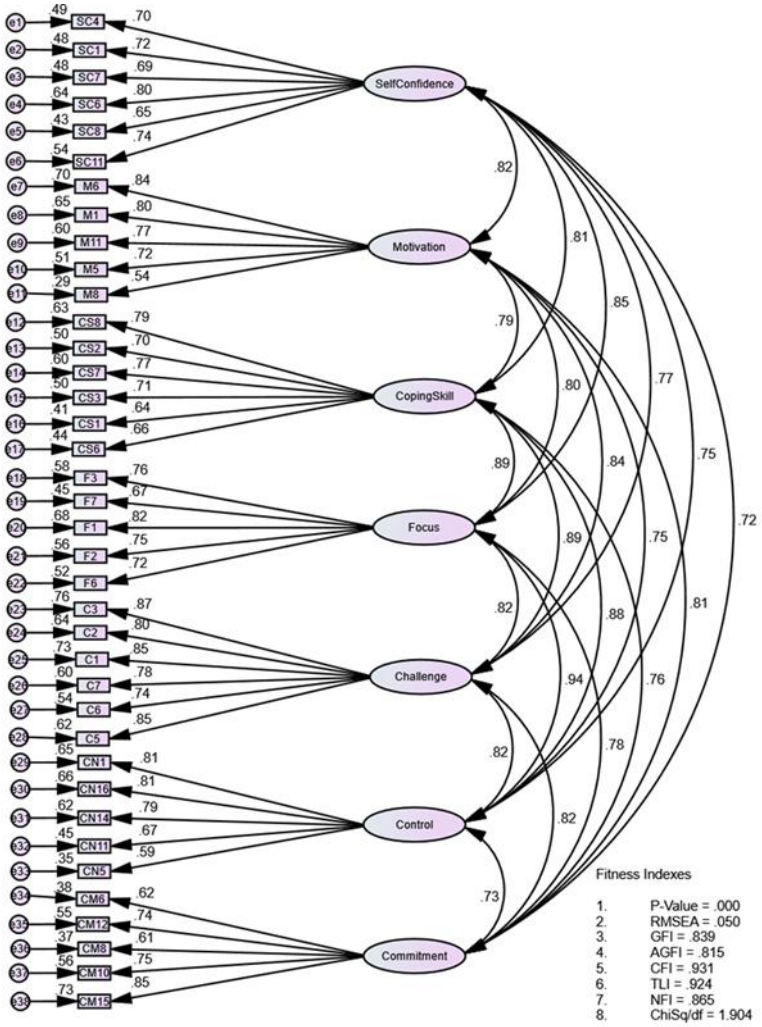

4. DISCUSSIONS

The iterative analysis process of goodness of fit is carried out and has recorded greater fit to the data. Additionally, this study has bridged the gaps by revealing several constructs that are commonly associated with mental toughness. All these constructs were also found to be among the positive outcomes in the adventure-based program. Findings of this study highlighted the interaction between these two fields. Thus, this study has introduced seven (7) components to tap adventure-based mental toughness.

In Stage 3, CFA conducted two (2) rounds to eliminate items based on analysis suggestions such as residual covariance and modification index (Saidon, 2012; Siraj et al., 2020). This step was taken because it was found that the developed model was still misfit and did not reach the minimum average variance explained. Out of a total of 67 items (from EFA analysis) a total of 29 items have been iteratively removed during this process. The detailed analysis also shows that this developed instrument has high internal consistency (α), which means that all measures are consistently tap the same latent construct (mental toughness). Finally, a total of 38-items from 7 constructs confirmed the validity and reliability. This means that the objective of developing AbMTI has been achieved.

Next, along with this process also goodness of fit is carried out and has recorded greater fit to the data. This also means that the model developed has achieved a significant value of validity. The analysis also suggested that convergent validity was achieved. In this process, convergent validity was examined through a significant high factor loadings on a factor that indicate they converge on some common point as suggested by Saidon (2012). This final analysis has also confirmed that the objectives of the study to validate AbMTM is achieved.

Moreover, this study has revealed the interaction between self-confidence and adventure-based mental toughness. Self-confidence was known as one of the common mental toughness' constructs (Crust & Keegan, 2010). This interaction is also evidenced by the number of past studies that have been conducted to assess the influence of adventure-based programs on individual self-confidence (Kovach, 2019; Baroun & Dierkes, 2016).

Secondly, adventure-based programs are clearly proven to have great potential in increasing the motivation of individuals (Susan, Julie, & Karla, 2018). In line with the idea, adventure-based programs are clearly proven to have great potential in increasing the motivation of the individual. Haluza, Schonbauer, and Cervinka, (2014), also highlighted the positive effect of adventure-based programs on individual motivation and the influence on mental toughness.

Next, coping skills are also found to be often associated with mental toughness (Singh, 2019; Crust & Swann, 2011). Several researchers argue that adventure-based programs always expose participants to challenging environments and activities. In this situation, coping skill plays a very important role in everyone facing challenging or difficult situations (Lee, Jun, & Park, 2018). It can be said that the ability to cope with different levels of pressure is related to mental toughness.

Furthermore, the findings of the study also stated focus as one of the factors in the development of mental toughness. This idea was found in line with Young and Pearce (2011). The ability to remain focused despite pressure is seen as a determinant of mental toughness. Adventure-based programs have the potential to be a medium of treatment to improve an individual's ability to focus. The finding of the study stressed the applicability of focus as the construct of adventure-based mental toughness was confirmed.

Next, the findings of this study also support the idea of several previous researchers who stated challenge as an integral component of mental toughness (McGeown, Clair-Thompson, & Putwain, 2018; Clough & Strycharczyk, 2012). In fact, the element of challenge is inseparable from and exists in the implementation of adventure-based programs. Challenge is a situation where one's ability to perform a great mental and physical effort to overcome it.

Additionally, the researcher noted that the component of control played a significant role in mental toughness development as proven by the linkage between control and mental toughness (Dewhurst, Anderson, Howe, & Clough, 2019). The ability to control positive energy, negative energy, and attitude are considered the fundamental aspects of mental toughness. In fact, control is known as an integral important construct in adventure-based mental toughness (Shafie et. al., 2020).

Finally, this study also highlighted commitment among the major components in mental toughness development (Gucciardi, Hanton, Mallett, & Temby, 2015). The study argues that the implementation of adventure-based programs through physical education always expose participants to challenging environments and an individual's level of commitment influences

mental toughness. The study highlighted that a great commitment encourages an individual to strive at their best to overcome challenges despite the difficulty.

5. CONCLUSIONS

To conclude, the model developed has achieved a significant value of validity. The analysis also suggested that convergent validity was achieved. In this process, convergent validity was examined through significant-high factor loadings on a factor that indicates they converge on some common point. The researcher relies on the idea of several studies that proposed convergent validity can be assessed through standard-loading (> 0.50); using Normed Fit Index (NFI = ≥ 0.90); and using Average Variance Extracted (AVE = ≥ 0.05) (Gaskin & James & Lim, 2019; Malhotra, 2011). This final analysis has also confirmed that the objectives of the study for the development of AbMTM are achieved.

To date, from the best of my knowledge, there is no evidence that adventure-based mental toughness models have been developed, especially in Malaysia. The need analysis conducted has also revealed that there is a very large gap in knowledge related to mental toughness among physical education teachers. Although most of them are agreed that adventure-based programs can improve mental toughness, the researcher found that it is just an assumption, hence without any solid evidence (Shafie & Che Mat, 2014). Nevertheless, this study supports the use of the Adventure-based Mental Toughness Model (AbMTM) to deepen adventure-based mental toughness in teaching physical education.

This study has provided a new horizon in theories related to outdoor education and mental toughness. Along with the detailed process in the development of the Adventure-based Mental Toughness Model (AbMTM), there are several significant implications that have been contributed to the theory. It is important to highlight that this study has significantly succeeded in producing a validated model to explore mental toughness specifically in an adventure-based setting. This clearly provides a new horizon field area hence based on the previous studies it is found most instruments and models are built based on sporting contexts. Since it was introduced in the '80s by a sports psychologist named James E. Loehr (1982), it has been found that most studies related to mental toughness have only focused on aspects of sports and involved the sport's population (e.g., athletes, coaches). Mental toughness has been extensively studied to see its influence on athletic performance.

The study novelty has positively impacted the field of education, industry, and nation. This study has discovered and served the new knowledge that covers various aspects in the field of recreational studies. It should be noted that it is an empirical study for this development and successfully achieved all objectives. Findings from this study provide great benefits to all those involved in further catalyzing the development of recreation in Malaysia.

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