THE DEVELOPMENT OF CURRICULUM FRAMEWORK FOR PRE-SERVICE MATHEMATICS TEACHERS

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ABSTRACT

This quantitative survey design study aims to develop a curriculum framework for pre-service Mathematics teachers in Mathematics Teacher Education Curriculum (MTEC). The sample of the study consisted of 491 pre-service Mathematics teachers selected using a stratified random sampling technique. The five-point Likert scale survey questionnaire which composed of six constructs and 46 items was used in this study. The instrument was validated by six education experts and its reliability was inspected using the value of Cronbach's alpha. Initially, the Exploratory Factor Analysis (EFA) was conducted using the Principal Component Analysis (PCA) to investigate the actual constructs and items that represents the curriculum framework for pre-service Mathematics teachers. The Covariance-Based Structural Equation Modelling (CB-SEM) method was conducted to validate the curriculum framework using the Confirmatory Factor Analysis (CFA). The findings showed that the content validity index of the instrument was 0.946 and the Cronbach's alpha reliability index was 0.932, indicating that the instrument was acceptable to be used in the study. The EFA findings showed that there are six constructs and 39 items remain with weighting factors exceeding 0.400. The six constructs were adapted for MTEC framework, namely Mathematical Professional Development (MPDev), Mathematical Philosophy (MPhi), Mathematical Psychological (MPsy), Mathematical Technology (MTech), Mathematical Historic (MHis) and Mathematical Social Re-Constructivist (MSRC). All the constructs achieved the acceptable fit values in Confirmatory Factor Analysis (CFA) for Index Category and Level of Acceptance for Every Fitness Index, and resulted with 32 items with factor loading above 0.400. The MTEC Framework also achieved the GOF for the sample of the data (RMSEA=0.039; GFI=0.907; CFI=0.954; ChiSq/df=1.654). Finally, the CB-SEM method has shown that all constructs are significantly related to the MTEC framework. In conclusion, MTEC framework is valid, reliable and well fitted. The implication of the study is that the MTEC framework provides a good guidance to all pre-service Mathematics teachers in the curriculum planning.

PEMBANGUNAN KERANGKA KURIKULUM UNTUK GURU PRA-PERKHIDMATAN MATEMATIK

ABSTRAK

Kajian kuantitatif dengan menggunakan reka bentuk tinjauan ini bertujuan membangunkan kerangka kurikulum untuk guru pra-perkhidmatan Matematik dalam Kurikulum Pendidikan Guru Matematik (*MTEC*). Sampel bagi kajian ini terdiri daripada 491 guru pra-perkhidmatan Matematik dalam bidang pendidikan guru yang dipilih secara teknik persampelan rawak berstrata. Soal selidik tinjauan skala Likert lima mata yang mengandungi enam konstruk dan 49 item digunakan dalam kajian ini. Pada awalnya, instrumen ini disahkan oleh enam pakar pendidikan dan kebolehpercayaannya diperiksa menggunakan nilai alfa Cronbach. Seterusnya, Analisis Faktor Penerokaan (*EFA*) dilaksanakan menggunakan Analisis Komponen Prinsipal (*PCA*) untuk menyiasat konstruk dan item sebenar yang mewakili kerangka kurikulum bagi guru pra-perkhidmatan Matematik. Akhirnya, kaedah Permodelan Persamaan Berstruktur berasaskan kovarian (*CB-SEM*) dilaksanakan untuk mengesahkan kerangka kurikulum tersebut dengan menggunakan Analisis Faktor Pengesahan (*CFA*). Dapatan menunjukkan indeks kesahan kandungan ialah 0.946 dan indeks kebolehpercayaan alfa Cronbach ialah 0.932, memberi indikasi bahawa instrumen tersebut boleh diterima untuk digunakan dalam kajian ini. Dapatan *EFA* menunjukkan terdapat enam konstruk dan 39 item kekal dengan pemberat faktor melebihi 0.400. Enam konstruk tersebut diadaptasi untuk kerangka *MTEC* iaitu Pembangunan Profesional Matematik (*MPDev*), Falsafah Matematik (*MPhi*), Psikologi Matematik (*MPsy*), Teknologi Matematik (*MTech*), Kesejarahan Matematik (*MHis*), dan Penstrukturan Semula Sosial Matematik (*MSRC*). Semua konstruk ini mencapai nilai padanan yang boleh diterima dalam CFA bagi Kategori Indeks dan Tahap Penerimaan bagi Setiap Indek Padanan dan menghasilkan 32 item dengan faktor pemberat melebihi 0.400. Kerangka *MTEC* juga mencapai kesesuaian padanan bagi sampel data (*RMSEA*=0.039; *GFI*=0.907; *CFI*=0.954; *ChiSq/df*=1.654). Akhirnya, kaedah *CB-SEM* menunjukkan bahawa semua konstruk mempunyai kaitan signifikan dengan kerangka *MTEC*. Kesimpulannya, kerangka *MTEC* adalah sah, boleh dipercayai dan mempunyai kesesuaian padanan. Implikasi bagi kajian ini ialah kerangka *MTEC* memberikan panduan terbaik bagi guru Matematik pra-perkhimatan dalam merancang kurikulum.

TABLE OF CONTENTS

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

INTRODUCTION

CHAPTER 2

LITERATURE REVIEW

CHAPTER 1

LIST OF FIGURES

LIST OF TABLES

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

LIST OF ABBREVIATIONS

AMOS	Analysis of Moment Structures
CB-SEM	Covariance-based SEM
CFA	Confirmatory Factor Analysis
EFA	Exploratory factor analysis
ICT	Information and Communication Technology
METP	Malaysia Economic Transformation Programme
MOE	Ministry of Education Malaysia
MOHE	Ministry of Higher Education Malaysia
MTS	Malaysia Teacher Standard
PISA	Program for International Student Assessment
SEARS-MT	The Southeast Asia Regional Standards for Mathematics
SEM	Structural Equation Modelling
TIMSS	Trends in International Mathematics and Science Studies
UiTM	MARA University of Technology
UPM	University Putra Malaysia
UPSI	Sultan Idris Education of University
UTM	University of Technology, Malaysia

APPENDIX LIST

CHAPTER 1

INTRODUCTION

1.1 Background of The Study

The Malaysian education system is based on the National Education philosophy and emphasises on the development of student emotions. It aims to produce physically, emotionally, spiritually and intellectually balanced individuals, which would result in Malaysians who are skilled and responsible in various fields (Ministry of Education Malaysia, 2008). The curriculum is an educational plan to achieve educational goals. It comes from Latin "currere" which means "the course to be run" (Sun, 2017; Johnson-Mardones, 2018). The curriculum intentions affect the conceptualised curriculum. The main components of the curriculum, goals and objectives, curriculum

content, methods and assessment structures are set up to produce instructions.

Malaysians are aware that only through quality education will this help the future generation in implementing and renewing Malaysia's education and economy system. This has led to two important policy documents: the Malaysia Economic Transformation Program (METP), which was enacted in 2010 and the Malaysia Education Blueprint 2013-2025 (Ministry of Education, 2012) which was introduced in 2013. The priority of thses policy documents is to improve the quality of teachers in the education system (Jala, 2010). Australia, South Korea, Hong Kong and Singapore have made extensive progress in education, and have made sustained progress in teaching and promoted their economic goals (Mok, 2007). The question raised therefore is whether the curriculum of Malaysia Teacher Education is capable on improving the quality of teachers as an indicator, and provides students with employability and be able to meet the needs and challenges of the changing global landscape (Zachariah, 2013).

Human resource education and development is the key to improving the competitiveness of the country (Ali et al., 2017). Teacher quality affects the achievement of human resource education and human capital development. Mathematics is not just a subject, but it plays an important role in other fields such as science, technology, and engineering. And it is from the prescribed traditional curriculum that has been enriched to a more innovative technology-based curriculum.

In this endeavour, the school will be the source of resource suppliers to target students in the development of good students skills in Mathematics, science, and technology (Tan & Leong, 2014). Malaysia Education Blueprint clearly states that teacher quality needs more effort in improving and upgrading, but the failure of teacher education appears exaggerated and the public is disappointed with the significant decline in education in Malaysia. The teacher educator needs to relook, rethink and reform a suitable and effective curriculum for pre-service Mathematics teacher that is grounded in the Malaysian context.

In order to improve the quality of education and educational outcomes in Malaysia, the education reform culminated in the development of a teacher standard in 2009, namely the New Malaysian Teacher Standards (MTS), which set the "high capacity" standard for the training of pre-service teachers. In the face of these institutional standards, pre-service teachers' educators may encounter the challenge in transforming pre-service teachers in deeply rooted beliefs, values, and prejudices in education. In light of this challenge, teacher educators need to have solutions to understand and redesign teacher education programmes in a more standardized way (Goh, 2012). The Malaysian Teacher Standard (MTS) 2009 consists of three main standards: (1) Professional values within the teaching profession, (2) Knowledge and understanding of education, subject matter, curriculum and co-curriculum, and (3) Skills of teaching and learning. MTS is just a common standard form for all subjects but not specifically for Mathematics. The Southeast Asia Regional Standards for

Mathematics Teachers (SEARS-MT) in the year 2015 proposed a basic development in conceptualizing the Malaysian Mathematics teacher quality based on the characteristics and attributes of Mathematics teachers in the Southeast Asian region. SEARS-MT has formally outlined four dimensions of Mathematics teacher quality: (1) Professional knowledge, (2) Professional teaching and learning process, (3) Personal and professional attributes, and (4) Professional communities. The outlines are given as guidance to provide benchmarks for relevant Malaysian educational divisions in formulating policies and in structuring Mathematics Teacher Education's Curriculum to improve and enhance the quality of Mathematics teachers. Furthermore, it also guides Mathematics teachers' professional development at a personal level and acts as performance evaluation.

To achieve the underline outcomes for "Learned Values-Driven Talent" in Malaysia Education Blueprint (Ministry of Education Malaysia, 2015), the first four shifts focused on higher education system, including the academic and vocational pathway and students, academics, and all Malaysians are involved in lifelong learning. The Ministry and Higher Learning Institutions will focus on developing more holistic and integrated curricula and enhance the ecosystem for student development. In order to create a good moral foundation, but also has the tenacity and enterprising spirit, for oneself and others to create new opportunities. Higher education needs to be excellent with diverse career paths and different institutions. Therefore, Malaysia needs to educate Malaysians to continually seek learning opportunities to enrich their world.

The importance of teaching is increasing in contemporary societies. Standards for learning are now higher than ever because people need more knowledge and skills to succeed. Mathematics education is becoming increasingly important for the success of both individuals and countries, and it proves those educational resources and professional teachers' abilities are important contributors to the deprivation of students and future energy sources. In the past decades, teachers are expected to only provide a small minority for ambitious intellectual work. However, they are now expected to provide almost all students for higher order thinking skills and skills that are only available for just a few. At present, the demand for teacher professions is high. Teachers are not only a source of knowledge and information to students but also to elicit students' abilities in more complex contexts.

Teachers have a role to guide and motivate all students, which is crucial in boosting the interest of students to learn something new (Mahamod, Yusoff & Ibrahim, 2009). The main purpose of Mathematics learning is to acquire basic mathematical skills, the understanding of basic mathematical concepts, the meaning of significant meaning, the development of desired attitudes, the achievement of good mathematical application, and the ability to make intelligent and independent interpretations. Effective mathematical learning depends on the teacher's teaching to ensure students understand the concept and mastery the skills in mathematics. Additionally, teachers need to identify the factors that prevent students from learning mathematics and look for approaches to overcoming barriers or negative effects in