



Faculty of Cognitive Sciences and Human Development

Computational Thinking: Experiences of Rural Pupils in Sarawak Primary School

Nur Hasheena Binti Anuar

**Master of Science
2021**

Computational Thinking: Experiences of Rural Pupils in Sarawak Primary School

Nur Hasheena Binti Anuar

A thesis submitted

In fulfillment of the requirements for the degree of Master of Science

(Learning Sciences)

Faculty of Cognitive Sciences and Human Development

UNIVERSITI MALAYSIA SARAWAK

2021

UNIVERSITI MALAYSIA SARAWAK

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DEDICATION

This thesis is dedicated to my family, teachers, and pupils at the Long Lamai village.

ACKNOWLEDGEMENT

First and foremost, I would like to express my profound and sincere gratitude to my research supervisor, Associate Professor Dr Fitri Suraya Mohamad, for her expertise and guidance, and her ongoing support. My heartfelt gratitude also goes to my co-supervisor, Dr Luca Morini for fostering my interest in the development of creative education technologies.

I would like to acknowledge, Newton AHRC-MoHE (UK SEA-NUOF JPTS (BPKI)), for funding throughout my research and data collection process. Also, my heartfelt thanks to my colleagues and the CreativeCulture team from my workstation at the Institute of Social Informatics and Technological Innovations (ISITI), for their great collaboration.

I would also like to acknowledge the support of the Ministry of Education for accepting my proposal and allowing me to carry out my work at the selected school. I would also like to appreciate the support and guidance from all teachers at the school and pupils for their amazing collaboration throughout the research.

I am also grateful to my family, friends, and colleagues for their encouragement and inspiration. Finally, I would like to acknowledge the efforts made by the Centre for Graduate Studies (CGS) and the management of Universiti Malaysia Sarawak to allow my thesis to be completed in UNIMAS.

ABSTRACT

Computational thinking (CT) is one of the cognitive processes involved in STEM learning which human use in problem-solving to provide computational solutions that humans and machines can support. It has been denoted as a universal skill needed for everyone to learn in life, starting from a young age. However, computational thinking term and the underlying skills still poorly understood and underestimated by teachers and pupils, especially in isolated primary schools at Sarawak. The study aims to identify the effective pedagogical approaches in learning Computational Thinking skills and address the needs and challenges faced in implementing Computational Thinking in a rural primary school in Sarawak. It involved 22 participants with 11 boys and 11 girls of Primary 4 and Primary 5 originated from Miri, Sarawak. The samples were chosen through the purposive sampling method. The study employed embedded mixed methods design using a quasi-experimental approach which aims to provide an in-depth understanding of how pupils in remote rural area adapt and process to learning Computational Thinking skills (i.e., abstraction, algorithmic thinking, and decomposition) as well as their attitudes towards computational thinking practices by engaging in an unplugged game-based, art-based, Scratch programming and robotic activities through a revised Computational Thinking pedagogical model. The Computational Thinking results of quantitative data were collected using pre-test and post-test that consisted of five subjective computational thinking items. The descriptive statistics and statistical tests were run using IBM SPSS Statistics 25. The analysis of independent variables was performed using a parametric test of Independent Samples t-test. The qualitative data such as field observation, interview, reflective written responses, and researcher interpretation were qualitatively analysed. The findings indicate that learning new skills such as Computational Thinking skills (i.e., programming skill) is perceived as

necessary by teachers and participants in rural school. Based on the qualitative and quantitative analysis of computational thinking pedagogical approaches, it can be concluded that computational thinking skills acquired through unplugged, art-integration, tinkering, making, remixing, and robotics approaches have been proven to be effective for primary school pupils at Sarawak at the primary level. Although the quantitative data does not show promising results, the qualitative data can be used to support the learning experiences and knowledge acquired from the learning activities proposed. Scaffold from adults and supportive peers are needed when learning computational thinking skills, especially for beginners. In conclusion, the results of the study provide positive and encouraging evidence on the "learning by doing" approach and the practicality of integrating computational thinking activities in rural schools can help rural school pupils develop Computational Thinking skills.

Keywords: Computational thinking, rural primary school, unplugged, art-integration, Scratch, robotics

Pemikiran Komputasional: Pengalaman Murid Luar Bandar di Sekolah Rendah Sarawak

ABSTRAK

Pemikiran Komputasional (CT) merupakan salah satu proses kognitif yang terlibat dalam pembelajaran STEM yang digunakan manusia dalam penyelesaian masalah untuk menyediakan penyelesaian komputasional yang dapat disokong oleh manusia dan mesin. Ini telah dilambangkan sebagai kemahiran universal yang diperlukan agar semua orang belajar dalam kehidupan, bermula dari usia muda. Walau bagaimanapun, istilah pemikiran komputasional dan kemahiran yang mendasari masih kurang difahami dan diremehkan oleh guru dan murid, terutamanya di sekolah rendah terpencil di Sarawak. Kajian ini bertujuan untuk mengenal pasti pendekatan pedagogi yang berkesan dalam pembelajaran kemahiran Pemikiran Komputasional dan menangani keperluan dan cabaran yang dihadapi dalam melaksanakan Pemikiran Komputasional di sekolah rendah luar bandar di Sarawak. Ia melibatkan 22 peserta dengan 11 kanak-kanak lelaki dan 11 perempuan dari Darjah 4 dan 5 yang berasal dari Miri, Sarawak. Sampel dipilih melalui kaedah persampelan bertujuan. Kajian ini menggunakan reka bentuk kaedah ‘embedded mixed methods’ dengan pendekatan kuasi eksperimen yang bertujuan untuk memberi pemahaman mendalam tentang bagaimana murid di kawasan pedalaman terpencil menyesuaikan diri dan memproses pembelajaran Kemahiran Pemikiran Komputasional (iaitu, abstraksi, pemikiran algoritma, dan penguraian) serta sikap mereka terhadap amalan Pemikiran Komputasional dengan melibatkan diri dalam aktiviti permainan unplugged, berasaskan seni, program Scratch dan robotik melalui model pedagogi Pemikiran Komputasional yang disemak semula. Hasil Pemikiran Komputasional data kuantitatif dikumpulkan menggunakan ujian pra dan ujian pasca yang terdiri daripada lima item pemikiran komputasional subjektif. Statistik deskriptif

dan ujian statistik dijalankan menggunakan IBM SPSS Statistics 25. Analisis pemboleh ubah tidak bersandar dilakukan dengan menggunakan ujian parametrik t-test sampel bebas. Data kualitatif seperti pemerhatian lapangan, wawancara, respons bertulis reflektif, dan tafsiran penyelidik dianalisis secara kualitatif. Hasil kajian menunjukkan bahawa mempelajari kemahiran baru seperti kemahiran Pemikiran Komputasional (iaitu kemahiran pengaturcaraan) dianggap perlu oleh guru dan peserta di sekolah luar bandar. Berdasarkan analisis kualitatif dan kuantitatif pendekatan pedagogi pemikiran komputasional, dapat disimpulkan bahawa kemahiran pemikiran komputasional yang diperoleh melalui pendekatan unplugged, seni-integrasi, bermain-main, membuat, remix, dan robotik telah terbukti berkesan untuk murid sekolah rendah di Sarawak di peringkat sekolah rendah. Walaupun data kuantitatif tidak menunjukkan hasil yang menjanjikan, data kualitatif dapat digunakan untuk menyokong pengalaman belajar dan pengetahuan yang diperoleh dari aktiviti pembelajaran yang dicadangkan. Perancah dari orang dewasa dan rakan sebaya diperlukan semasa belajar kemahiran Pemikiran Komputasional terutama untuk pemula. Kesimpulannya, hasil kajian memberikan bukti positif dan memberangsangkan mengenai pendekatan "learning by doing" dan kepraktisan mengintegrasikan aktiviti Pemikiran Komputasional di sekolah luar bandar dapat membantu murid sekolah luar bandar mengembangkan kemahiran Pemikiran Komputasional.

Kata kunci: *Pemikiran komputasional, sekolah rendah luar bandar, unplugged, seni-integrasi, Scratch, robotik*

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LIST OF ABBREVIATIONS

BI	<i>Bahasa Inggeris</i>
BM	<i>Bahasa Malaysia</i>
CSTA	Computer Science Teachers Association
CT	Computational Thinking
CTPF	Computational Thinking Pedagogical Framework
EPRD	Educational Planning Research and Development
ICT	Information and Communication Technology
ISTE	International Society for Technology in Education
JPNS	<i>Jabatan Pendidikan Negeri Sarawak</i>
KSSM	<i>Kurikulum Standard Sekolah Menengah</i>
KSSR	<i>Kurikulum Standard Sekolah Rendah</i>
MOE	Ministry of Education
PISA	Programme for International Student Assessment
RBT	<i>Reka Bentuk dan Teknologi</i>
SPSS	Statistical Package for the Social Sciences
STEM	Science, Technology, Engineering, Mathematics
STEAM	Science, Technology, Engineering, Arts, Mathematics
TIMSS	Trends in International Mathematics and Science Study

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter is segmented into several sections. Section 1.2 discussed the background of the study which further divided into two subsections. Section 1.3 described the research gap found in the previous literature. Section 1.4 and Section 1.5 highlighted the research objectives followed by the research questions. Section 1.6 described the conceptual framework of the study. Section 1.7 pinned point to the significant contribution of the study. Sections 1.8 addressed the limitations found in the study. Section 1.9 explained the conceptual and operational definitions used in the study. Section 1.10 summarised Chapter 1.

1.2 Background of the Study

The emergent of computational technology today's has advanced the way human live, work, and even think (Digital Promise, n.d.). Digital Promise (n.d.) added that educating young people and the workforce is necessary to thrive in a computational world by developing skills that embody the demands of the innovation modern world. According to Shahali et al. (2017), 1.3 million STEM jobs in different sectors are projected by Malaysia in 2020 under The New Economic Model (NEM) to support the growth of infrastructure and industrial clusters in the nation. To help Malaysia achieve the desired number of STEM workforce by 2020, STEM education must be prioritised (Shahali et al., 2017). However, the Government of Malaysia still facing challenges to meet the targeted STEM workforce by 2020 (Shahali et al., 2017).