

**RECONNECTING LEARNING IN NUMERACY
REMEDIAL CLASS: A MULTIPLE
EXPLORATORY CASE STUDY OF
MATHEMATICS PRIMARY TEACHERS IN
TEACHING AT-RISK DYSCALCULIC PUPILS**

FU SAI HOE



UMS

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THE DEGREE OF DOCTOR OF PHILOSOPHY**

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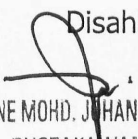
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DECLARATION

I, Fu Sai Hoe, hereby declare that this thesis "Reconnecting Learning in Numeracy Remedial Class: A Multiple Exploratory Case Study of Mathematics Primary Teachers in Teaching At-risk Dyscalculic Pupils" is an authentic work done by my own for the award of the degree of Doctor of Philosophy in the Faculty of Psychology and Education. I also declare that the materials in this thesis are of my own except for quotation, excerpts, equations, summaries and references, which have been duly acknowledged.



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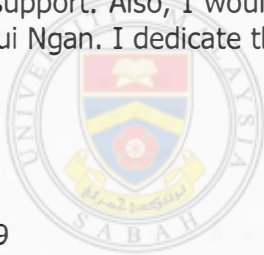
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ABSTRACT

Dyscalculia is a specific learning disability that may affect the acquisition of knowledge about numbers and arithmetic. It is about 6 percent of the population is struggling with dyscalculia. In Sabah, it was reported that the prevalence rate 5.5 percent of the primary school students suffered from Dyscalculia using the computer-based Dyscalculia screener by measuring pupils' response accuracy and response time to test items. In order to help at-risk dyscalculic pupils to master the number sense and assist teachers in teaching at-risk dyscalculic pupils, this study aims to administrate qualitative multiple case studies to explore the teaching of number sense using a new idea which is known as "Reconnecting Learning". This teaching strategy is developed to teach number sense and to support pupils at risk of dyscalculia to master pre-number skills and pre-counting skills which are a prerequisite to learning numbers. This research blends the Active Learning, Feuerstein' Mediated Learning Experiences, Tall's mathematics cognitive learning theory to derive a new teaching method following Liebeck's ELPS sequence - "Reconnecting Learning" to form a new teaching strategy. Three cases were chosen carefully in different primary school site and the case was bounded by time and place, time and activity and definition and contexts. Purposive sampling was used in this study to ensure the target pupils screened using UMS dyscalculia screener were relevant to at-risk dyscalculia and the teachers involved in this study were chosen based on criterion sampling. Data were collected from three primary school remedial mathematics teachers and three pupils at-risk of dyscalculia in Sandakan, Sabah through lesson observations for synthesizing the pupil's learning progression and conducted semi-structured interviews with three particular teachers. On top of that, analysis of documents such as reflective journals and electronic daily lesson plans was performed in order to gain a comprehensive picture of this teaching strategy. The study findings were analyzed manually through qualitative thematic analysis and grounded theory coding process. Findings emerged seven themes to reveal that this new teaching strategy was 1) a well-organized contents and structural activities 2) systematic and 3 simple implementation steps 3) compatible with innate abilities 4) physical features of Reconnecting Learning 5) transferable and practical 6) cultivate learner's willingness to learn and 7) barriers and adoption for Reconnecting Learning to scaffold the pupil who was at risk of dyscalculia in particular to number sense. At the end of this study, the pupils' performance was improved in the UMS dyscalculia screener results. The findings could guide education policymakers, administrators, authorities, teachers and parents to take the necessary measurement to help the at-risk dyscalculic pupils to learn number sense.

ABSTRAK

PEMBELAJARAN SAMBUNG SEMULA DALAM KELAS PEMULIHAN MATEMATIK: KAJIAN KES PELBAGAI DALAM KALANGAN GURU MATEMATIK SEKOLAH RENDAH YANG MENGAJAR MURID BERISIKO DISKALKULIA

Diskalkulia merupakan salah satu masalah pembelajaran yang menjejaskan pengetahuan berkaitan nombor dan aritmetik. Kira-kira 6 peratus daripada populasi dunia menghadapi diskalkulia. Di Sabah, dilaporkan 5.5 peratus murid sekolah rendah mengalami diskalkulia melalui saringan perisian komputer Dyscalculia UMS yang mengukur ketepatan dan masa tindak balas murid dalam menguji item numerasi. Bagi membantu murid-murid berisiko diskalkulik menguasai angka dan numerasi, serta membantu guru mengajar murid-murid berisiko diskalkulik, kajian ini bertujuan untuk mentadbir kajian kualitatif kes pelbagai bagi meneroka pengajaran numerasi menggunakan idea baru "Pembelajaran sambung semula". Strategi pengajaran ini dibina untuk mengajar numerasi dan membantu murid berisiko diskalkulia menguasai kemahiran pra-nombor dan pra-pengiraan yang merupakan prasyarat dalam mempelajari nombor. Kajian ini menggabungkan Pembelajaran Aktif, Pengalaman Pembelajaran Mediasi Feuerstein, Teori Pembelajaran Kognitif Matematik Tall sebagai teori asas untuk membina kaedah pengajaran baru mengikuti urutan ELPS Liebeck - strategi pengajaran "Pembelajaran sambung semula". Tiga kes dipilih dengan teliti di sekolah rendah yang berbeza, dan kes tersebut dibatasi oleh masa dan tempat, masa dan aktiviti serta definisi dan konteks. Persampelan bertujuan digunakan dalam kajian ini bagi memastikan murid-murid yang disasarkan menggunakan saringan berasaskan perisian komputer Diskalkulia UMS, serta guru-guru yang terlibat dalam kajian ini dipilih berdasarkan persampelan kriteria. Data dikumpulkan dari tiga orang guru pemulihan matematik sekolah rendah dan tiga orang pelajar yang berisiko Diskalkulia di Sandakan, Sabah melalui pemerhatian dalam kelas untuk mensintesis perkembangan pembelajaran murid, selain melakukan wawancara separa berstruktur dengan tiga orang guru tersebut. Di samping itu, analisis dokumen seperti jurnal reflektif dan rancangan pengajaran harian elektronik turut dilakukan untuk mendapatkan gambaran komprehensif mengenai strategi pengajaran baru ini. Penemuan kajian dianalisis secara manual melalui analisis tematik kualitatif dan proses pengkodan berasaskan teori grounded. Tujuh tema didedahkan dalam strategi pengajaran baru ini iaitu; 1) kandungan teratur dan aktiviti yang berstruktur, 2) tiga langkah pelaksanaan yang sistematik dan mudah diaplikasi, 3) sesuai dengan kebolehan semula jadi, 4) ciri-ciri fizikal "Pembelajaran sambung semula", 5) boleh diaplikasi di tempat lain dan praktikal, 6) memupuk kesediaan murid untuk belajar, dan 7) halangan dan inovasi "Pembelajaran sambung semula" kepada murid berisiko diskalkulia khususnya untuk mempelajari makna nombor. Pada akhir kajian ini, prestasi murid didapati meningkat melalui keputusan saringan diskalkulia berasaskan perisian komputer UMS. Penemuan ini dapat membimbing para pembuat dasar, pentadbir, pihak berkuasa, guru dan ibu bapa bagi mengambil tindakan susulan yang sesuai untuk membantu murid berisiko diskalkulia.

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LIST OF ABBREVIATIONS

- LINUS - Literacy and Numeracy screening
- MOE - Ministry of Education Malaysia
- RL - Reconnecting Learning
- MLE - Mediated Learning Experience
- ELPS - Experience With Physical Objects, Spoken Language That Describes That Experience, Pictures That Represent The Experience, Written Symbols That Generalize The Experience
- JPN - Jabatan Pendidikan Negeri Sabah (Sabah State Education Department)
- EPRD - Education Planning and Research Department



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