A Study to Foster Discovery Learning in Mathematics at Primary Schools in the Republic of the Marshall Islands through the Integration of Concrete-Pictorial-Abstract (CPA) and Structured-Problem Solving Approach

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Marshall Islands Standard Achievement Test (MISAT) (2018) clarifies that geometry is one of the weakest mathematical areas among most of the public primary and secondary schools in the Republic of the Marshall Islands. The purpose of this study is to foster Discovery Learning in Mathematics at Primary Schools in the Republic of the Marshall Islands through the integration of Concrete-Pictorial-Abstract (CPA) and Structured-Problem Solving (SPS) Approach. Why discovery learning? Mostly, the traditional teaching approach in the public education of the Republic of Marshall Islands (RMI) limits students from advancing their higher order thinking skills. Most of mathematics lessons observed at some of the public primary schools in the Republic of the Marshall Islands were mostly lecturing so that students had minimal opportunity to exercise higher order thinking skills. Therefore, enhancing the abilities of RMI students to be critical thinkers and problem solvers is ultimately crucial. In this study, the teaching style to foster discovery learning entailed the integration of CPA and SPS strategies. The reason behind the integration is to scaffold discovery learning. Stigler and Hiebert (1997) illustrated that Japanese mathematics lessons as "structured-problem solving" are very effective in fostering higher thinking skills. Based on previous knowledge, a new task is given for students to solve where many different ideas are shared and discussed. The Concrete-Representation-Abstract (CRA) [CPA] approach has also been employed to aid students with learning disabilities to learn mathematics; CRA[CPA] has been reported to be effective in remediating deficits in basic mathematics computation (Morin & Miller, 1998), in fractions (Butler, Miller, Crehan, Babbit, & Pierce, 2003) and algebra (Witzel, Mercer, & Miller, 2003). In 2016-2017 school year, *Math in Focus* textbook [which is the current textbook for teaching primary mathematics] was bought and training about CPA approach was also conducted. As a result, the RMI Public School System (PSS)

already have insight about CPA, and using CPA as another scaffolding to foster higher order thinking skill through SPS is necessary because students have never had experience of SPS. Furthermore, in primary level, students are not assigned homogeneously to a section based on their academic abilities but are mixed heterogeneously. A total of 89 students from 2 primary schools participated in this study. However, due to the issue of absenteeism, the actual sample population was 80 students retrieved from 38 students at school A (CC = 18 and EC = 18) and 42 (CC = 24 and EC = 20) from School B. The experimental class (EC) and the controlled class (CC) were both taught by the author. The lesson structure of the EC was composed of Concrete-Pictorial-Abstract guided through Structured-Problem Solving lesson format. The lesson structure of CC entailed lecturing and collaborative work. After pre-test and post-test were given, it was found that i) in both CC and EC, the pre-test score (CC- 0.97, EC -0.76) was very low and not so much difference of pre-test scores, ii) in both groups, there was improvement from pre-test score (CC- 0.97, EC -0.76) and post-test score (CC-7.4, EC-6.3), iii) there was improvement from pre-test score to that of post-test score in both groups, iv) the post-test score's standard deviation (CC-sd=5.2, EC-sd=5.2) of both groups was large enough compared with average test score (CC-7.4, EC-6.1), which implies that there would be a huge range among students in both groups. The overall score result of the controlled class turned out to be better than the experimental class. However, the experimental class showed a greater impact in the higher order thinking activity than the control class. The importance of CPA is to enhance proactive learning where students can proactively manipulate materials and experience visualization while moving toward abstract. Within each stage, it is imperative that every student understands its basis and meaning. Using Structured-Problem Solving approach through the manipulation of materials as scaffolding proved to be an effective approach to enhance students' higher-order thinking skills. The schools and sections were randomly selected, and it turned out that one of the sections in the control class was composed of more students with better academic performance. Small sample size is one of the limitations of this study. Due to COVID-19, the second part of this study was not conducted. The integration of CPA and SPS showed a great impact in mathematical content and application.