

Improving students' mathematics academic ability by implementing structured
problem solving and formative assessment activities in El Salvador
—through the implementation of face-to-face and video-based lessons—

Human Education

Global Education Course

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Background and benchmark

The improvement of students' learning achievement in mathematics is often addressed by the countries. El Salvador has implemented; since 2015, a new textbook policy based on a revised syllabus. This new approach on teaching has been accompanied by the technical support of Japan, and the effectiveness of such new textbook implementation has been reported in previous researches with evidence from the classroom, students, and teachers. However, it is still needed to overcome some difficulties and issues in order to better improve the students' learning achievements.

The present dissertation study reported here, describes how students may improve their academic ability by how the teacher implements the structured problem solving and some formative assessment activities through the use of lesson plans or interactive videos.

Structured Problem-Solving and Formative Assessment

Aiming to improve the students' academic ability; which is understood as the improvement of students' cognitive skill,

depending on how well the children were taught; an intervention was designed that consisted of concretizing the structured problem-solving posed by Shimizu that is widely applied in Japan, and complementing such approach with the formative assessment activities concerning the teacher side posed by Black, William and Thompson. In order to concretize and merge the two frameworks mentioned above, some lesson plans were elaborated. These lesson plans were implemented in both modalities, face-to-face and adapted to the online environment by using interactive videos.

Data collection and assessment frameworks

The data was collected, firstly, about the teacher's content knowledge and pedagogical content knowledge based on the seminal work of Shulman. The schools that participated were selected randomly from the results of the teachers based on the average ability on content knowledge and pedagogical content knowledge plus and minus one standard deviation, in order to assure an equivalent ability among the teachers who conducted the lessons.

This study was conducted within 2021

and it was prepared and adapted to the situation that happened during the COVID-19 pandemic influence. By the time that the research was conducted, it was possible to take into account schools in both modalities, face-to-face and online. For this reason, four teachers with average ability were selected with their classrooms of about ten, six, nine and fifteen students.

In order to measure the construct of 'academic ability', it was necessary to measure the students' 'cognitive skills' through a paper-based test in face-to-face lessons and through a Google forms-based test in online lessons. Also, 'the way that children were taught' was measured by conducting an analysis on the recorded videos of the lessons delivered, and by using a rubric on the lesson plan adherence in face to face lessons. Conversely, the same dimension was measured through the interaction with the videos in the online lessons.

Results

The results showed that students at the experimental group performed better in the reasoning skills (0.049) considering a 0.05 for the significance level throughout the study. This result seemed to be related to the frequency in which teachers involve student in higher (0.008) or lower order questions (0.05) during the whole class discussion (*neriage*) moment of the structured problem-solving approach. Conversely, no difference was found in the online intervention, which is also related to the way

that students interacted with the videos.

Moreover, the data showed that the implementation of activities related to the structured problem solving and formative assessment are strongly associated with how much the teachers adhered to the lesson plan (0.96**).

Conclusions

It can be said that from the intervention in the usage of the lesson plans based on structured problem solving and formative assessment activities by the teachers in the face-to-face lesson, the cognitive skills of reasoning seemed to be significantly improved.

On the other hand, even though the online intervention was not so successful in this study, it also elicited that despite the scarcity of proper interaction with the interactive videos, it was not elicited that any difference existed in accordance with the 'normal' online lessons conducted during the COVID-19 scenario. In other words, it was the same the group that interacted as usual with their resources than the groups that most of the students (66%) could not interact even with one of the provided videos. This finding reasserts what actually is perceived by researchers and educators, and it seems that the real consequences of the COVID-19 online lessons are, by now, unmeasured in El Salvador.