

A Study on Comparison of Attitude and Problem Solving Ability in Students and Teachers through Global Connected Learning Based on Smart Education

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Abstract

In this study, we suggest a global connected learning environment based on smart learning principles to enhance problem solving ability in U.S. and Korean students. According to the results of this research, participants responded that Cultural Respect was the best effect of the research; however, they struggled with the concept of Smart Learning Environment. Furthermore, the students' problem solving ability was enhanced. Thus, we can conclude that global connected learning based on smart learning principles is effective in enhancing problem solving ability.

Keywords: Problem Solving Ability, Global, Connected, Smart Education, Smart Learning

Introduction

Smart learning is a 21st-century educational paradigm that aims to discover students' talent and to foster global leaders by using information technology and network resources in school education. In South Korea particularly, the vision for smart learning is to nurture global human resources to lead the global community [1].

Given the social and national attention to smart learning, many scholars have begun to conduct extensive research into smart learning's conceptual definition, instructional strategy, and technological environment [2]. Additionally, in Korea, pilot schools disseminate smart learning methods in actual classes, based on the ideal of using education to raise the competence of 21st-century learners [3].

Research frequently identifies problem solving ability as the most important skill for future life and active participation as a citizen of the 21st century [4][5][6][7][8]. Furthermore, problem solving ability is an important aspect for 21st-century learners with regard to smart learning methods [2]. Thus, based on advanced research, we can conclude that smart learning is intended to extend the capabilities of 21st-century learners, and to raise their problem solving ability in particular. However, to ensure internal stability of smart learning in fostering global leaders, problem solving ability must be enhanced based on globalized cogitation, not just simple problem solving. This necessitates the creation of a worldwide learning environment, one which transcends the current, limited domestic learning environment.

In this study, we attempt to use smart devices to expand the boundaries of smart learning from a domestic to an international learning environment, thus enhancing students' problem solving ability based on globalized cogitation.

Research Design

The goal of this study was to examine the change in teachers' and students' problem solving ability based on our instructional treatment: use of smart devices within a worldwide learning environment. Our research questions were as follows: (a) How are teachers' and students' thought processes changed by the global smart learning environment? and (b) How does problem solving ability compare before the educational treatment and after?

To conduct this research, we selected four U.S. elementary school classes and two Korean elementary school classes to participate in global smart learning, from schools requiring the use of smart pad devices. Each class consisted of approximately 30 students, and all classes were from fifth grade. We analyzed and compared each class's curriculum to select adequate subject and learning content, with a focused on recycling. We selected the following learning goal: Students in partnering countries will be able to define and identify their community's recycling practices, and will share with each other, learning more about themselves and each other in order to build respectful, reflective, collaborative, and creative minds. Subsequently, we selected a curriculum consisting of nine sessions: (1) Intro to Recycling, (2) Identification of Sub-topic, (3) Self-reflection on Sub-topic, (4) Study of Sub-topic in the Community, (5) Presentation, (6) Viewing and Discussion of Presentations, (7) Questions and Feedback, (8) Comparative Reflection, and (9) Overall Reflection. This content was designed as a one-month module for the regular class. Additionally, we developed learning materials and the portal site to facilitate students' global interaction.

To examine the degree of change in problem solving ability before and after the educational treatment, we used the problem solving ability test developed by Moore (1997) [9]. The test consists of questions with positive or negative tendency. Thus, we divided questions into groups based on positive and negative tendency and conducted a dependent sample t-test to compare the students' pre- and post-treatment

responses. Additionally, we conducted interviews with all teachers and with five students randomly selected from each class immediately following the research treatment. Interview questions were divided into the following categories: (a) International Interaction, (b) Peer Interaction, (c) Cultural Respect, (d) Learning Content, and (e) Smart Learning Environment. After the reflective interviews, we divided the responses according to positive or negative tendency. The overall research design is shown in Figure 1.

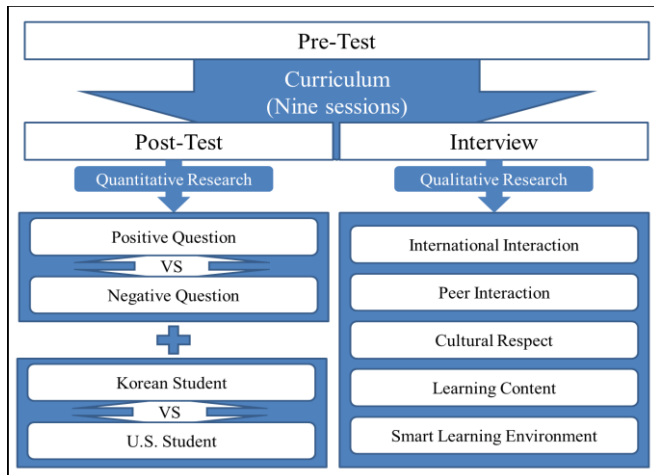


Figure 1:Overall Research Design and Method

Development of the Smart Learning Environment

In this study, we focused on the smart learning environment as a condition of education. To conduct this research, we selected the experimental groups using the following standards: (a) the classroom should have enough smart tablets for learning, at least one device per group of two students; (b) students and teachers should be familiar with use of smart devices in class; and (c) the wireless network environment should be supported without any network obstacles. We developed the homepage included the web & cloud server with LMS system since the LMS system is effective on the distance learning environment [10][11][12](see Figure 2).

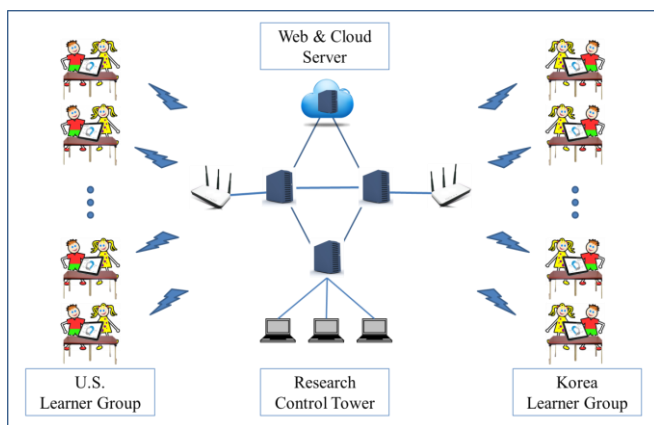


Figure 2:Smart Learning Environment Composition Diagram

The smart learning application was developed with consideration for asynchronous connections [13], given the time difference of approximately 13 hours between the United States and South Korea. Various functions were included to foster mutual exchange of students' opinions to overcome the time difference, for example, they are able to upload their presentation and share the idea using the discussion board. We also considered each country's culture when developing the smart learning module to provide learners with proper motivation (see Figure 3).



Figure 3:Learning Contents based on each Country's Culture

Experiment Result of Research Question (a)

To examine research question (a), we conducted interviews with teachers and students to evaluate the change in their thought processes as a result of this study (see Table 1).

Table 1:Result of Interview with Teachers and Students

Section	Positive Responses		Negative Responses	
	Frequency	%	Frequency	%
International Interaction	33	22.8	2	3.1
Peer Interaction	21	14.5	31	48.4
Cultural Respect	38	26.2	1	1.6
Learning Contents	29	20.0	4	6.3
Smart Learning Environment	24	16.6	26	40.6
Total	145	100	64	100

Interviews were conducted immediately following the one-month educational treatment. Interview questions were categorized into five sections: International Interaction, Peer Interaction, Cultural Respect, Learning Contents, and Smart Learning Environment. We analyzed student and teacher responses according to positive or negative tendency. According to the interview results shown in Table 1, *Cultural Respect* received the highest positive response, 26.2%. When we look through the interview transcriptions, most students mentioned that the treatment was a great chance for contact with other cultures. On the other hand, although though the goal of the research was global connected learning based on smart learning principles, *Peer Interaction* received the lowest positive response, 16.6%. According to the interview transcriptions, particularly those of students, many students

had difficulty in sharing the smart devices. When we observed the research classes, they seems to prefer using smart devices; however, although these experimental classes had more exposure to smart devices than standard classes, participants found it difficult to share the device or to effectively divide and delegate specific roles for the class.

With regard to negative response results, *Peer Interaction* received the highest negative response rate, 48.4%, and *Cultural Respect* received the lowest negative response, 1.6%. These results correlate with the highest and lowest positive responses.

Analysis of the interviews offers the following results: (a) This study, which conducted global connected learning based on smart learning principles, offered students the chance to meet and understand other cultures; (b) this study determined that smart learning environments solve the problem of physical limitation for globally extended classrooms; and (c) when using smart devices, prerequisite ethics and guidelines for understanding and cooperating with teammates should be taught before the main activity.

Experiment Result of Research Question (b)

To examine research question (b), we conducted Moore's (1997) problem solving ability test to compare the degree of change before and after the treatment. The test consists of six main questions, each with positive and negative inquiries. In this study, we obtained a total score for both positive and negative questions, then compared mean score and p-value ($p < .05$) statistically using both independent and dependent t-tests. First, we analyzed a dependent t-test to compare pre- and post-treatment tests (see Table 2).

Table 2: Result of Dependent t-test between Pre-and Post-test

Section		<i>M</i>	<i>SD</i>	<i>P</i>
Positive Question	Pre-test	68.59	9.39	.213
	Post-test	69.88	11.33	
Negative Question	Pre-test	66.24	6.87	.000
	Post-test	56.85	8.44	

As shown in Table 2, *negative questions* presented a statistically significant p-value of .000. The mean score of the post-test decreased with regard to the pre-test. This means that students' negative problem solving ability aspect decreased during this study.

To compare the problem solving ability of U.S. and Korean students, we conducted statistical analysis with an independent t-test of the U.S. and Korean students' using pre- and post-tests (see Tables 3 and 4). This t-test indicated a statistically significant p-value of .003 for *positive questions*. This means that before the research treatment, the U.S. students in the study had higher problem solving ability than the Korean students (the mean score was higher than that of the Korean students' group).

After the research treatment—global connected learning based on smart learning principles—we conducted statistical analysis with an independent t-test, comparing the U.S. and

Korean students' post-test responses. The result of this t-test did not indicate any statistically significant p-value.

In summary, we conclude based on the independent t-tests of both pre- and post-test responses that Korean students' problem solving ability increased during this research. We believe the reason for the decreased gap in problem solving ability is related to the goal of this study: *global connected learning between U.S. and Korean students*. Because U.S. and Korean students connected with one another in the smart learning environment, they gained positive interaction affecting problem solving ability.

Table 3: Result of Independent t-test at Pre-test

Section		<i>M</i>	<i>SD</i>	<i>P</i>
Positive Question	U.S Student	72.68	9.39	.003
	Korean Student	65.73	8.37	
Negative Question	U.S Student	64.93	8.24	.223
	Korean Student	67.15	5.66	

Table 4: Result of Independent t-test at Post-test

Section		<i>M</i>	<i>SD</i>	<i>P</i>
Positive Question	U.S Student	71.39	10.83	.362
	Korean Student	68.83	11.68	
Negative Question	U.S Student	56.18	10.21	.594
	Korean Student	57.3	7.05	

Conclusions

In this study, we conducted research on smart education in a global connected educational environment. Smart learning arose from the social and national needs to foster outstanding 21st century leaders. However, most research has thus far been confined to the domestic level, because related research is limited and it is difficult to conduct realistic connections with other countries. However, 21st century society needs individuals with problem solving ability on a global level. If the smart learning environment is well-composed, then global connected learning can be conducted with other countries.

Thus, we suggest using a global connected learning environment based on smart learning principles to enhance problem solving ability. We conducted two types of analysis to determine the results of the treatment: (a) analysis of interview results, and (b) statistical analysis of independent and dependent t-tests. Based on the interview results, participants responded that Cultural Respect was the greatest effect of this research; in contrast, they struggled with the Smart Learning Environment.

Furthermore, the students' problem solving ability was enhanced by this research treatment. Thus, we can conclude that global connected learning is effective for enhancing problem solving ability. However, preparations for smart learning environments are necessary to ensure proper cooperation and collaboration with teammates.

Finally, we propose the following topics for future research: (a) extended research into global connected learning; (b) research conducted with more participants; and (c)

consideration for how synchronized classrooms can be realized between countries with significant time differences.

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