The effect of project-based cooperative learning on disability empathy in pre-service early childhood teachers

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Abstract: This study investigated the effect of project-based cooperative learning in an introductory special education class on disability empathy. Disability empathy is an important competency for pre-service teachers who teach children with disabilities. The subjects of this study were 49 university students who were completing a qualification course for pre-service teachers who teach children with disabilities. First, through theoretical learning, interest and understanding of disabled infants and toddlers were raised, and educational program production activities were carried out to increase understanding of disabilities. Project-based cooperative learning was conducted for a total of 30 hours over 15 weeks. As a result of the study, it was found that the disability empathy of pre-service early childhood teachers significantly increased after the implementation of project-based cooperative learning, and the active interaction item score was the highest in the class satisfaction area. As a result, it was found that project-based cooperative learning has a significant effect on pre-service early childhood teachers' disability empathy and promotes active interaction. The significance of this study is that it empirically verified the effect of project-based cooperative learning on preservice teachers' disability empathy. It is hoped that the results of this study will be used as teacher education materials to improve pre-service teachers' disability empathy.

Keywords: *Children, Competency, Cooperative learning, Disability empathy, Early childhood teacher, Education program, Project.*

1. Introduction

Modern society is rapidly changing and requires the convergence of various domains and the convergence of various generations. Individuals living in this era require more abilities than before, and they need to understand themselves, others, and the world. Learning is necessary for individuals to go beyond their capabilities and create positive value based on collaborative relationships. In this respect, project-based cooperative learning is an effective teaching and learning method that can cultivate various future competencies such as personal responsibility, social skills, communication skills, facilitating interactions, and problem-solving skills [1, 2]. Project-based cooperative learning is a teaching technique that aims to complete a task in learning, that is, a project. Cooperation among members is required to complete these tasks, and this is done through the process of raising, exploring, and completing tasks through discussions among members. For this reason, project-based cooperative learning corresponds to a learner-centered teaching method [3]. Of course, to complete these tasks, not only cooperation between learners but also cooperation between instructors and learners is required. Through these collaborative educational activities, learners can develop a sense of responsibility and a self-directed attitude and learn social capabilities such as cooperation and communication skills [4]. The goal of education is not only to impart knowledge but also to develop the ability to apply and utilize the learned knowledge in everyday life. A typical example of this application ability is self-directed learning. Project-based cooperative learning is an effective educational method that can maximize learners'

initiative and ability to utilize knowledge. Through project-type classes that explore topics of interest and propose and solve problems on their own, learners develop creativity, critical thinking, and communication and collaboration skills [4-6].

On the other hand, in addition to the cognitive effect of project-based cooperative learning, the affective effect is also important, and the representative one is understanding others. The ability to understand, collaborate, and communicate with others is a relationship-oriented defining ability [7]. Empathy is an important skill in forming relationships with others. Park [8] reported on the improvement of empathy ability in adolescents through cooperative learning, and Hong [9] also reported that art classes to which the cooperative learning model was applied had a positive effect on the improvement of empathy ability. Lee [10] also reported that the overall empathy score improved after cooperative music activities. Consideration, communication, and empathy among members are necessary for the smooth progress and problem-solving of collective projects. Empathy refers to the ability to accurately recognize and understand the emotions of others and respond appropriately [11, 12]. In other words, it means the overall ability to understand the state of others and feel and express similar emotions. Teachers' empathy ability is a useful construct that increases interaction with children and has a positive effect on teachers' happiness [13]. This study was conducted with a focus on disability empathy. Disability empathy refers to the ability to empathize with disabilities, which is a concept that includes cognitive, emotional, and expressive empathy for disabilities. In other words, it means the ability to understand the condition of a disabled child, feel similar emotions, and respond appropriately [14]. In previous studies, there were reports that the higher the empathy ability of teachers who guide disabled children, the lower the teacher's burnout [15] and the higher the teacher's efficacy and job satisfaction [16, 17]. As such, empathy is an essential element not only for general education scenes but also for teachers who guide children with disabilities.

Looking at previous studies, project-based cooperative learning has been shown to improve the self-efficacy of instructors and learners [18, 19] critical thinking and communication skills [20] and creativity [1]. However, in education, not only cognitive growth but also growth in the affective domain is important. Therefore, to resolve this imbalance, it is necessary to pay more attention to the defining factor. Therefore, in this study, disability empathy, which is important for pre-service teachers for infants and toddlers with disabilities, was selected as a research topic. In other words, through project-based cooperative learning, we tried to explore how pre-service early childhood teachers' ability to empathize with disabilities changes and to confirm the effectiveness of education. The research questions for this study are as follows:
1. What is the difference in disability empathy before and after project-based cooperative learning?
2. What are the class effects of project-based cooperative learning?

2. Method

2.1. Participants

This study was based on project-based cooperative learning conducted within the introductory special education curriculum. The subjects of this study were 49 university students who were completing a qualification course for pre-service teachers for disabled infants and toddlers at a university in Gyeonggi-do. The average age was 22.3 years. The grades were 11 students (22.4%) in the 1st year, 11 students in the 2nd year (22.4%), 19 students in the 3rd year (38.8%), and 8 students in the 4th year (16.3%). As for the data collection method, disability empathy test sheets were distributed to students and pre- and post-tests were conducted. The pre-test was conducted in the first week of the semester, and the post-test was conducted in the last week after the results were announced. The tool used for the pre-post-test is the disability empathy [14] test sheet, which consists of 3 factors and 14 questions. The sub-factors consist of cognitive empathy, emotional empathy, and expressive empathy and are measured on a 5-point scale. The reliability of the scale was .873, and the score in this study was .887. The composition of the disability empathy scale and examples of items are presented in the following Table 1.

Table 1.
Example items.

Factor	N	Item
Cognitive empathy	5	When I talk to children with disabilities, I will think from their point of view.
Emotional empathy	5	I will rejoice when the handicapped child rejoices.
Expressive empathy	4	I will comfort the handicapped child with warm words.

2.2. Process

This study aimed to learn theoretical contents about children with disabilities in the introductory special education course, develop a disability understanding education program, and apply it to actual educational institutions. In general, the stages of project-based cooperative learning are composed of four stages: (1) topic selection, (2) progress planning, (3) exploration, and (4) result presentation. In this study, the process was further subdivided, focusing on the development and application of learners' educational programs. The overall steps consist of: (1) selecting learner-centered topics; (2) project structuring; (3) project creation; (4) project application; (5) project evaluation and feedback. The learners freely formed groups, and each group selected a topic of interest. The main goal of cooperative learning is to develop and apply projects that help in understanding and improving awareness of disabilities, and methods such as storytelling and games were used for teaching and learning. To enhance the completeness of the project, the class was composed of one hour of theory class and one hour of disability understanding education program development so that theoretical knowledge could be reflected in the development of the educational program. Weekly team meetings were held to ensure that assignments were performed smoothly, problems were identified, and improvements were reflected through frequent feedback from instructors during the process.

Table 2.
Stages of project.

N	Step	Learning activity
1	Orientation	Team composition and task presentation
2	Topic selection	Select topic of interest for each team
3	Topic selection	Materialize disability understanding education
4	Structuring your project	Explore class methods
5	Structuring your project	Class method selection
6	Structuring your project	Basic design of training program for each team
7	Structuring your project	Interim presentation and discussion
8	Project production	Writing a lesson plan
9	Project production	Development of teaching media
10	Project production	Development of teaching media
11	Project application	Selection of applicable institutions, consultation on how to proceed
12	Project application	Apply training program by team
13	Project application	Apply training program by team
14	Project application	Apply training program by team
15	Project evaluation	Final evaluation and feedback

Table 2 presents the main steps and learning activities of this project-based collaborative learning process. The total composition consists of 15 sessions, consisting of 4 stages and learning activities for each stage.

2.3. Data Analysis

For data analysis, frequency analysis and descriptive statistical analysis were used for the characteristics of the study subjects. For the pre-post-test, the internal agreement (Cronbach's α) was used to look into how reliable the disability empathy scale was. A paired sample t-test and analysis of variance were used to look at the effect before and after the programme. The statistical tool used in this analysis is Jamovi.

3. Results

3.1. Disability Empathy Difference Before and After Project-Based Collaborative Learning

Forty-nine students who participated in the project-based cooperative learning within the Introduction to Special Education course were analysed for differences in disability empathy. The analysed results are presented in Table 3. First, looking at the average disability empathy, the average before implementation of project-based cooperative learning was 53.1 (SD = 4.83), and the average after implementation was 60.8 (SD = 5.06). In other words, it was found that disability empathy was improved after implementing project-based cooperative learning compared to before implementation, and this difference was statistically significant (p<.001). Next, the average difference in each subdomain of disability empathy was examined. Disability empathy consists of cognitive empathy, emotional empathy, and expressive empathy. The average value was high in the order of emotional empathy, cognitive empathy, and expressive empathy, and the factor that showed the most improvement was emotional empathy.

Table 3.
Differences pretest and post-test scores on disability empathy.

Factor	test	N	M	SD	t	p
Disability empathy	Pre test	49	53.1	4.83	13.34***	<0.001
	Post test	49	60.8	5.06		
Cognitive empathy	Pre test	49	19.4	2.22	8.62***	<0.001
	Post test	49	21.7	2.58		
Emotional empathy	Pre test	49	18.8	2.11	9.27***	<0.001
	Post test	49	22.1	1.82		
Expressive empathy	Pre test	49	14.9	1.84	8.48***	<0.001
	Post test	49	16.9	1.9		

Note: *** p<0.001.

Table 3 presents the results of pre-post-difference testing for the total disability empathy score and sub-scores. The pre- and post-test analysis results were significant at the significance level of 0.001. These results mean that project-based cooperative learning had a positive effect on pre-service early childhood teachers' disability empathy.

3.2. Educational Effect through Learner Satisfaction Survey

This project-based cooperative learning is a learner-centered project. To examine the educational effect, a learner satisfaction survey was conducted. The survey was conducted focusing on the areas of class planning, class operation, class evaluation, and overall satisfaction after the introductory special education class was over. The learners evaluated that this project-based cooperative learning was based on the interests of the learners, was systematically operated as planned, and was also evaluated in an appropriate way. Overall satisfaction was high, with 4.71 points. The area with the highest satisfaction was the class operation area, and the item score of 'Interaction was actively carried out in this class' was the highest at 4.82.

Table 4.
Student satisfaction with project based cooperative learning.

Area	Contents	Score (5)
Lesson plan	This class aroused the interest and interest of the learners	4.78
Class operation	This class was conducted systematically according to the syllabus	4.57
	Interaction was active in this class	4.82
	Feedback was given appropriately during the class	4.65
Class evaluation	The evaluation method for this class is suitable	4.55
Satisfaction	Overall, I am satisfied with this class	4.71

Table 4 presents the learner satisfaction scores of project-based cooperative learning. The satisfaction score is a score out of 5.

3.3. Qualitative Analysis through Learner Journals

In this class, learners presented and shared the results of the project and reflected on the overall learning through writing a reflection journal. The results are analyzed as follows: First, pre-service early childhood teachers reported that they were able to broaden their understanding and knowledge of children with disabilities through the development and application of disability understanding programs. In addition, it was reported that it served as an opportunity to strengthen the determination to develop a better educational program and pride as a teacher. The difficult part for the learners was the development of educational programs according to age and the part of conducting education with the theme of disability as a medium. Teacher feedback in the actual field also accounted for a large part of the feedback on the methodological aspect to increase the suitability according to age and the educational effect. Learners often expressed a sense of burden because they were developing educational programs for the first time, but they were able to complete the project through active exchange of opinions among team members and feedback from instructors. As a result, while reporting a sense of achievement and pride for the final product, it showed a positive learning attitude and awareness. It was found that they strengthened their will for growth while overcoming difficulties in the class process through cooperative learning.

Table 5.
Learner journal.

- It was difficult to consider suitability according to age because I had little experience meeting disabled children, but I was proud that the children responded happily and showed interest during class. I want to accept the feedback of the teacher and the professor and provide education on understanding disabilities in a more fun way in the future.
- At first, I had a lot of worries about what kind of teaching aids to make to easily understand disabilities, but it was easy to proceed because I talked a lot with the team members and the topic was decided. I learned that even simple things take a lot of time and effort, and I was proud that the children were teaching with the teaching aids I made. Next time, I want to make other play programs that I can enjoy with my children.
- It was the first time that children used teaching aids, so it was clumsy, and there was a lot of trial and error. I think we can make a more useful educational program with this class as an opportunity.
- I worried a lot at first, but when I finished it and went to the institution to give a class, I got feedback on what I thought was lacking. I came to know what I was still lacking and what I hadn't considered before, and it was a useful time. If this opportunity comes next time, I think I can make better teaching materials.
- While developing the educational program, I felt that I needed to know more about and consider the characteristics of children with disabilities. It was time to think more deeply about the considerations as we received feedback on unexpected aspects from the actual institution.
- I was worried that multimedia teaching materials would be unfamiliar to children, but I was surprised by the high concentration of children. I felt that it is not easy to educate the contents of disability awareness improvement according to the learner's level, and it was a time to realize the prejudice and awareness of

disability that I have.

- It took a lot of time and effort to develop the educational program, but I was proud to see the completed work, and it was even better to see the children's interest. Next time, it would be nice to create a story yourself and develop it in the form of a creative fairy tale. It was a meaningful time to learn about disabilities and children.

Table 5 shows the results of a qualitative analysis of the effectiveness of cooperative learning through learner journals. Learners reported a sense of accomplishment and pride in the final product, showing positive learning attitudes and perceptions. It was found that overcoming difficulties in the class process through cooperative learning strengthened the will for growth.

4. Conclusion

This study is to apply project-based cooperative learning with the theme of disability understanding education within the introductory special education class and to find out the effect of education. To this end, the degree of disability empathy was measured for pre-service early childhood teachers through pre-and post-tests, and a class satisfaction survey was conducted. As a result of the study, after the project-based cooperative learning, pre-service early childhood teachers' ability to develop disability empathy improved, and the factor that showed the biggest change was emotional empathy. In the case of the class satisfaction survey, the overall satisfaction level was high at 4.71 points, and the item with the highest score was 'Active interaction in this class'. Based on these results, project-based cooperative learning has a positive effect on pre-service early childhood teachers' disability empathy and, at the same time, contributes to active interaction. Even in the results of the analysis based on the journals submitted by the learners, the learners reported a sense of achievement, pride, and a positive learning attitude while making a commitment to continuous growth.

Based on the results of this study, the discussion is as follows: First, in this study, project-based cooperative learning was conducted with the theme of understanding disability, and disability empathy was selected to evaluate the effectiveness of education. In other words, by shifting the educational focus from cognitive factors to affective factors, the field of research has expanded. In this study, it was found that project-based cooperative learning had the greatest impact on emotional empathy among disability empathy areas of pre-service early childhood teachers. Previous studies also showed that emotional empathy had a greater influence than cognitive empathy [21]. This suggests that the learners empathize with and perceive other people's emotions more significantly than cognitive understanding. It is also in line with the claim that emotional empathy precedes cognitive empathy [22]. However, empathy can be better understood when cognitive, affective, and expressive components work together. The circulation model of empathy also emphasizes the model in which cognitive and emotional expressive elements interact with each other [23]. Therefore, it is necessary to educate pre-service teachers so that they can be integrated with an understanding of disabilities and express empathic attitudes based on emotional empathy. Second, in this study, learner-centered education was practiced by applying project-based cooperative learning to foster pre-service teachers' professionalism related to disability inclusion education. To develop the professionalism of pre-service teachers, understanding and practical learning about the education field for children with disabilities are necessary. The paradigm of future education is shifting to learner-centered education, and it is being made in the direction of emphasizing creative convergence education. Project-based cooperative learning is self-directed learning, from selecting topics according to interest to producing project outcomes. This type of learning can contribute to the improvement of cooperative spirit, communication ability, and problem-solving ability among learners. It can also help pre-service teachers develop a sense of efficacy and self-esteem in their major. It was also confirmed that growth and meaningful learning as pre-service teachers are possible through journals written by learners. Third, although the application of project-based cooperative learning is a meaningful attempt, it is necessary to elaborate and specify the planning and preparation process for learners who are new to it. Learners who were new to these topics reported

feeling overwhelmed and burdened with planning and conception. Problems were solved and final products were completed through communication and cooperation with team members, but academic burden and anxiety would be reduced if guidance and feedback in inquiry and investigation activities were tailored to learners. Prior research also emphasizes the provision of scaffolding to maximize learning effects [24]. This, in turn, will contribute to enhancing learning outcomes and satisfaction.

Although this study contributed to increasing interest in cooperative learning and disability empathy, it has the following limitations: First, there is a limit to the generalization of the research results because this study targets the subjects and learners of one university. In follow-up research, it is necessary to conduct research targeting university students in various regions. As a result, these efforts will contribute to improving cooperative education and the quality of education for children with disabilities.

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Competing Interests:
The author declares that there are no conflicts of interests regarding the publication of this paper.

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