



The Effects of Designing a Transdisciplinary Inquiry-based Curriculum on Pre-service Teachers: A Case of International Baccalaureate *

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Abstract

The present study aims to investigate the effect of the design process of transdisciplinary inquiry curriculum on the PYP pre-service teachers' group work skills, reflective thinking levels and curriculum design orientations. The study employs convergent design. For the quantitative part of the study a one-group pretest-posttest experimental design was employed, and the qualitative dimension was based on the case study design. The study group consisted of 15 pre-service teachers from different branches attending a university's International Baccalaureate Education Certificate training program. Pre-service teachers designed a transdisciplinary inquiry-based curriculum for 6 weeks. Qualitative data were collected through self-evaluation form, group evaluation form and semi-structured interview form. Quantitative data were collected through Group work Skills Scale, Reflective Thinking Levels Scale and Curriculum Design Orientations Scale. Qualitative data were analyzed through content analysis. Frequency analysis was performed for the evaluation forms; the results of the scales were analyzed with the *Wilcoxon Signed-Rank Test*. The effect size was calculated with the *Pearson Correlation Coefficient (r)* statistic. A significant difference was observed in the posttest in terms of the group work skills, reflective thinking levels, and curriculum design orientations of the pre-service teachers in designing a transdisciplinary inquiry-based curriculum, which implies that the application was effective. The study found that pre-service teachers favored student-based and inquiry-based curriculum and their performances were improved in terms of fulfilling responsibilities, time-management, providing support and making an effort. In addition, pre-service teachers had difficulties in curriculum planning, writing main ideas, organizing activities, considering the age level and writing action etc.

Keywords

Transdisciplinary Inquiry-based Curriculum
Group work Skills
Reflective Thinking Skills
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Introduction

Alternative Route to Education: International Baccalaureate

IB [International Baccalaureate] was founded in Geneva, Switzerland in 1968 and is an educational organization. There are more than 5000 IB schools worldwide (International Baccalaureate Organization [IBO], 2020). IB offers students from 3 to 19 years of age with four different levels of education. PYP (*Primary Years Program*) is for students aged 3 to 12; MYP (*Middle Years Program*) is for students aged 11 to 16; DP (*Diploma Program*) is for students aged 16 to 19; CP (*Career-related Program*) is for students aged 16 to 19 (IBO, 2017). PYP is called the primary years program and includes primary education, including early childhood. There are over 1800 PYP schools worldwide, while in Turkey the number is 36.

In PYP education, which is based on student-centered teaching, the focus is on teaching practices that enable knowledge to be structured in a cognitive and social context with individual and group works. This philosophical understanding is reflected in both learning and measurement processes. What students learn and how they learn is important and individual differences are not considered a problem but a teaching diversity. Learning environments, teaching materials, in-class and out-of-class teaching activities are implemented through student-centered programs designed by teachers. Student-oriented curricula are implemented through learning environments, teaching materials, in-class, and out-of-class teaching activities designed by teachers.

PYP curriculum framework is shaped by the students' interests and questions in the dimensions of **knowledge, conceptual understandings, skills, dispositions** and **action**, which are determined by IB. During the education period, students who are engaged in activities related to these five dimensions are expected to reach the IB learner profile (*inquirers, knowledgeable, thinkers, communicators, principled, open-minded, caring, risk-takers, balanced, reflective*) (IBO, 2018). Another behavior that is considered to be important for students in the PYP curriculum is international awareness. Cause (2009), in his study on how to achieve international awareness in PYP schools, states that each student can realize his / her international ideas through inquiry and other teaching methods. Studies show that the concept of leadership (Day, Townsend, Knight, & Richardson, 2016; Lee, Hallinger, & Walker, 2011); students' success in different courses (Campbell, Chittleborough, Jobling, Tytler, & Doig 2014; Carber & Reis, 2004; Dickson, Perry, & Ledger, 2018; Frank, 2009; Healer, 2013; Hemelt, 2014; Tan & Bibby, 2011; Toe et al. 2016); classroom teaching (Alford, Rollins, Stillisano, & Waxman 2013); self-efficacy and self-regulation skills (Kitsantas & Miller, 2015; Lau, Kitsantas, Miller, & Rodgers, 2018) have been examined within the scope of PYP education. In addition, there are studies investigating the international awareness of students (Barratt et al., 2018) and describing PYP curriculum models (Ateş, 2011; Sezgin, 2014). These studies show that the effects of PYP education on students are object of curiosity, and therefore, examined with different aspects. The present study examines the experiences of pre-service teachers who are training to be PYP teachers. In this context, it is important to explain the features of the PYP education context.

PYP's Teaching Focus: Transdisciplinary Approach and Teaching of the Approach

Each discipline produces knowledge with a unique methodology. However, in order to solve the complex problems and to understand the reality of the universe, disciplines need to intersect at some point. Piaget (1992) put forward the concept of the "*circle of sciences*" to explain the interdependence of sciences, drawing attention to the complementary connections of different disciplines. Piaget (1972) expresses a gradual classification of disciplines: from a disciplinary to multidisciplinary approach in which they do not directly influence each other, from multidisciplinary to interdisciplinary approach, and from interdisciplinary to transdisciplinary approach in which the boundaries of disciplines are intertwined and disappeared.

The integration of the disciplines varies according to the "*multidisciplinary, interdisciplinary, or transdisciplinary*" approach. Multidisciplinary approach refers to the focus of many disciplines on a common problem. The same issue can be dealt with in different disciplines, but there are no transitions or references between disciplines. For example, in an endemic or pandemic event, the economy and education separately explain that event's outcomes. Transdisciplinary studies support both traditional and interdisciplinary scientific activities (Stauffacher, Walter, Lang, Wiek, & Scholz, 2006). Transdisciplinary knowledge includes a system that has a humanistic value (Nicolescu, 2012). Wickson, Carew, and Russell (2006) states that societies face complex and multidimensional problems that are not limited to a single real-world discipline, and that transdisciplinary research begins with a problem that really exists in the world, not with the problem in the mind. The transdisciplinary approach seeks to explain a problem beyond the scope of a discipline with the power of knowledge from different disciplines and members from these disciplines use a common conceptual framework. In this way, the boundaries between disciplines are removed (Choi & Pak, 2006; Collin, 2009; Fedor-Freybergh, 1999; Flinterman, Tecler-Mesbah, Broerse, & Bunders, 2001; Klein, 2014; Rosenfield, 1992; Young, 1998). Chiesa, Christoph, and Hinton (2009), on the other hand, define transdisciplinary as a concept in which various disciplines are connected to a new discipline. The transdisciplinary approach differs from the interdisciplinary approach in the sense that it removes all the boundaries between different disciplines. There is a common concept, a case or a problem in the interdisciplinary approach. However, each discipline acts on its own since the borders are distinctive. For example, the effect of a pandemic on the economy, tourism, education, and health can be examined with an interdisciplinary approach. Every discipline describes a focus issue considering the boundaries of its field. Although that focus issue does not remove the boundaries of the disciplines, it creates a common intersection point. Transitions between disciplines are flexible; they can benefit from the scientific knowledge of other disciplines. In a transdisciplinary approach, on the other hand, boundaries between disciplines are removed. Disciplines have to create a common sense regardless of their perspectives.

If each discipline is a color, a new color formation is provided by mixing the colors in a transdisciplinary approach. Similarly, fields such as biology, chemistry, physics, and zoology can work together to create a formula for how to provide protection against a pandemic that humanity struggles with. Therefore, it can be said that the transdisciplinary approach is the creation of harmony.

In terms of teaching, the transdisciplinary approach is within the scope of integrated curricula since it brings different disciplines together for a common purpose. Integrated programs do not aim to do the same thing, but to reach different things in different ways. In these processes, students are encouraged to link their learning experiences and schemes to create in-depth meaning about themselves and their environments. They are also encouraged to derive knowledge from the real context and use knowledge in integrated ways because they do not know the limits of disciplines and research methods (Beane, 1995). Boyer (1995) states that it is important for students to make connections between disciplines and to discover ways to bring the disciplines together. The PYP training program also focuses on transdisciplinary understanding. The transdisciplinary curriculum starts with the real-life situation and not with common subjects or skills, and the process is shaped by students' questions (Drake, 2007). Transdisciplinary teaching helps students explore different contexts by highlighting a problem. Students solve the problem by multitasking (Herro & Quigley, 2017). This way, students go beyond different solutions or perspectives rather than finding a single line of solutions to problems (Mishra, Koehler, & Henriksen, 2011). Transdisciplinary teaching is motivating for activities such as acquiring knowledge, critical thinking and creative thinking. In this approach, students are seen as a whole and they are given the ability to learn to learn (Jeder, 2014). Students discover similarities between transdisciplinary teaching and human experiences; understand the content and methods of academic disciplines with the integration disciplines (IBO, 2010; Marshall, 2014). The PYP training

program includes 6 transdisciplinary themes, including: “*Who we are, where we are in place and time, how we express ourselves, How the world works, how we organize ourselves, Sharing the planet*” (IBO, 2010). Students acquire behaviors in the dimensions of knowledge, concept, skill, attitude and action with these transdisciplinary learning themes. Although the basic framework of each learning domain is determined by IB, schools establish the things the students will question relevant themes depending on students' interests.

As it is known, student-centered practices work successfully in the systems that are organized according to the learning needs of students and give an active role to the student in their learning processes. Teaching processes, learning environment, activities, and resources, which are based on the guidance of teachers, are organized for the benefit of students. First of all, students should perceive learning as a need and be enthusiastic about learning. At this point, students' questions are the key to learning. PYP educations are structured with a research-based and inquiry-based curriculum as they are focused on the solution of questions in the transdisciplinary teaching approach.

Teaching Focus of PYP: Inquiry-based Curriculum

The content of the inquiry-based curriculum is shaped according to the questions of the students. Learners are the centre of the teaching-learning process, that is why the interests and needs of the students are considered crucial. Student-centered practices provide students with a free environment in which they can find answers to their questions, progress at their own learning speeds and participate in decision-making processes (Benson, 2012; Sparrow, Sparrow, & Swan, 2000). Students are active participants in the process and teachers guide the students to help them during activities. (Leonor, 2015). PYP defines the teacher's role as creating a learning environment that encourages students to take as much responsibility for their own learning as possible (IBO, 2010).

In inquiry-based curricula, students are active throughout the learning process. The process begins with determining what students know and what they want to learn. Necessary in-class and out-of-class conditions are created for students to find answers to their questions. In addition, it is important to integrate inquiry activities into the curriculum in this process, and it is meaningful for the students to arrange them to include their past experiences. In this context, the studies show that the inquiry-based curriculum approach contributed positively to the students' academic achievement, conceptual understanding, motivation, interest in science, attitude, and high-level thinking skills (Burrowes, 2003; Cheang, 2009; Conklin, 2012; Knight & Wood, 2005; Leonor, 2015; Osborne, 2010; Pedersen & Liu, 2003; Tien, Roth, & Kampmeier, 2002). As Bruner (2009) puts it, the desire to learn and how this desire can be awakened should be emphasized and the interest in the material is the best stimulus for learning. The researchers have examined the effects of inquiry-based education on students within the scope of PYP (Bell, 2018; Hamm, Cullen, & Ciaravino, 2013; Van Aalst & Truong, 2011). In addition, there is a study that examines teacher views about inquiry-based instruction (Twigg, 2010). Similarly, there are studies in which teachers' views on the transdisciplinary teaching approach are examined (Özer, 2010; Savage & Drake, 2016) and studies about teaching practices based on the transdisciplinary cognitive neuroscience model (Flogie, Dolenc, & Aberšek, 2015). This research focuses on the in-depth analysis of reflective thinking, group working skills, and curriculum design orientations of the teachers who have prepared a transdisciplinary inquiry-based curriculum.

Teacher in the Process of Designing a Transdisciplinary Inquiry-based Curriculum

Teacher competencies affect student success. The school-based curriculum of PYP is prepared and implemented by the teachers. Since PYP programs are also school-based, teachers take on the role of both preparers and implementers of the programs. Teachers are expected to have the competence to design, implement and evaluate the program and it is important that they develop themselves continuously. Cook (2015) states that the professional development of PYP teachers is driven by school-

based studies and that collaboration is seen as an important factor in this process. For this reason, professional development of teachers is also emphasized in PYP schools. Since school-based curriculum is based on collaboration, teachers are required to continue their professional development on a practical basis. In this sense, it is crucial to address the perspectives of teacher training programs in Turkey, where the current research was carried out.

Numerous approaches and classifications have been developed to guide different paradigms of teacher training in the world. In general, it can be suggested that teacher training approaches are shaped by "traditional, behavioral, cognitive and constructivist" approaches. The training of pre-service teachers is depended on "the information transfer" in the traditional teacher training model, "the role-model teacher" in the behavioral teacher training model, "the expert teacher" in the cognitive teacher training model, and "teaching to learn" in the constructivist teacher training model (Güneş, 2016). The preferred teacher training model determines the training procedures and competences. Teacher training has been considered important in Turkey, as well as all over the world. It should be based on the needs of the present world. The pre-service curriculum is the key component of the teacher training. However, teacher training curriculum may lack certain aspects of pre-service training. Yıldırım (2018) points to the problems of teacher training curricula in the sense that they lack application-based) approach, and instead, based on the knowledge-based approach. Güneş (2016) emphasizes that information transfer and behavioral changes are the primary goals of the faculties' courses and that an educational perspective of practicality and learning to learn is still inadequately addressed. Similarly, Şendağ and Gedik (2015) point out the need for a systematic model for teacher training in Turkey that is not information-oriented but based on the simultaneous theoretical knowledge and practice process in a real classroom and school environments and supported by expert teachers. Similarly, Güneş (2016) addresses the need to reorganize the undergraduate programs based on the skill-teaching approach and to train teachers who learn. In addition, studies revealed that teachers believe that teacher training curricula need revision and improvement (Can, 2019; Koçyiğit & Eğmir, 2019). In this regard, teacher training curriculum need to be student-centered, application-based and should have skill-based outcomes. It is understood that teacher training programs in Turkey have a traditional approach, focus on the information transfer and behavioral changes, and teaching practices and learning-to-learn strategies remain in the background. In the IB system, teachers are expected to have trained with the approach of "teaching to learn." A teacher's ability to teach students to learn depends on observing and experiencing how it is taught. Teachers in IB programs need to prepare and apply teaching practices based on the constructivist approach and maintain and improve professional development. Therefore, it can be inferred that pre-service teachers in Turkey need mostly learner-centered practices.

In Turkey, the Ministry of National Education (MONE) prepares the curriculum of pre-school, elementary, middle and high school education and issues them to the schools for their implementation. The roles of teachers is to implement the curriculum and they are not expected to contribute to the development of the curriculum. This trend is reflected in teacher training at universities. The concept of the curriculum is theoretically included in the course contents of the Higher Education Institution, Faculty of Education, Teacher Training Undergraduate Programs guideline, which was put into force in 2006-2007 academic year (Tan Şişman, 2017). Higher Education Institution Education Faculty Teacher Training Undergraduate Curriculum was updated in 2018-2019 academic year and it includes "Curriculum Development in Education" elective course (Higher Education Institution [HEI], n.d.). Therefore, the instruction of how to develop a school-based course or curriculum is left to the initiative of the instructors and the choices of the students.

Pre-service teachers can graduate without taking a course on curriculum development. Therefore, the pre-service and in-service teachers may be unfamiliar to the development of a school-based curriculum. As a matter of fact, Baş (2016) concluded that the competencies of classroom teachers

for curriculum development are at a moderate level. Duman (2006) found that pre-service teachers have a negative perception about themselves in terms of curriculum development competencies. Similarly, Erdem and Eđmir (2018) found that level of curriculum literacy is low in pre-service teachers. Konař and Yađcı (2016) emphasize the need for teachers to develop a school-based curriculum in science and art and that in-service trainings should focus on teaching practices. Therefore, it is clear that teachers should have knowledge and skills in school-based curriculum development and be supported accordingly.

In the preparation of a transdisciplinary inquiry-based curriculum, teachers are expected to adapt to the system, develop a student-centered understanding of education, have group working skills, think critically, and feed on experiences. In transdisciplinary education mutual learning takes place and trust building among members is essential. Teachers, students and other stakeholders form a community that designs learning processes and work as a team member in complex projects. Disciplines are respected in this process and each team member is expected to have a deep knowledge of his / her field. It is also essential to create an innovative environment. Ensuring mutual trust between members is emphasized and members are expected to unite in professional humility. This increases the competencies of the group (Augsburg, 2014; Broersma, 2014; Stauffacher et al., 2006). Wiggins and McTighe (2006) stated that collaborative curriculum is mandatory in the PYP training process; Cook (2015) states that collaborative work is the food of PYP teachers. Wall and Shankar (2008) emphasizes the importance of relationships, intellectual freedom and a collaborative spirit in transdisciplinary studies. The current study investigates the development of group-working skills of pre-service teachers who need to work collaboratively. Thus, the study of the effect of transdisciplinary inquiry-based curriculum design on pre-service teachers' group work skills is one of the variables of the study.

Teachers' understanding of education is as important as the ability to work within groups in the process of preparing a transdisciplinary program. Bunnell, Fertig, and James (2019) say that teachers' identities are affected by institutionalization process of IB schools. Savage and Drake (2016) states that PYP teachers consider philosophical understanding as important as management and cooperation. Richardson, Anders, Tidwell, and Lloyd (1991) state that there is a close relationship between teachers' beliefs and teaching behaviors. It is possible to say that the curriculum design approaches reflecting the educational beliefs and educational philosophy of the teachers also affect the teaching practices (Bař, 2013). Cheung and Ng (2000) states that adaptation to the curriculum is not possible if teachers believe that the curriculum design is not valuable. Schiro (1992) states that it is important to determine whether teachers' beliefs about curricula and teaching practices have changed. In this regard, another variable of the study is the curriculum design orientations of the pre-service teachers.

It is important for teachers to reflect on their experiences and to reflect them on subsequent activities in terms of the quality of teaching. Dewey (1933) states that ideas are based on findings in the process of reflective thinking and that they are rejected or accepted over time. Rodgers (2002) states that reflective- thinking teachers have the characteristics of questioning and understanding their own thoughts; discovering different ways of expressions; conducting research in accordance with the rules and employing problem solving skills. If teachers acquire reflective thinking skills, their students will be able to gain this skill as well. PYP education system also emphasizes that teachers should value research-inquiry-based learning and set an example in this regard (IBO, 2017). In this context, examining the way PYP pre-service teachers' evaluate their own experiences during curriculum design and reflect this on the activities is important. In addition, the lack of a study examining the change in reflective thinking skills of PYP teachers is one of the reasons for including this variable in our study.

Darling-Hammond and Post (2000) states that if teachers are supported, the quality of education will increase. Savage and Drake (2016) states that it is important to strengthen teachers' skills as much as to develop a transdisciplinary curriculum with collaborative studies. This study discusses the experiences regarding the process of designing a transdisciplinary inquiry program. It is believed that the results and suggestions obtained from the research can guide teachers' professional development needs. With these in mind, problem statement of the study is the following: *"Does the process of designing an interdisciplinary inquiry-based curriculum affect PYP pre-service group teachers' work skills, reflective thinking levels and curriculum design orientations?"* The aim is to investigate the effect of the process of designing an interdisciplinary inquiry-based curriculum on PYP pre-service group teachers' work skills, reflective thinking levels and curriculum design orientations. In line with our aim, the following questions are asked:

1. Does the process of designing a transdisciplinary inquiry program make a significant difference between pretest and posttest total scores of teacher candidates' group work skills?
2. Does the process of designing the transdisciplinary inquiry program make a significant difference between the pretest and posttest total scores of the reflexive thinking levels of teacher candidates?
3. Does the process of designing a cross-disciplinary inquiry-based curriculum make a significant difference between the pretest and posttest total scores of curriculum design orientations scale?
4. What are the teachers' views on group work, their developmental process and student-centered curriculum?

Method

This study is a mixed method study in which qualitative and quantitative methods are used to examine the effect of the processes of preparing interdisciplinary inquiry units on teachers' group work, reflective thinking and curriculum design orientations. Mixed-method research is a research approach in which both quantitative and qualitative data are collected to understand the research problem, and two data sets are combined (collated) to draw conclusions (Creswell, 2017; Creswell & Plano Clark, 2015; Plano Clark & Ivankova, 2018). Plano Clark and Ivankova (2018) state that mixed-method research is a dynamic process influenced by personal, interpersonal, and social contexts. They suggest that these contexts are composed of various conditions such as environment, setting, relationships, communities, and beliefs. This study also prompted teacher candidates to consider various contexts, such as the conditions of their pre-service training, the studies for professional development, the preparation of the curriculums in the country, and the necessity for the collaborative work in the program they want to be professional as a teacher. The study group's knowledge on transdisciplinary inquiry and curriculum development in education, and their relations with the dependent variables in the study were considered as their context, and the relationships among the group were considered as interpersonal context. That the central structure of curriculum development in Turkey is not a school-based design program and that the given education will enable PYP teachers to work in the IB schools are considered as social contexts in the research. Besides, it was appropriate to control and reinforce the results with qualitative data obtained from the quantitative pattern of the research. Thus, it was necessary to combine the strengths of both quantitative and qualitative data to investigate the research problem, which is assumed to be affected by more than one context.

Mixed method researches may differ in terms of order, priority, timing of qualitative and quantitative data collection. The present study employed embedded mixed method since the qualitative data supports the quantitative data. The quantitative part of the study was designed according to the

single-group pretest-posttest design; while the qualitative part was conducted according to the case study design. Figure 1 shows the embedded design of the study.

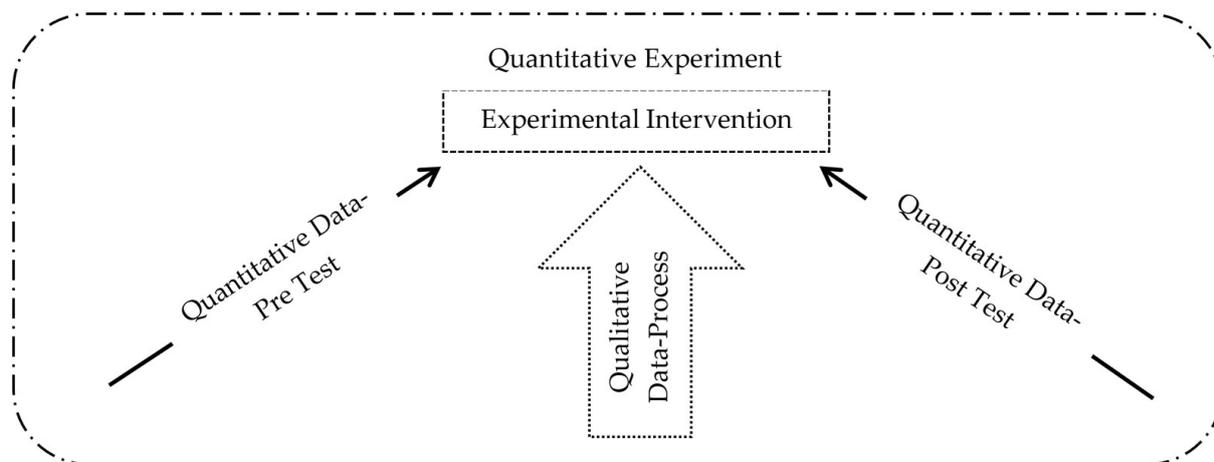


Figure 1. Embedded Mixed Method Design

Figure 1 demonstrates that quantitative data were collected at the beginning and end of the experimental intervention, and qualitative data were collected after the process. The quantitative and qualitative approaches of the research are described below:

Quantitative Process: The quantitative dimension of the study was designed according to the single-group pretest-posttest design in order to determine the effect of the processes of preparing the interdisciplinary inquiry units on teachers' group work, reflective thinking and educational program approaches. Experimental patterns aim to explore cause and effect relationships between variables, and the main condition for a research to be experimental is that subjects are assigned to the experimental conditions randomly (Büyüköztürk, 2014). The experimental procedures are performed on one group in a single-group pretest and posttest design, and through performing pretest before application, and posttest after the application, subjects' measurements for the dependent variable are determined (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz, & Demirel, 2019). The single-group pretest-posttest design was chosen because a randomly selected control group that have the similar characteristics to the study group couldn't be formed from outside and even if it could be formed, it wouldn't be possible to know whether the individuals in the control group received any other training during the treatment process. Some of the participants in the study group are teachers, and some of them are undergraduate students. Therefore, it was not appropriate to establish a control group to observe the changes and to compare the measurements with the experimental group. Therefore, it was not considered appropriate to observe the change in the control group and compare the measurements with the experimental group. In this context, the problem of the research was carried out on a single group and quantitative data were obtained by applying the scales of dependent variables twice as pre-test and post-test. The single-group pretest-posttest design of the study is shown in Table 1:

Table 1. The Single-Group Pretest-Posttest Design of the Study

Groups	Pre-test	Implementation	Post-test
E	GWSS	Transdisciplinary Inquiry-based Curriculum	GWSS
	RTLS		RTLS
	CDOS		CDOS

(E: Experiment Group; GWSS: Group Work Skills Scale; RTLS: Reflective Thinking Level Scale; CDOS: Curriculum Design Orientations Scale)

In the study, no comparisons were made between the measurements and groups. The Control group was not created due to the characteristics of the participants, which can be a limitation of the research. Indeed, it is not easy to relate between the findings of the quantitative data and the given education. Therefore, researchers took some measures to ensure validity and reliability throughout the process. Qualitative data were used to check the reliability of the quantitative data. The Qualitative data were collected weekly during and at the end of the application. Thus, quantitative and qualitative data were compared to see whether the study group attempted for a different professional development before the research, which is thought to affect the measurements. No change was observed in this regard in the study group.

Qualitative Process: The qualitative dimension of the study was designed as a holistic single case study in order to determine the participants' views on groupworks, self-assessments and curriculum design orientations in the process of preparing transdisciplinary inquiry-based units. Case study is a research method in which a current phenomenon is examined, described and explained in depth by what, how and why questions, using multiple data sources in real life context (Gürbüz & Şahin, 2018; Merriam, 2013a; Yin, 2009). In the holistic single case design, there is a single unit of analysis and it is used to monitor the effect of a well-formulated theory (Yıldırım & Şimşek, 2018). In this study, a single study group was used as the analysis unit and the data were collected through self-assessment forms. Figure 2 shows the holistic single case design of the study:

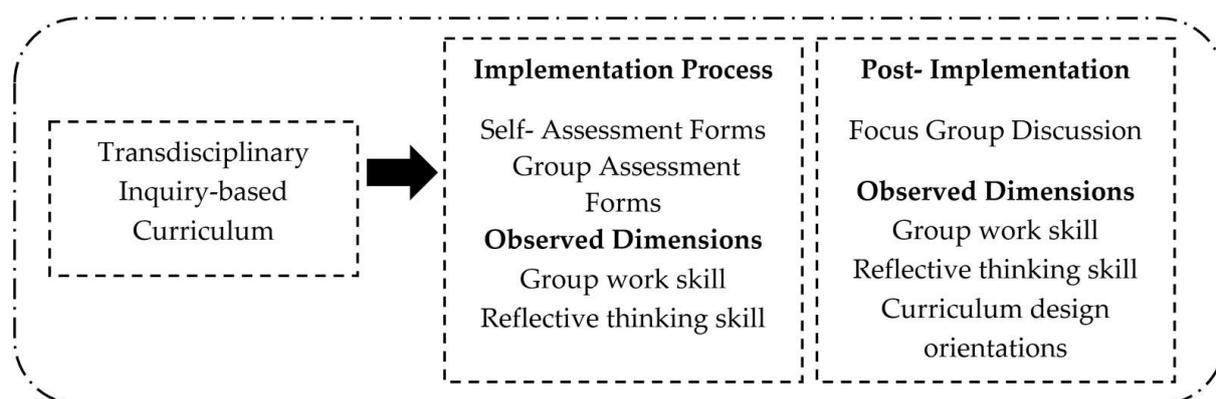


Figure 2. Holistic Single Case Design of the Study

Study Group

This study was conducted in the spring semester of 2018-2019 academic year within the scope of IBEC [International Baccalaureate Education Certificate] training program given at the Continuing Education Center of a private university. The study group was determined according to criterion sampling. The main criterion is that the participants have no previous experience in preparing a transdisciplinary inquiry program and are from different branches. 18 pre-service teachers' enrolled in the IBEC program. However, the study group consisted of 15 volunteer teachers, who continued their education from start to finish and participated in all practices. Qualitative and quantitative data was collected from these participants. Table 2 demonstrates the demographic information of the participants.

Table 2. Demographic Information of the Participants

Code	Sex	Age	Field	Employment Status	Grade Level	Professional Seniority	Graduate Education	University Type
P1-G1	F	21	ELT	Student	4	-	No	Private
P2-G1	F	23	PST	Student	4	-	No	Private
P3-G1	F	25	GAC	Student	4	-	No	Private
P4-G1	F	21	GAC	Student	4	-	No	Private
P5-G1	F	22	EST	Student	4	-	No	Private
P6-G2	F	27	MT	Teacher	-	6	No	Government
P7-G2	M	27	PST	Teacher	-	6	No	Government
P8-G2	M	31	PST	Teacher	-	5	No	Government
P9-G2	F	29	PST	Teacher	-	4	No	Government
P10-G3	F	22	PST	Student	3	-	No	Private
P11-G3	M	28	PST	Teacher	-	7	No	Government
P12-G3	F	26	ELT	Teacher	-	3	No	Government
P13-G3	F	27	ELT	Teacher	-	3	No	Government
P14-G4	F	23	PSE	Student	3	-	No	Private
P15-G2	F	24	GAC	Student	3	-	No	Private

(P: Participant; G: Group; F: Female; M: Male; ELT: English Language Teaching; PST: Primary School Teaching; GAC: Guidance and Counseling; MT: Mathematics Teaching; PSE: Preschool Education)

As shown in Table 2, 3 of the participants were male and 12 were female; 8 of them were students, 7 of them were teachers and their age range varied between 21-31 years. The participants consisted of teachers and students. However, since the participants were PYP pre-service teachers registered in the IBEC certificate program, the term 'pre-service teacher' was used for participants. 8 of the participants were in the department of Primary School Teaching, 3 of them were in Guidance and Counseling, 2 of them were in English Language Teaching, 1 of them was in Pre-school Teaching and 1 of them was in Mathematics Teaching. None of the participants who graduated from the university had any postgraduate education. Seven participants attended a private university, and eight graduated from state universities in different cities. Student participants continue to one of the 3rd and 4th-grade levels, while the professional seniority of teacher participants varies between 3-6 years. Focus group interviews were conducted with 11 participants including at least one participant from each group, (P3, P4, P6, P7, P8, P9, P11, P12, P13, P14, P15). In the process of designing a transdisciplinary inquiry-based curriculum, participants from different branches were included in the G1, G2, and G3 groups.

Data Collection Tools

The details of quantitative and qualitative data collection instruments are presented under two separate headings:

Quantitative Data Collection Tools

The quantitative data were collected through *Group Work Skills Scale*, *Reflective Thinking Level Scale* and *Curriculum Design Orientations Scale*.

Group Work Skills Scale

To examine the effect of the process of designing a transdisciplinary inquiry-based curriculum Group Work Skills Scale, which was developed by Cumming, Woodcock, Cooley, Holland, and Burns (2014) to determine the group work skills of university students, was used. The scale was adapted to Turkish by Ozan (2018). While adapting the scale, Ozan (2018) carried out the language validity of the scale with 70 pre-service teachers and performed construct validity with 509 pre-service teachers. He tested the construct validity of the scale with exploratory and confirmatory factor analyzes. 5-point (*1 Never, 2 Rarely, 3 Sometimes, 5 Often, 6 Always*) Likert scale consists of two factors and ten items. Two

factors in the scale were **task** and **interpersonal interaction**. Each factor included five items. Items “i2, i4, i6, i8, i10” measure the task size; items “i1, i3, i5, i7, i9” measure the interpersonal interaction dimension. There is no item with negative expression in the scale. The highest score is 50 and the lowest score is 10. The reliability coefficients calculated for the whole instrument were Cronbach Alpha .80 and Spearman-Brown .74 (Ozan, 2018).

Reflective Thinking Level Scale

To investigate the effect of designing a transdisciplinary inquiry-based curriculum on the reflective thinking skills Reflective Thinking Level Assessment Scale was used. It was developed by Kember et al. (2000) and adapted to Turkish by Başol and Evin-Gencil (2013). RTLAS was designed to measure the level of reflective thinking skills of university students at the end of a lesson. Başol and Evin-Gencil (2013) states that the scale can be used to examine the levels of reflective thinking skills of study groups. Başol and Evin-Gencil (2013) studied the construct validity of the scale with 151 teacher candidates for language validity and 1413 teacher candidates. They also tested the construct validity of the scale with exploratory and confirmatory factor analyzes. The scale is a 5 point-Likert scale (5 *strongly agree*, 4 *agree*, 3 *neutral*, 2 *disagree*, 1 *strongly disagree*), consisting of 4 factors and 16 items. The factors in the scale are as follows: **habitual actions, understanding, reflection and critical reflection**. Each factor includes 4 items. Items “i1, i5, i9, i13” measure habitual action; items “i2, i6, i10, i14” measure understanding; items “i3, i7, i11, i15” measure reflection and “i4, i8, i12, i16” items measure critical reflection. There are no reverse-coded items in the scale. The lowest score that can be acquired from the scale is 16 and highest score is 80. The reliability coefficients of the whole instrument were calculated as Cronbach Alpha .77 and Spearman-Brown .77 (Başol & Evin-Gencil, 2013).

Curriculum Design Orientations Scale for Teachers

To investigate the effect of designing a transdisciplinary inquiry curriculum on curriculum design orientations Curriculum Design Orientations Scale was used. The scale was developed by Baş (2013). Baş (2013) collected data from 300 teachers and tested the construct validity of the scale with exploratory and confirmatory factor analysis. Data were collected from 300 participants to develop the scale. The construct validity of the scale was examined by exploratory and confirmatory factor analyses. 5-point (5 Strongly Agree, 4 Agree, 3 Neutral, 2 Disagree, 1 Strongly Disagree) Likert scale is a 3-factor, 30-item instrument. Factors in the scale were categorized as **subject-based design, student-centered design** and **problem-based design**. Items “m14, m15, m17, m18, m20, m21, m23, m25, m28, m30” are for measuring subject-based design; items “m1, m2, m3, m6, m7, m8, m9, m11, m12, m24” are for student-centered design; items “m4, m5, m10, m13, m16, m19, m22, m26, m27, m29” are for measuring the problem-based design. All items in the scale are positive. The highest score that can be obtained from the scale is 150; the lowest score is 30. The reliability coefficients of the whole instrument were Cronbach Alpha .94 and Spearman-Brown .91. The Cronbach's alpha reliability coefficients for the sub-dimensions of the scale were between .89 and .87 (Baş, 2013).

Qualitative Data Collection Tools

Qualitative data were collected through self-assessment form, group assessment form and semi-structured interview form.

(I). Self- Assessment and Group Assessment Forms

In the research, self and group evaluation forms were used to involve the participants in the case determination process. The focus of the self-assessment form is on the internal observations and reflective actions of the pre-service teachers' individual development in the design process of the transdisciplinary inquiry-based curriculum. The group assessment form was used to determine the opinions of the candidates regarding the group performances in the design process of the transdisciplinary inquiry-based curriculum.

In order to prepare self and group evaluation forms literature was reviewed (Bahar, Nartgün, Durmuş, & Bıçak, 2009; Kiroğlu, 2011; Kutlu, Doğan, & Karakaya, 2009). Assessment forms are composed of checklist and open-ended questions. The criteria of the checklist are as follows: [strong performance (3), medium performance (2), low performance (1)]. The checklist of the self-evaluation form provides a review of 6 performances, and the checklist of the group evaluation form provides a review of 7 performances. The number of open-ended questions in the self and group evaluation forms is two. Expert opinions were taken from measurement and evaluation, curriculum and instruction and Turkish language and literature departments for the appropriateness of assessment forms. Forms were edited in line with the opinions of the experts.

(II). Semi-Structured Interview Form

At the end of designing an PYP transdisciplinary inquiry-based curriculum, focus group interviews are conducted with pre-service teachers to identify the contributions of group work and to learn about their curriculum designs and personal growth. Semi-structured interview forms were used during interviews. Semi-structured interview form was based on the sub aims of the study. Before applying the semi-structured interview forms, they were checked by field experts (measurement and evaluation, Turkish language and literature, curriculum and instruction) for its appropriateness for sub aims of the study and language. It is ready for use with the changes made after the expert examination. For example, the first question of the form is, "What do you think about the student-centered application of PYP teaching?"

There are three open-ended questions in the revised form:

- 1) How do you evaluate the PYP curriculum that is organized in line with students' interests, curiosity and questions?
- 2) How do you evaluate the impact of preparing a collaborative PYP transdisciplinary curriculum on teachers?
- 3) What kind of changes you experienced during PYP transdisciplinary curriculum design practice? Can you give an example?

Authorized IBEC Curriculum and its Application Process in Turkey

There are 6 main courses in IBEC training program, which was authorized by IB to PYP teacher training program in Turkey. These courses are: "*Curriculum Development, IB Philosophy and Instructional Methods, IB and Material Development, IB and Measurement & Evaluation, Social Responsibility, Teaching Practice and Career Development*". Brief descriptions of each course are as following: *IB and Measurement & Evaluation* course focuses on process-based performance assessment and complementary methods of measurement & evaluation; *IB and Material Development* course includes designing the in-class activity materials; *Social Responsibility* course encourages students to participate in community service practices and to develop a social consciousness; *Teaching Practices and Career Development* course aims for students to apply IB philosophy in the real classroom environment. *IB Philosophy and Instructional Methods* course involves internalization of constructivism approach that IB philosophy is based on together with student-centered practices. In PYP teaching practices, context-based learning, concept-based learning, research and inquiry-based learning are essential and the curricula are expected to be designed with a transdisciplinary approach. In the *Curriculum Development* course, participants design the content, educational status (activity, material, community-based and individual-based actions, etc.) and evaluation elements of the curriculum in the context of a transdisciplinary approach within the scope of IB philosophy. Therefore, this course is planned to form the framework of the other courses.

IB Philosophy and Instructional Methods and Curriculum Development courses were conducted by the researcher on the same day with integrated activities. By the end of these courses, students are expected to: “(I) internalize PYP philosophy and understand the learner profile, (II) understand the concept of integrated curriculum and design a transdisciplinary curriculum, (III) internalize the teaching approaches of PYP curriculum (IV) Plan activities related to inquiry-based curriculum, (V) Understand the roles of stakeholders in the curriculum development process and fulfill the necessity of cooperation”. In the research, the process of preparing a transdisciplinary inquiry program is structured as theory and practice. Table 3 shows the application flow:

Table 3. The Process of Designing Transdisciplinary Inquiry Curriculums

Week/Hour	Theory / Implementation	Course Content
1/4	Theory	Holistic Education Approach
2/4	Theory	What is Transdisciplinary Inquiry Curriculum?
3/4	Implementation	Designing a Transdisciplinary Inquiry Curriculum I “Who we are?”
4/4	Implementation	Designing a Transdisciplinary Inquiry Curriculum II “Where we are in place and time”
5/4	Implementation	Designing a Transdisciplinary Inquiry Curriculum III “How we express ourselves”
6/4	Implementation	Designing a Transdisciplinary Inquiry Curriculum IV “How the world works”
7/4	Implementation	Designing a Transdisciplinary Inquiry Curriculum V “How we organize ourselves ”
8/4	Implementation	Designing a Transdisciplinary Inquiry Curriculum VI “Sharing the planet”

As shown in Figure 3, theory and practice have been combined in designing the transdisciplinary inquiry program. For practice, the teacher candidates firstly got general information about transdisciplinary teaching. Resources and chapters related to the course content (Choi & Pak, 2006; Drake, 2007; Erickson, 1995; IBO, 2010; Jacobs, 1989) were shared with pre-service teachers. Suggestions for the integrated program design in the preparation of a transdisciplinary inquiry program were also examined (Erickson, 1995; Jacobs, 1989; Newell, 1994). Following the theoretical knowledge, study groups were created (G1-G2-G3).

Participants from different branches took part in each group and the curriculum design practices continued with the same group until the end of the process. The pre-service teachers designed an inquiry-based curriculum on 6 transdisciplinary themes (*Who we are, where we are in place and time, how we express ourselves, How the world works, how we organize ourselves and Sharing the planet*) through group work. The steps of preparing a transdisciplinary inquiry-based curriculum that the participants will follow were prepared by the researcher following the PYP principles, the steps of designing an integrated curriculum, and so on. The design of a cross-disciplinary inquiry program has six steps.

- 1. Determining Transdisciplinary Theme:** At this stage, one of the PYP transdisciplinary themes is chosen for the preparation of the curriculum.
- 2. Brainstorming:** This stage is the most important stage in terms of establishing the basic framework and affecting the subsequent activities. At this stage teachers produce ideas and make joint decisions. This step also includes determining main idea about the theme, identifying the level of IB learner profile at the end of the unit and writing of the concept-skills-attitudes and actions as outcomes.
- 3. Writing of the Line of Inquiry:** At this stage, it is expected that an inquiry framework will be created to enable the students to internalize the main idea. The disciplines which have the main idea as a research subject in real life are determined and the contexts and perspectives of the disciplines related to the main idea are revealed. Thus, different aspects of the transdisciplinary

theme are discussed. It should be ensured that the inquiry lines arouse curiosity among the students, that they are considered worthy of learning, and that they make students acquire multiple perspectives.

4. **Planning the Instruction:** At this stage, learning activities based on research and inquiry will be prepared in order to make students acquire the concepts, skills, attitudes and actions. When creating activities, attention should be paid to the student's structuring of knowledge and the teacher's role in the process.
5. **Evaluation the Instruction:** At this stage, process-based assessment and evaluation tools to be used to monitor and improve students' performances are identified and prepared.
6. **Revision the Instruction Design:** At this stage, the designed transdisciplinary inquiry-based curriculum is revised using the "Inquiry Unit Rubric" before its implementation and the related arrangements are made.

Data Collection and Analysis

The research data were collected within the scope of "Curriculum Development and IB Philosophy and Teaching Methods" courses in the IBEC Education Program in the spring term of the 2018-2019 academic year. During the research, pre-service teachers were provided to prepare a transdisciplinary inquiry-based curriculum. The program started in March and ended in June. The data were collected in three different ways: Scales, assessment forms and interviews. The scales were used twice as pre-test and post-test. The self-assessment and group assessment forms were carried out during the application process and semi-structured interview forms were carried out at the end of the application process. For the pilot study, the researcher applied the semi-structured interview form prepared for the focus group interviews with a group of prospective teachers who continued the same training in Istanbul. The pilot study proved that the semi-structured interview form was available. In the research, focus group interviews lasted about an hour, and there was a voice recorder during the interview.

Qualitative data obtained from open-ended questions in assessment forms and interviews were analyzed through content analysis. The codes were generated by the researcher through selective coding and their related themes were identified. Themes and their codes are given in tabular form. The degrees of participation in the performances in the checklists in the assessment forms [strong performance (3), medium performance (2), low performance (1)] are counted and presented in terms of frequency. However, no statistical calculation was performed on these numerical data. The changes monitored in six different performance tasks are presented in a table.

IBM SPSS 23 package program was used in the analysis of the quantitative data. The descriptive statistics of the total scores of the pre-service teachers from the GWSS, RTLS, and CDOS scales were interpreted on the basis of arithmetic mean, standard deviation, minimum and maximum values. In order to calculate the significance between the difference scores obtained from GWSS, RTLS, and CDOS scales before and after the experimental procedure, it was decided to determine the appropriate statistical technique. Firstly, data sets were examined, and no missing values were found. Then, Z standard scores were examined for extreme values and all values were in the range of [-3, + 3]. According to the normal distribution, 99% of the data should be +3, -3 standard deviations from the mean (Çokluk, Şekercioğlu, & Büyüköztürk, 2010). Büyüköztürk (2018) states that if the sample size is generally 30 or more, the distribution does not deviate considerably from the standard references. As the sample sizes in the pretest and posttest measurements were 15 in the current study, the data were analyzed with the *Wilcoxon Signed Ranks Test*, one of the non- parametric tests. A significant difference was obtained in measurements, and the effect size was calculated with *Pearson's Correlation Coefficient r*. The *r* values were interpreted as small correlations for .10, medium for .30, and large for .50 (Field, 2009). Significance level was taken as .05 for statistical analysis.

Reliability and Validity

Creswell and Miller (2000) state that data triangulation is a validation procedure. In this study, data were collected through scales, assessment forms (checklist, open-ended question) and interview. Thus, the research topics could be examined in depth and the consistency could be checked.

The Cronbach's Alpha (α) reliability values for the GWSS, RTLS and CDOS were .80, .77, and .94, respectively. Cronbach (1990) stated that the coefficients between 0.60 and 0.70 are sufficient for reliability. These values indicate that the Cronbach Alpha coefficients of the three scales are reliable.

For the content, language validity of the items in the checklists in the assessment forms, 8 field experts were consulted for Content Validity Index (CVI) values were calculated. McKenzie, Wood, Kotecki, Clark, and Brey (1999) state that if the content validity is checked with 8 field experts, the items may be significant at a minimum of .78. In this context, it can be said that items with values between 0.90 and 1.00 are valid. In addition, the items that were checked for language were not modified. Afterwards, the applicability of semi-structured interview form and assessment forms was tested by applying them to the participants who were taking same training in another city. No problems were identified in the application of interview questions and assessment forms.

The qualitative data of the interviews and open-ended questions in the evaluation forms were coded with content analysis by the researcher and then by an expert in education. Codings by two researchers were examined and a consensus was reached. The coder reliability among the researchers was calculated by the formula by Miles and Huberman (1994, p. 64); " P (% of consensus%) = $[Na$ (Consensus) / Na (Consensus) + Nd (Disagreement)] X100". The reliability of the qualitative data obtained through the interview was calculated as .84 and the reliability of the qualitative data obtained from open-ended questions was .82. Miles and Huberman (1994) stated that 80% consensus should be sought for coder reliability. In this context, it can be said that the coding for qualitative data is reliable.

Direct quotations of the participants from the interviews are presented in the study. The names of the participant were not revealed, and certain codes were given to represent them (K3, G1 for interviews, K1, G 2, Task 5 for open ended questions).

The Role of the Researcher and Ethical Precautions

The research was carried out by the researcher. The researcher received his doctorate in the field of Curriculum and Instruction. She has studies on interdisciplinary teaching approach in integrated programs. The researcher developed *IB Philosophy and Teaching Methods* and *Program Development* courses during IBEC program. Therefore, she chose to teach the aforementioned courses. The researcher was an observer during the individual and group activities and did not intervene to change the course of the research. Lincoln (1995) associates researcher's relationships with participants with ethics (as cited in Merriam, 2013b). The researcher, who is the instructor of the course, informed the participants about the aim, importance and process of the study.

The pre-service teachers' willingness to quit the education process that they voluntarily participated in was also considered. The researcher did not exert pressure on the absentee candidates. The research process was conducted with fifteen people who participated regularly.

Results

Descriptive Statistics of GWSS, RTLS and CDOS

Descriptive statistics regarding the total scores of GWSS, RTLS, and CDOS are presented in Table 4. Table 4 shows that the scores of GWSS, RTLS, and CDOS increased in the post-test.

Table 4. Descriptive Statistics of GWSS, RTLS and CDOS

Scale	Test	N	\bar{X}	sd	Min.	Max.
GWSS	Pre-Test	15	41.33	5.13	32.00	47.00
	Post-Test	15	45.66	3.82	39.00	50.00
RTLS	Pre-Test	15	53.66	9.02	30.00	64.00
	Post-Test	15	61.13	4.64	54.00	70.00
CDOS	Pre-Test	15	99.46	14.72	64.00	114.00
	Post-Test	15	116.53	6.54	106.00	131.00

Table 4 reveals that the scores obtained by preservice teachers from GWSS, RTLS and CDOS increased in favor of the post-test.

Findings regarding the Group Work Skills

Scales, assessment forms and focus group interviews were used to examine the group work skills of pre-service teachers while designing a transdisciplinary inquiry-based curriculum. Relevant findings are given respectively.

Pre-Test and Post-Test Results for Group Work Skills

Table 5 presents the *Wilcoxon Signed-Rank Test* results of GWSS, to reveal whether there is a significant difference between pre-test and post-test results:

Table 5. *Wilcoxon Signed-Rank Test Results of GWSS Pre-Test and Post-Test Mean Scores*

Posttest- Pretest	N	Mean Rank	Sum of Ranks	z	p
Negative Rank	3	4.17	12.50	2.51*	.012**
Positive Rank	11	8.41	92.50		
Ties	1				

* Based on negative ranks ** $p < .05$

Table 5 reveals that there is a significant difference between the pre-test and post-test scores of the pre-service teachers' group working skills [$z=2.51, p < .05$]. It is understood that this difference, which is observed in the mean and total of the difference scores, is in favor of the posttest. *The Pearson Correlation Coefficient (r)* statistic (effect size) was applied to examine the significance of this difference, which was found statistically meaningful, and calculated as .46. Hence, it can be said that designing a transdisciplinary inquiry curriculum has more than a moderate effect on teacher candidates' group work skills.

Findings on Group Work

Group work skills of the pre-service teachers was examined with group assessment forms and focus group interview. Participants were asked to fill out the group assessment forms to evaluate the performance of the group they are a member of. Table 6 shows the findings regarding the group assessment checklist.

Table 6. Results of Group Assessment Checklist

Performance	Tasks of Transdisciplinary Inquiry-based Curriculum Design																	
	Task I			Task II			Task III			Task IV			Task V			Task VI		
	Strong	Medium	Low	Strong	Medium	Low	Strong	Medium	Low	Strong	Medium	Low	Strong	Medium	Low	Strong	Medium	Low
Task was completed successfully.	9	1	5	9	4	1	11	4	-	13	2	-	14	1	-	14	1	-
Team learning was supported	10	2	3	11	4	-	13	2	-	14	1	-	14	1	-	15	-	-
Participants made effort during this study.	5	9	1	5	5	5	6	8	1	7	7	1	14	1	-	14	1	-
There are important things in this task that needs improving as a group.	7	3	6	5	8	2	5	10	-	5	6	4	4	4	7	3	3	9
Information and notes were shared during the task.	9	1	5	7	5	3	8	7	-	8	7	-	9	5	-	11	4	-
The time was used sufficiently during the task.	6	3	6	7	6	2	7	8	-	7	8	-	8	8	-	10	5	-
Participants made contributions with new ideas and opinions.	9	1	5	7	8	-	8	5	2	9	6	-	10	5	-	11	3	1

Table 6 shows that the groups have changed in terms of 7 performances from the first task to the sixth task. In this context, it was observed that pre-service teachers fulfilled their responsibilities and made efforts in group works, learning, sharing information and so on. They can provide support from different perspectives, learn to use time effectively, support different views, and their competences have improved. The results of open-ended questions of assessment forms are given in Table 7 and Table 8:

Table 7. Findings Related to the Success of Group Members

Themes	Codes	Performance Tasks					
		I	II	III	IV	V	VI
Curriculum Design	Finding / enriching activities	*	*	*		*	*
	Planning transdisciplinary curriculum	*		*	*		*
	Doing research	*	*		*	*	
	Activity writing			*		*	*
	Knowledge of the steps of curriculum design	*		*			*
	Transferring subject matter knowledge		*	*	*		
	The use of technology, internet etc.	*				*	
	Visual design (writing, drawing etc.)		*	*			
	Material design / preparation		*				
Thinking	Creative thinking	*	*	*	*	*	*
	Critical thinking	*	*			*	
	Decision making						*
Group Work	Responsibility fulfilment	*	*	*	*	*	*
	Cooperation	*	*	*	*	*	*
	Exchanging ideas	*	*	*	*		*
	Adaptation to the group	*		*		*	*
	Encouraging / motivating the group		*			*	

Table 7. Continued

Themes	Codes	Performance Tasks					
		I	II	III	IV	V	VI
Group Work	Active participation	*	*				
	Management and guidance		*				
	Conflict control / Mediation						*
	Keeping calm		*				
Time Management	Fast planning			*	*		*
	Efficient use of time		*				

The * sign represents success in performance tasks.

Table 7 presents the success of group members in six tasks. Results revealed the themes of 'curriculum design, thinking, group work and time management'. Pre-service teachers were mostly successful at 'finding activities, designing a transdisciplinary curriculum, doing research, fulfilling a responsibility, cooperation, exchanging ideas etc. Table 8 shows the challenges that pre-service teachers experienced during the process of curriculum design.

Table 8. Finding regarding the Difficulties Group Members Faced

Themes	Codes	Performance Tasks					
		I	II	III	IV	V	VI
Curriculum Design	Writing main ideas	*	*	*	*		*
	Designing a transdisciplinary curriculum	*	*		*		*
	Ordering/arranging the activities	*	*	*	*		
	Recognizing the age level	*		*		*	
	Finding/enriching the activities	*	*			*	
	Designing a warm-up activity				*	*	*
	Activity writing		*		*	*	
	Linking five key elements			*			*
	Knowledge of the steps of curriculum design	*	*				
	Writing the line of inquiry	*					*
	Integration of transdisciplinary curriculum				*		
	Following the line of inquiry			*			
	Alternative assessment		*				
	Integration of international awareness						*
Thinking	Decision making		*		*	*	
	Creative thinking		*	*			
Group Work	Reaching a consensus			*	*	*	
	Communication			*		*	
	Persuasion					*	
	I didn't have difficulty doing the tasks			*	*	*	*

The * sign represents success in performance tasks.

Table 8 reveals the findings regarding the difficulties the group members faced during the fulfillment of six tasks. Findings include curriculum design, thinking, group work themes. While designing a transdisciplinary inquiry-based curriculum pre-service teacher mostly had difficulty in main idea writing, planning a transdisciplinary curriculum, ordering/arranging the activities, minding the age level, finding/enriching the activities, designing warm-up activity, activity writing, decision-making, reaching a consensus etc. Moreover, from the third performance task group members did not experience any difficulties in design process. Following are some of the quotations from the group interviews:

Success

"In the process of design all members had a different idea, resulting in a nice plan. The most successful aspect was cooperation." (P3, G1, Task 3).

"The most successful aspect of the program was that everyone listened to each other with respect and everyone was satisfied in the end because their ideas were included." (P15, G2, Task 5)

Difficulty

"We had difficulty in preparing a plan as a group. Since there was a lot of activities to plan, we couldn't quite know how to place the activities into the plan" (P5, G1, Task 2).

"We had difficulty in finding an activity to raise an international awareness" (P12, G3, Task 5)

Pre-service teachers were asked about the effects of designing a transdisciplinary curriculum with group work and collaboration on themselves. Findings in this regard revealed the themes of **versatility, career development and curriculum**. Under the theme of versatility participants stated that they learned *different viewpoints/ideas* (P4, P12), *gained competences in different fields* (P3, P14) with planning a transdisciplinary PYP curriculum with cooperation. Pre-service teachers also stated that thanks to this program they were provided cognitive and affective opportunities in terms of career development such as giving importance to sharing (P13), creative thinking (P8), being in a solidarity (P9), learning different methods and techniques (P6), making use of the individual differences (P8), feeding the mind (P8). In addition, pre-service teachers believe that designing a curriculum helps with; *systemizing the curriculum* (P9, P15), *designing a student-centered curriculum* (P7), *drawing attention* (P12), *meeting the lack of curriculum* (P13) and *enriching the theme/context* (P3, P4, P7, P12, P13, P15). In this context opinions of three pre-service teachers from each group:

"Having different branch teachers means enriching the plan. Having different ideas and different ideas helps make the plan more versatile and richer. For me, learning about other fields and seeing different ideas contributed greatly." (P4, G1).

"Preparing our works with the branch and branch teachers pushed us to a great process of mental change. Our individual differences enabled us to work more creatively..." (P8, G2).

"The preparation of teachers as a group will ensure the enrichment of the program. Sharing experiences with each other is very valuable. As the curriculum is designed with the comments of all teachers, it will be easier to overcome the deficiencies." (P13, G3).

Findings on Reflective Thinking Skills and Self-Assessment

In the process of designing cross-disciplinary inquiry curriculum among pre-service teachers, reflective thinking skills and self-assessment situations were examined through a **scale, self-assessment forms and focus group interview**. Findings in this context are given respectively.

Pre-Test and Post-Test Findings for Reflective Thinking Skills

The relationship between pre-test and post-test mean scores of the prospective teachers was examined with the associated *Wilcoxon Signed-Rank* and the results of the analysis are presented in Table 9:

Table 9. *Wilcoxon Signed-Rank Test Results of Pre-test and Post-test Mean Scores of RTLS*

Posttest- Pretest	N	Mean Rank	Sum of Ranks	z	p
Negative Rank	1	6.00	6.00	3.07*	.002**
Positive Rank	14	8.14	114.00		
Ties	0				

* Based on negative ranks **p< .05

Table 9 reveals that there is a significant difference between the pre-test and post-test scores of the pre-service teachers' group working skills [$z=3.07, p<.05$]. It is concluded that the difference, which is observed in the mean and total of the difference scores, is in favor of the posttest. To examine the significance of this difference, which was found statistically significant, the *Pearson Correlation Coefficient* (r) statistic (effect size) was applied and measured as .56. Thus, it refers that designing a transdisciplinary inquiry curriculum has a high level of influence on teacher candidates' reflexive thinking skills.

Findings Regarding Self-Assessment

In the study, self-assessment of pre-service teachers were examined with self-assessment forms and focus group interview. During the design period of the transdisciplinary inquiry-based curriculum, participants were asked to complete self-assessment forms in order to evaluate their own performance. The findings of the evaluation of this form with the checklist are given in Table 10.

Table 10. Findings on Self- Assessment Checklist

Performance	Tasks of Transdisciplinary Inquiry-based Curriculum Design																	
	Task I			Task II			Task III			Task IV			Task V			Task VI		
	Strong	Medium	Low	Strong	Medium	Low	Strong	Medium	Low	Strong	Medium	Low	Strong	Medium	Low	Strong	Medium	Low
I learned a lot of things on this mission.	13	2	-	14	1	-	13	2	-	12	2	1	11	4	-	15	-	-
I participated in the task.	8	5	2	9	4	2	9	6	-	10	4	1	11	4	-	13	2	
I shared my notes and knowledge with my group mates	8	4	3	9	3	3	9	4	2	10	2	3	10	5	-	14	1	-
I made an effort in this task.	8	1	6	9	4	2	9	3	3	10	3	2	11	4	-	13	2	
There are important things in this task that I need to improve.	13	2	-	6	3	6	5	1	8	4	3	8	2	4	9	-	2	13
I used the time spared for the task efficiently.	4	4	7	5	5	5	6	6	3	8	7	-	9	6	-	11	4	-

Table 10 shows that pre-service teachers experienced a significant change in 6 performances from the first to the sixth task. It is seen that pre-service teachers support their group friends, make efforts in group works and learn to use time effectively. The findings obtained from the open-ended questions of the self-assessment form are presented in Table 11 and Table 12, respectively.

Table 11. Findings Regarding the Perceptions of the Pre-service Teachers' Success

Themes	Codes	Performance Tasks					
		I	II	III	IV	V	VI
Curriculum Design	Transdisciplinary curriculum design	*	*	*	*	*	*
	Finding/enriching activities	*	*	*		*	*
	Main idea writing		*	*	*	*	*
	Linking 5 key elements			*	*	*	*
	Material design/preparation		*	*	*		*

Table 11. Continued

Themes	Codes	Performance Tasks					
		I	II	III	IV	V	VI
Curriculum Design	Recognizing the age level	*	*				*
	Writing the line of inquiry			*			*
	Activity writing			*			*
	Doing research					*	*
	Knowing the steps of curriculum design			*			*
	Use of technology, the internet etc.		*		*		
	Visual design (lettering, drawing etc.)	*	*				
	Alternative assessment			*			
Transferring subject matter knowledge			*				
Thinking	Creative thinking	*	*	*	*	*	*
	Critical thinking	*	*				
	Practical thinking	*					
	Decision-making	*					
	Justification		*				
	Producing solutions					*	
	Brainstorming					*	
Group Work	Idea exchange	*	*	*		*	*
	Responsibility fulfilment		*	*	*	*	*
	Cooperation		*	*		*	*
	Directing and guiding	*	*			*	*
	Supporting/ motivating the group		*	*		*	*
	Work control/ mediation			*			*
	Active participation		*				*
	Adaptation to the group		*				
Time Management	Quick planning				*	*	*
	Efficient use of time	*					

* The mark represents successful situations in performance tasks.

The findings in Table 11 show the pre-service teachers' perceptions of their success in six tasks. The findings revealed four themes: curriculum design, thinking, group work and time management. Pre-service teachers found themselves successful in terms of transdisciplinary curriculum design, finding/enriching activities, main idea writing, linking 5 key elements, material design/preparation, creative thinking, idea exchange, responsibility fulfillment, cooperation, cooperation, directing and guiding, supporting/motivating the group, quick planning and so on.

The opinions of the pre-service teachers about the situations they have difficulty in the curriculum design process are given in Table 12.

Table 12. Findings Regarding the Difficulties Pre-service Teachers Faced

Themes	Codes	Performance Tasks					
		I	II	III	IV	V	VI
Curriculum Design	Main idea writing	*	*	*	*	*	
	Transdisciplinary curriculum design	*	*	*	*		
	Finding/enriching activities	*	*	*		*	
	Activity writing		*	*		*	*
	Recognizing the age level	*				*	*
	Transdisciplinary curriculum integration					*	

Table 12. Continued

Themes	Codes	Performance Tasks					
		I	II	III	IV	V	VI
Curriculum Design	Material design/ preparation	*		*			
	Alternative assessment		*		*		
	Designing warm-up activities					*	*
	Writing the line of inquiry			*			
	Knowing the steps of curriculum design	*					
	Ordering/ arranging activities		*				
Thinking	Decision-making		*			*	
	Creative thinking	*	*				
Group Work	Reaching a consensus		*	*			
	Communication			*			*
	Negative effect of dominant students			*			*
	Unclear distribution of work		*				
I didn't have difficulty doing the tasks				*	*	*	*

* The mark represents successful situations in performance tasks.

Table 12 show the situations in which pre-service teachers had difficulty in six tasks. The findings are gathered in the themes of curriculum design, thinking and group work. When designing a transdisciplinary inquiry-based curriculum, pre-service teachers were more likely to have difficulty in writing main ideas, planning transdisciplinary curriculum, finding/enriching activities, activity writing. In addition, it is seen that teacher candidates stated that they didn't have difficulty as of the third performance task. The teacher candidates also expressed that they did not have difficulty in curriculum design since the third performance task. Below are excerpts from the views of pre-service teachers in three different groups:

Success

"I find myself successful in decision-making, designing an activity and time management" (P13, G3, Task 1).

"Trying to have a professional approach to things when there are disagreements in the group" (P6, G2, Task 6)

Difficulty

"I used the internet to create this plan and shared the information I found with my group members. I came up with the ideas for most of the activities." (P1, G1, Task 4).

"The assessment and action stages were a challenge for me. I had difficulty in finding / creating alternative assessment tools other than traditional assessment tools" (P7, G2, Task 2)

In the study, pre-service teachers were asked about the changes they experienced during PYP curriculum design process. In this context, the findings were gathered in terms of **mental development, affective development, PYP education and professional development**. During this process, pre-service teachers stated that they experienced certain affective and cognitive changes in terms of *development of imagination* (P4), *increase in productivity / creativity* (P4, P6, P14), *gaining research and inquiry skills* (P3, P6), *change of perspective* (P7, P8, P12, P13), *understanding the importance of cooperation* (P4), *self-confidence* (P13), *the state of happiness* (P13), *motivation* (P7, P8) and *acquiring the habit of literature review* (P3). Within the context of PYP curriculum the following outcomes are stated: *internalizing the PYP philosophy* (P3, P6, P7, P9, P13, P15), *believing in the advantage of the PYP curriculum* (P8), *gathering knowledge about PYP* (P3), *preparing student-centered activities* (P3), *designing an transdisciplinary inquiry-based curriculum* (P9), *transferring knowledge to the real-world context* (P8, P13). Also, pre-service teachers listed the following as part of their professional development: *questioning their professional competence*

(P3, P7), *gaining competence* (P7, P13), *having an optimistic perspective towards the profession* (P8), *learning different assessment methods* (P6) and *discovering themselves* (P8). Below are excerpts from the views of pre-service teachers in three different groups:

“When I first started this program, I had little knowledge of it. Later on, as my knowledge improved on the topic, I realized the things that I needed to change as a teacher. At first, I was asking about how to be an effective teacher myself. Now, thanks to IB, I found the answers that I’ve been looking for. This process helped me improve my questioning and inquiry skills. Now I’m reviewing more sources than before to learn more and I’m preparing student-centered activities.” (P3, G1).

“Since the beginning I have learned too many methods, techniques, assessment scale and activities. I had a limited perspective before, but now I am able to form creative approaches. I was able to explore the IB philosophy in depth and I have employed it in my daily life. I went through a process of interrogation and change in every way. It helped me develop both professionally and personally” (P6, G2).

“I certainly felt very big changes in my perspective. Creating an educational environment in which students value people, nature and environment and make their own decisions is one of the greatest contributions of the program.” (P12, G3).

Findings on Curriculum Design Orientations

Pre-service teachers' curriculum design orientations were examined through scale and a focus group interview. The findings are as follows:

Pre-test and Post-test Results regarding Curriculum Design Orientations

The pre-test and post-test descriptive statistics results sub-dimensions of CDOS are presented in Table 13:

Table 13. Descriptive Statistics of CDOS

Sub dimension	Measurement	N	\bar{X}	sd	Min.	Max.
Topic-based	Pre-test	15	23.00	5.83	14.00	34.00
	Post- test	15	24.06	4.96	17.00	36.00
Student-centered	Pre-test	15	40.40	9.04	16.00	50.00
	Post- test	15	46.86	1.88	43.00	50.00
Problem-based	Pre-test	15	36.33	8.86	16.00	45.00
	Post- test	15	45.33	2.60	41.00	49.00

Sub-dimensions of CDOS reveal that the scores of the pre-service teachers increase in favor of the post-test for each sub-dimension. Table 14 shows the *Wilcoxon Signed-Rank Test* results of pre-test and post-test scores of CDOS.

Table 14. CDOS Pre-test and Post-test Mean Score Results of *Wilcoxon Signed-Rank Test*

	Posttest- Pretest	N	Mean Rank	Sum of Ranks	z	p
Topic-based	Negative Rank	8	6.13	49.00	.245*	.807
	Positive Rank	5	8.40	42.00		
	Ties	2				
Student-centered	Negative Rank	0	.00	.00	3.200*	.001**
	Positive Rank	13	7.00	91.00		
	Ties	2				

* Based on positive ranks **p<.05

* Based on negative ranks **p<.05

Table 14. Continued

Problem-based	Posttest- Pretest	N	Mean Rank	Sum of Ranks	z	p
	Negative Rank	1	2.50	2.50	3.270*	.001**
	Positive Rank	14	8.39	117.50		
	Ties	0				

* Based on negative ranks **p<.05

Total Score	Posttest- Pretest	N	Mean Rank	Sum of Ranks	z	p
	Negative Rank	0	.00	.00	3.422*	.001**
	Positive Rank	15	8.00	120.00		
	Ties	0				

* Based on negative ranks **p<.05

Table 14 shows that there is no significant difference between the pre-test and post-test mean scores of the pre-service teachers regarding the subject-centered sub-dimension [$z=.245, p >.05$]. A significant difference was found between the pre-test and post-test mean scores of the pre-service teachers regarding the student-centered sub-dimension [$z=3.200, p <.05$]. A significant difference was also observed between the pre-test and post-test mean scores of the pre-service teachers regarding the problem-centered sub-dimension [$z=3.270, p <.05$]. There was a significant difference between the pre-test and post-test mean scores of the pre-service teachers regarding the whole scale [$z=3.422, p <.05$]. *Pearson Correlation Coefficient (r)* (effect size) was examined and calculated as .62 to examine the significance of this statistically significant difference in practice. In this context, it can be said that the process of designing a transdisciplinary inquiry-based curriculum has a high level of effect on curriculum design orientations of pre-service teachers.

In the research, prospective teachers were asked their opinions about the contributions of the student-centered curriculum. The findings were categorized in **student** and **learning / teaching** themes. Pre-service teachers believed that the student-centered curriculum provided the following for students: *active participation* (P3, P4, P6, P8, P9, P11, P13, P14), *knowledge configuration* (P8), *personality development* (P14), *communication and social skills* (P6), *meeting needs and interests* (P8, P13), *increase in academic success* (P14), *increase in self-confidence* (P14), *increase in ambition to work* (P14), *use of their full potential* (P7). In addition, they think that this curriculum provides *permanent* (P3, P4, P8, P9, P11), *economical* (P12) and *efficient learning* (P6, P12, P13, P15).

"It is a bit difficult to prepare a student-centered one. However, when we look at the results of the student's acquisition and outcomes, it is absolutely necessary to prepare student-centered curriculum. This way, learning becomes more permanent because the student is active and expresses his / her ideas more easily." (P4, G1).

"In the 21st century, the value of people and living things has increased. Individual differences, interests and potentials of individuals have become more and more important these days. Every person has the right to discover and use his / her own potential, skill and characteristics. Students should be given these opportunities. Each student is unique." (P7, G2).

"Active participation of the learners is ensured, and their self-confidence increases with success. The ambition to work has a positive effect on personality development." (P14, G3).

Conclusion and Discussion

PYP education builds on student-centered teaching methods and techniques and holds the idea that knowledge is structured in a social and cognitive context. PYP educations examine real-life problems according to students' questions and curiosities within the framework of transdisciplinary understanding. PYP claims that real life-related subject areas are crucial for learning (IBO, 2010). In this process, teachers are expected to master and organize the practices based on student-centered understanding. Teachers are open to improving their knowledge, attitudes, skills, and competencies. It is important to monitor and improve the competencies of teachers in the process of preparing integrated

curricula. In this study, curriculum design orientations of pre-service teachers, the changes in their levels of group work and reflective thinking were examined during the training.

PYP transdisciplinary inquiry-based curricula require the collaboration of teachers from different disciplines. One of the results of the present study is that IB teachers attach importance to cooperation in curriculum design processes. (Bergeron & Dean, 2013; Cook, 2015). In their study, Savage and Drake (2016) stated that classroom teachers, PYP coordinators and branch teachers work together in transdisciplinary PYP curriculum preparation. In addition, it was concluded that teachers consider cooperative planning for transdisciplinary teaching and learning very important. PYP educations are developed on a school-based basis and teachers prepare units jointly and implement them. Thus, the importance of group work in the preparation of integrated curriculums emerges. In this study, the effect of the process of designing a transdisciplinary inquiry-based curriculum on pre-service teachers' group working skills was examined and a significant difference was found in favor of post-test. In addition, it was concluded that the process of designing a transdisciplinary inquiry-based curriculum affects group work skills at a high level. It is also concluded that designing a transdisciplinary inquiry curriculum affected group work skills a little more than a medium level. According to Garet, Porter, Desimone, Birman, and Yoon (2001), content knowledge, active learning opportunities, group work, the participation of teachers from the same school and the duration of the activity significantly affect teachers learning. Netten and Germain (2000) state that social capacity include working in collaboration, being tolerant of other perspectives, planning and organizing the work, respecting deadlines, and accepting others. Augsburg (2014) states that expectations for group success in transdisciplinary studies are supported by group members and that transdisciplinary cooperation involves mutual trust, personal chemistry and a sense of security. The design of a transdisciplinary program requires the cooperation of different disciplines. Also, contrary to traditional approaches, teachers play an active and practice-oriented role in the process. In this context, it can be said that pre-service teachers in different disciplines who prepare transdisciplinary inquiry-based curriculum adapt to each other, support group members emotionally and cognitively, manage the process and prepare the curriculum successfully.

During the PYP training process, it is considered important that students reflect their experiences to their lives, which is stated as one of the outcomes of the program. In the research with teacher candidates, Leung and Kember (2003) stressed that there is a relationship between learning and reflexive thinking. Henriksen (2016) states that transdisciplinary thinking skills are as important for teachers as for students. In this study, the effect of designing a transdisciplinary inquiry-based curriculum on the reflective thinking skills of pre-service teachers was examined and a significant difference was observed. In addition, it was concluded that the process of designing a transdisciplinary inquiry-based curriculum affects the reflective thinking skills at a high level. Tasker, Johnson, and Davis (2010) explains that collaborative practices affect professional development positively, and when supported by groups members, individuals have the opportunity to organize themselves by questioning and to restructure their professional beliefs. "Reflection" is an essential skill in teacher training that allows learning in practice and supports professional development. Since it is assumed that pre-service teachers who can critically reflect on themselves are much efficient, teacher training programs should highlight improving the reflection skills of pre-service teachers (Yıldırım, 2011). During the study, pre-service teachers were given the opportunity to evaluate both themselves and the groups they belong to. In this case, questioning one's own performance and efforts to improve it can be considered as a natural result.

In this study, pre-service teachers were asked to evaluate group and individual performances in each curriculum design process and each finding was supportive of one another. Groups and individual performances were designed to cover the following points: fulfilling responsibilities, effective use of time, providing support and making efforts. In addition, results revealed that pre-service teachers had difficulty in planning of instruction, writing main ideas, organizing activities, minding the age level, writing action, etc. in almost all performances while preparing a transdisciplinary inquiry-based curriculum. This may be due to the lack of clear statement of the knowledge, skills,

attitudes, concepts and actions in PYP educations. Savage and Drake (2016) similarly examined the experiences of PYP teachers and concluded that teachers had difficulty in understanding the PYP framework, basic and related concepts and writing of main idea. However, the pre-service teachers also stated that they were successful in the following situations: planning instruction in terms of activity, materials, etc., writing main ideas, linking 5 basic elements, creative thinking, adapting, etc. This result can be attributed to the willingness of teachers to learn and produce.

It is important that teachers' philosophical and pedagogical understanding is supported in the cause of adaptation to IB philosophy. Factors such as school support, workshops and professional development that are provided by IB are effective for teachers' participation in IB programs (Dickson et al., 2018). Savage and Drake (2016) regards teachers' philosophy and attitudes as central to PYP practices since teachers design and carry out the teaching process within the framework of the belief they believe. Since PYP training programs are student-centered, it is important that teachers' philosophical understanding weigh in this direction. In this study, the effect of the design of transdisciplinary inquiry-based curriculum on the pre-service teachers' curriculum design orientations was examined and a significant difference was revealed. In addition, it was concluded that the designing transdisciplinary inquiry-based curriculum has a high level of impact on student and problem-centered curriculum design. The remarkable point of the study is that the pre-service teachers' curriculum design orientations does not shift from subject-centered to student or problem-centered curriculum design. Doğanay (2011) concluded that the teacher candidates enrolled in the Secondary Education Master's Program without Thesis experienced some change in the philosophical idea of the education they received. On the contrary, Kozikoğlu and Erden (2018) did not observe a significant difference in teacher candidates' educational philosophy and beliefs during pre-service training. These findings can be explained with the philosophical understanding of pre-service training that teacher candidates attend. There was no significant difference between the pre-test and post-test mean scores of the pre-service teachers about their subject-centered curriculum design orientation. This can be explained by the pre-service teachers' voluntary participation in IBEC training and their willingness to contribute to their professional development. Examining the changes in educational philosophies of teacher candidates during four-year graduate education, Doğanay and Sarı (2018) indicate that the students' existentialist philosophical ideas increased in the fourth grade. This result may explain why the participant teacher candidates in this study do not adopt a subject-centered approach. Similar to this research, Holeva (2012) concluded that PYP training and practices had positive effects on teachers' educational philosophies and teaching experiences. In addition, the teachers stated that they acknowledge the international perspective and inquiry-based learning approach. In the interviews, pre-service teachers stated that with student-centered curriculum design students' academic achievement will be increased, their expectations will be met, they will discover and use their potential, learning will be more permanent, and teaching will be economical and efficient. In their study, Bergeron and Dean (2013) concluded that IB teachers adopted a student-centered, concept and project-based, high-level-thinking-focused, research and inquiry-based, reflective education approach that cares about individual needs. Twigg (2010) states that PYP teachers believe that students have a say in their own learning process during the inquiry process. In addition, he claims that the fact that teachers see themselves as both students and teachers is far from traditional understanding. In this context, it is possible to say that the transdisciplinary inquiry-based curriculum strengthens teachers' understanding of student and problem-centered curriculum design. Hill (2011) states that the IB education system will require significant changes in terms of curriculum, pedagogy and assessment for teachers, especially in contexts where teacher education is traditional. Güneş (2016) also emphasized the need to improve undergraduate programs in Turkey to include skills teaching and train teachers who learn-to-learn. All in all, the results reveal the importance of supporting teachers as active learners in both undergraduate and in-service training processes in every system based on student-centered teaching practices.

Suggestions

Based on the findings of the research, the following implications for practice and research have been developed:

- In this research, the changes of pre-service teachers in reflective thinking, group working skills and curriculum design orientations were observed and evaluated. Future studies can investigate the effects of integrated curriculum development on teachers' different cognitive skills and affective characteristics.
- This research is designed according to mixed method approach in which qualitative and quantitative data are collected in order to reach related sub-objectives. The efforts and problems of teachers in integrated curriculum preparation processes can be examined through action research.
- The present study is based on the transdisciplinary inquiry-based curriculum design steps that was developed by the researcher. Future studies may re-test this model or develop a whole different model.
- The present study observed that teachers had difficulty in understanding and integrating PYP elements. In this context, instructional guidelines on how to select, write, and evaluate these items can be prepared.
- The results of the study show that teachers can prepare their curricula with collaboration. In this context, the number of in-service trainings aimed at strengthening teachers' curriculum literacy can be increased.

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