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## The Enhancement of Prospective Teachers' Competence and Awareness in the Understanding by Design

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In this study, a group of participants found the process of designing backward thinking distressing. Furthermore, the lack of practical strategies in schools and the absence of resources related to planning can lead to inadequacy in teachers' planning skills. This research aimed to enhance prospective teachers' competence and awareness of Understanding by Design. A case study was conducted with the participation of 17 teacher candidates from Kırıkkale University, Faculty of Education in Türkiye. The selection of candidates was voluntary. A 30-hour course on the theory and stages of backward design used in Understanding by Design was implemented from May 16th to 19th, 2022. This qualitative research employed data collection tools such as pre- and post-study open-ended questionnaires and performance tasks assessing lesson designs. The Understanding by Design template lesson plan and thought process were used to teach backward design in planning the training activity. The evaluation revealed that the pre-service teachers effectively utilized critical concepts associated with Understanding by Design, expressing their intention to incorporate understanding-based design into their future lessons and projects. The participants also emphasized the importance of all teachers adopting this instructional approach. Ultimately, the research suggests that the participants' competence and awareness of understanding-based design significantly improved throughout the course.

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## Introduction

Understanding by Design is a pedagogical framework that aims to cultivate students' understanding and enable them to effectively transfer and apply what they have learned (McTighe, 2021). The aim of an understanding-centered instructional design is to help students develop comprehension by involving them in active questioning and reconsideration of ideas that may seem illogical, difficult, or complex to them (Wiggins & McTighe, 2005). When

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someone says that something is achieved through design, they mean that it is not a result of coincidence or chance but rather the outcome of thoughtful planning. Teachers, like architects, engineers, and programmers, are designers because they plan purposeful, consistent, effective, and engaging lessons, units, activities, and assessment activities (McTighe, 2021). The understanding-based design approach suggests a backward design process. Most plans are executed forward from today, chronologically. Those who plan this way outline their steps in a sequence that leads them toward a desired future. In backward design, this chronological order is completely reversed. It starts by considering the future output and goal and then moves backward to identify all the necessary steps to reach that goal (Wiese, Buehler, & Griffin, 2016). Covey (2002) states in his book "The 7 Habits of Highly Effective People" that effective individuals in different fields are those who plan with a focus on goals and keep the results in mind. A person who starts planning by thinking about the end first engages in mental creation and then moves on to physical creation. When the initial work is not done carefully, expensive changes that double the cost may have to be made during the second creation phase.

In backward design, educators first consider the desired changes in students, determine the learning evidence for the lesson based on that, and then plan the instructional process. Backward design has been accepted as the planning approach for understanding-based design by Wiggins & McTighe (2005). This instructional curriculum design approach is compatible with Tyler's (2013) suggestion to start with the target behavior that defines the desired changes at the end of the process. In this approach, goals (behavioral objectives), instructional experience, and assessment are interconnected (Ocriciano, 2021). Spady (1994) advised in the outcome-based education approach that educational programs should start from where you want the students to arrive. Backward design leads to more clearly defined objectives in instructional programs, more appropriate assessment processes, and more purposeful teaching. Educators often approach lesson design in a forward design style, meaning they think about how to teach the content, develop assessments around learning activities, and then try to make connections to the learning objectives of the lesson. In backward design, however, educators focus on the learning outcomes that students need to know and be able to do at the end of the process before thinking about the objectives and how to teach the content. Therefore, backward design is considered a much more intentional and assessment-focused approach than traditional design methods (Bowen, 2017). Backward design is a widely accepted planning approach in curriculum and instructional design, particularly in understanding-based design.

Forward design starts with a syllabus that includes objectives, moves to strategies and methods, and then continues with the assessment of learning outcomes. Resolving issues related to syllabus content and sequencing is crucial in forward design, which has been the major tradition in language curriculum development (Richards, 2013). Wiggins & McTighe (2005) provide an example of a typical forward-design lesson plan: the teacher selects a topic for a lesson, chooses a resource, selects instructional methods based on the resource and the topic, and chooses essay questions to assess student understanding of the book. In forward design, the focus is on the subject, with a perspective from the present to the future. In central design, on the other hand, learning activities in the teaching-learning process are central. According to Bruner (2021), these lessons evolve through student responses. In student-centered lessons, examination, analysis, and evaluation are conducted to reach definitions and principles. Content evolves through student-centered activities in the classroom. Research on teachers' practices generally indicates that they follow a central design approach, considering the activities and teaching processes they will use (Richards, 2013). Therefore, this design can be understood as a learner- and learning-focused perspective (Leung, 2012). Central design is more concerned with learning processes than predetermined objectives. Activity-oriented teachers focus more on

superficial short-term activity goals rather than long-term learning goals (Wiggins & McTighe, 2005).

Backward lesson design is a simple, rational, structured framework for learner-centered learning. This approach allows the teacher to identify critical competencies that students need to develop through various, engaging lessons and design unique ways for them to demonstrate their learning (Lumbreras & Rupley, 2020). Understanding-based design is an instructional design model that prioritizes desired outcomes and assessment, followed by the presentation of learning evidence, and finally the determination of the learning plan and methods (McTighe, 2021). Desired outcomes include the knowledge and skills instructors want their students to acquire when they complete the lesson. After determining the learning objectives, the second stage involves designing the evidence for assessment. In the final stage, the instruction is planned. In the first stage, the focus is on the big idea, essential questions, and statements of understanding, and the learning outcomes are written. The learning outcomes also serve as statements showing how the knowledge will be transferred. In the desired outcomes section, the initial focus is on the big ideas. The key point in the big idea is what is worth understanding among all the ideas we teach. The answer to this question is that understanding-based design aims for students to understand and be ready to apply big and transferable concepts (Wiggins & McTighe, 2005). Hutchins (1952) has listed many big ideas such as democracy, knowledge, science, and state (cited in Ellis, 2015). The final topic to consider in the desired learning outcomes phase is to determine how the student can use the knowledge in future topics and situations when understanding is achieved. Another task in the transfer stage is for students to understand the connections between different topics in different subjects or between these topics and real-life situations. Backward design's desired outcomes step is followed by the learning evidence section. In the second stage, the necessary qualifications, understanding, and transfer evidence are considered (McTighe, 2021). In this stage, the identified performance task is defined as an assessment tool that presents the student with a problem or an authentic situation, assigns them a role, and requires them to prepare and perform the given task accordingly (Yurtseven, 2016). Performance tasks determine how well students have acquired the knowledge within the unit and their level of understanding of the subject. In cases where performance tasks are inadequate, the secondary evidence section, which includes other assessment tools, can be utilized. Wiggins & McTighe (2005) have presented a method called GRASPS, which provides guidance to teachers in preparing performance tasks. These steps represent the elements of performance. Firstly, the purpose (goal) and role of the performance are determined, followed by deciding who the audience will be. In the next stage, the situation is described, the product and criteria for success are determined.

In the planning of learning experiences, McTighe (2021) emphasizes the importance of creating more authentic performance tasks and projects for effective teaching. When this is achieved, the likelihood of children asking, "Why do I need to learn this?" decreases. When determining learning experiences, it is crucial to be consistent with the first two parts, take all the gains into account, and include activities that will lead to success in performance tasks (Gürbüz, Koçak, & Yurtseven, 2022). To prepare an effective instructional plan that can lead students to desired outcomes, Wiggins & McTighe (2005) have developed the stages of the learning plan known as the WHERETO acronym. It answers the "Why" we are going there and "Where" we are going. This stage determines the success criteria in the performance task and presents the assessment list. The second stage is the Hook, which aims to engage and warm up the students. In this part, the ultimate transfer goals should be considered, and connections should be made by prioritizing the most important aspects. In the Equip stage, while equipping the students, the ultimate transfer goals should be considered. The Rethink/Revise stage allows for students to

rethink and revise. The Self-evaluation and Reflect stage is where self-assessment and self-reflection take place. In the other steps of the lesson plan and the learning-teaching process, thinking is done regarding tailoring instruction and reorganizing.

Many universities and high schools in different countries publish instructional design studies based on backward design and prepare guide texts for instructors. Efforts are made to develop both understanding and competence in educators and teachers. It has been reported that through design, Understanding by Design is a planning model that places competencies recommended by the OECD, including critical thinking, communication, collaboration, creativity, and commitment, at the forefront of instructional presentation (Lumbreras & Rupley, 2020). The results of the study demonstrated that understanding by design-based instructional design positively affects teachers' professional development and students' successes (Uluçınar, 2021). Study investigated the effectiveness of combining the backward design model with cognitively guided instruction as an instructional framework to teach primary school 3rd-grade students in elementary mathematics. Study showed that the combination of both models contributed to improving student performance (Walters, 2018). Mctighe (2019) noted that new teachers exhibit weak planning skills, such as excessive reliance on the scope of the textbook, creating random activities, and preparing multiple-choice tests. These planning errors can cause problems for students in applying what they have learned or connecting it to the context. Similarly, Ozyurt, Kan & Kıyıkçı (2021) found that science teaching designed with Understanding by Design model increased the success of fourth-grade students in nutrition and ensured the sustainability of new learning. They suggested that using Understanding by Design should be promoted through in-service training for primary school teachers and practical training within teacher education programs. It is recommended to develop the understanding-based design competencies of both teachers and teacher candidates in studies.

Looking at the findings, it is observed that teachers experience inadequacy in unit planning based on this model, especially in determining assessment evidence before planning the learning process and establishing the relationship between goals/standards (Boozer, 2014). The excessive workload and lack of sufficient time in the schools where teachers work are as amongst the factors that hinder unit planning (Walters, 2018; Yurtseven & Altun, 2017). Graff (2011) stated that starting with desired outcomes inherent in the backward design approach helps novice teachers in designing instruction and evaluating the program. However, in this study, a group of participants found the process of designing backward thinking distressing. Furthermore, the lack of practical strategies in schools and the absence of resources related to planning can lead to inadequacy in teachers' planning skills. Based on this need and the gap in the literature, the aim of the study is to enhance the competence and awareness of teacher candidates regarding Understanding by Design. Within this framework, at the end of the professional development course organized, the aim is to increase teacher candidates' awareness of the necessity and importance of Understanding by Design model by enabling them to design from the end to the beginning, determine significant ideas and transfer components. Considering that this training was organized one month before the graduation of teacher candidates, it is believed that this 30-hour professional development training can be used to enhance awareness and competence in teachers.

## **Method**

### ***Research Design***

This study adopts a qualitative research design, specifically a case study approach, which involves an intensive and detailed description and analysis of a particular case (Christensen, Johnson, & Turner, 2015). In this study, the case under investigation pertains to the impact of a training program that seeks to enhance the competency and awareness of pre-service teachers in understanding-based design. To examine the development of competency and awareness, a pre-post research design is employed, which involves collecting data from the same group of participants at two different time points. This design enables the exploration of changes in the phenomenon of interest. It allows for a comparison between the two data sets to assess the impact of the educational activity/program. By employing this research design, the study aims to uncover the effects of the training program on pre-service teachers' understanding-based design competencies and awareness (Kumar, 2011).

### ***Study Group***

The study was conducted with 4th-year pre-service teachers studying at Kırıkkale University Faculty of Education. Seventeen voluntary pre-service teachers studying Mathematics Education, Science, Guidance and Psychological Counseling, Social Studies, and Classroom Education programs participated in the study.

**Table 1. Provides the Participants' Codes and Demographic Information**

Kod	Class	Gender	Department
1. M-CG-1	4	Male	Counseling and Guidance
2. M-CG-2	4	Male	Counseling and Guidance
3. F-CG-3	4	Female	Counseling and Guidance
4. F-CG-4	4	Female	Counseling and Guidance
5. F-SCI-1	4	Female	Science Education
6. F-SCI-2	4	Female	Science Education
7. F-SCI-3	4	Female	Science Education
8. F-SCI-4	4	Female	Science Education
9. F-CE-1	4	Female	Classroom Education
10. F-CE-2	4	Female	Classroom Education
11. F-CE-3	4	Female	Classroom Education
12. F-MAT-1	4	Female	Elementary Mathematics Education
13. F-MAT-2	4	Female	Elementary Mathematics Education
14. F-MAT-3	4	Female	Elementary Mathematics Education
15. F-MAT-4	4	Female	Elementary Mathematics Education
16. F-MAT-5	4	Female	Elementary Mathematics Education
17. K-SSE-1	4	Female	Social Studies Education

### ***Designing and Implementing the Understanding by Design Training Activity Process***

A 30-hour course has been planned that includes the theoretical foundations of Understanding by Design, the power of design, big ideas, the theory and stages of backward design, and its implementation. Expert faculty members were reached out and their participation was ensured for providing the training in the study. During this process, ethics committee permission document was obtained (Session number 64). In the stage of determining the teacher candidates, applications were received through Google Docs on a voluntary basis, and those who met the criteria were selected, their permissions were obtained, and a WhatsApp group was created. Information was provided to this group regarding the building where the





course would be held, as well as facilities such as meals and transportation provided to them. The selected classroom in the school building where the course would be organized was enriched visually by equipping it with materials such as posters and banners prepared about Understanding by Design, big ideas, and the stages of backward design. Subsequently, the program for the training activity was shared with the participants. Face-to-face training sessions were conducted on May 16-19, 2022. An attendance rate of 80% was mandatory for the training activities and implementation studies, and three participants who failed to meet this requirement were excluded from the program.

Design and planning were conducted in accordance with the principles of Understanding by Design, starting from the end and working backward. During the training sessions, activities such as presentations, group work, learning conversations, and filling out learning journals were carried out. The researcher and research assistant were consistently present in the training sessions, guiding group work and the completion of templates. Examples, templates, and other products were shared with the study group during the training. The Understanding by Design training activity program is provided in Appendix 1. In the first session of the program, introductory activities were conducted with the participants. To facilitate better acquaintance among participants, an informative and entertaining drama activity was carried out, and the necessary documents regarding the activity were completed. In the following hours and days, videos containing backward design seminars by McTighe & Wiggins were watched and analyzed to gain firsthand knowledge, and presentations on the necessity of design, the nature of education and design, and big ideas were given by field experts. On the second day of the program, the basic concepts and stages of Understanding by Design were explained, template lesson plans were examined, and preparations for implementation were made. Participants were asked questions about the content of the template and their ideas were gathered. On the third day of the program, based on the acquired knowledge, teacher candidates in groups designed unit plans in their fields using the principles of backward design. Participants transferred the concepts of Understanding by Design and the planning framework to their own fields. On the fourth day, unit plans created by teacher candidates were examined by other groups, information was exchanged, and preparations were made for the presentation. Subsequently, unit designs prepared using the Understanding by Design planning framework were evaluated by field experts and other teacher candidates using the Understanding by Design standards rubric. Reflective learning journals were filled out at the end of each day, and participants engaged in learning conversations with each other. The Understanding by Design template lesson plan and thought process were used to teach backward design in planning the training activity. At the end of the training activity, participation certificates were given to the participants.

### ***Data Collection and Analysis***

For data collection, the researchers utilized researcher-developed forms containing open-ended questions, which were administered to the participating teacher candidates both before and after the program implementation. These interview forms were designed to ensure parallelism and content comparability among the questions. Comprising ten open-ended questions, the forms aimed to elicit insights into the participants' knowledge, skills, and competencies acquired throughout the program. The utilization of open-ended questions, also referred to as unstructured questions, offered distinct advantages in terms of providing the researchers with comprehensive and detailed information on the subject matter, as well as the potential to elicit unexpected responses. The open-ended format allowed for a rich exploration of the topic, allowing for in-depth analysis and interpretation of the gathered data (Creswell &

Poth, 2016). The forms prepared with open-ended questions to allow participants to express their views and experiences about Understanding by Design without limitations. The involvement of multiple researchers in the process of developing data collection tools and analysis was also seen as a reliability measure (Yıldırım & Şimşek, 2018). The forms containing open-ended questions were given to the participants before and after the Understanding by Design course, and they were asked to fill them out. The obtained data were recorded by the researchers and subjected to content analysis. Content analysis, which consists of coding, determining subcategories, and creating categories, was used for content analysis. In the recording analysis unit, which is stated as the smallest unit of analysis, coding operations such as identifying words, symbols, and key important words, as well as sentence and paragraph analysis, were performed. After the coding process, the data were classified, and categories and themes were created based on the content. To prevent confusion during the analysis, a code including the participant's department, gender, and serial number was assigned to all teacher candidates. For example, F-SCI-1 represents a female participant in the Science Education program and is the first participant.

Another data collection tool used in the study is the Understanding by Design standards rubric. Several studies have shown that assessment checklists allow instructors and students to evaluate performance reliably (Reddy & Andrade, 2010). Graded scoring keys provide the desired validity in assessing complex competencies without compromising reliability needs (Jonsson & Svingby, 2007). Rubrics are used to analyze every element of the expected product or process in a performance task according to predetermined criteria. While serving as an assessment tool, rubrics can be used to evaluate all types of performances.

### **Findings**

The comprehensive analysis of the data acquired through the completion of open-ended question forms by the participants prior to the Understanding by Design professional development training has yielded significant findings pertaining to the importance of design, Understanding by Design and the overarching concept of the big idea. To present these findings in an organized manner, a detailed table has been constructed, showcasing the identified themes, categories, and corresponding codes derived from the analysis of the collected data. The findings shed light on the participants' perspectives and understanding regarding the key elements of Understanding by Design, providing valuable insights into their perceptions and knowledge in relation to this instructional approach.

**Table 2. Before the Training Activity**

<b>Theme</b>	<b>Category</b>	<b>Code</b>
Rationale of Design	Design as the opposite of chance	Without design, there is randomness
	Planning before the lesson	Sometimes even designing our sentences
	Designing the digital environment	A good way chosen to reach people
	Designing the learning environment	Designing the classroom environment Designing the social environment
Understanding-Based Design	Design	A kind of preparation for the lesson The process of construction
	Understanding	Mental interpretation The way to ensure good understanding

		Transferring to students by making it meaningful
Big Idea	Groundbreaking new ideas	Not occurring to anyone Outside the norm
	Problem-solving idea	Solving an ongoing problem Big idea as a savior
	Targeted big idea	Having significant goals Decisions that will elevate you Source of motivation

Within the thematic framework of "The rationale of design," participant statements were categorized and analyzed, revealing a range of perspectives and expressions related to various aspects of design. These encompassed notions such as design as a counterpoint to chance, the importance of pre-lesson planning, the role of design in shaping the digital and physical learning environment, and the significance of designing the social dynamics within the classroom. Coding analysis further elucidated a diverse range of expressions that underscored the significance of design, including references to constructing sentences in the classroom and the fundamental role of design in mitigating randomness. A representative participant statement exemplifying the themes within "The rationale of design" is provided below:

First, let us think about classroom design. If even the desks in a classroom are not arranged correctly, learning can be hindered. Insufficient classroom materials can disrupt education. If a student experiences problems in the social environment, it can affect education. Just as we do planning before doing a job, we should also do it in teaching. In the schools where we did internships, sometimes we even design our sentences before delivering the lesson so that we don't falter and minimize mistakes." (F-MAT-4)

Under the Understanding-Based Design theme, expressions were found in the categories of design and understanding. In the coding of understanding, participants emphasized the mental interpretation and the need to transfer subjects to students in a way that ensures good understanding. Some participants stated that they did not have knowledge about the Understanding-Based Design theme and could not make comments about it. Here are some of the participant statements under the Understanding-Based Design theme:

I don't have any knowledge about this topic, but I think it is a design model created for the event/situation to be more permanent and understandable. The aim here is for the information to be comprehensible and applicable. (F-CG-4)  
 Understanding-Based Design could be about conveying a subject to students by making it meaningful. The better the student comprehends the subject, the better it is. (F-SCI-2)

Lastly, under the Big Idea theme, the opinions of teacher candidates were categorized as groundbreaking new ideas, problem-solving ideas, and targeted big ideas. On the other hand, it was determined that big ideas were seen as saviors. Some participants mentioned that having big goals is essential and that these goals serve as decisions that will elevate individuals and a source of motivation. In the Problem-Solving Idea category, it was expressed that big ideas can be used in solving ongoing societal problems. Here are some of the participant statements under the Big Idea theme:

When I hear 'big idea,' it comes to my mind as an idea that will solve an ongoing problem or something that has never been heard before. I haven't had a big idea that I can call 'big idea.' We can help students generate big ideas by developing their critical thinking skills. (M-CE-3)



The analysis of the pre-training explanations provided by the participating teacher candidates revealed a notable discrepancy between their responses and the theoretical framework of Understanding-Based Design. Rather than specifically addressing the core principles of Understanding-Based Design, their explanations predominantly centered around the broader concept of design as a necessity in various facets of life and the learning process. Notably, participants emphasized the interconnectedness between lesson preparation and lesson design. Furthermore, the findings indicated a distinctive perception among participants regarding the big idea, wherein it was perceived as something exceptional, extending beyond conventional notions and encompassing ideas that were deemed unlikely to be conceived by others. These observations shed light on the participants' initial understandings and interpretations of Understanding-Based Design, providing insights into their conceptualizations of design and the significance ascribed to the big idea.

**Table 3. The Desired Outcomes of Education Activity**

<b>Theme</b>	<b>Category</b>	<b>Code</b>
Desired Outcomes	Describing the achievements	Describing knowledge gains Describing skill gains Knowing and being able to do
	Asking essential questions	Sparking curiosity Prompting critical thinking
	Setting objectives	Achieving the desired goal Establishing general objectives
	Identifying big ideas	Encompassing the achievements The essence of the unit Being engaging
	Identifying transfer statements	Being able to transfer to real life Being able to transfer to a different unit Being able to transfer to a different lesson
	Understanding statements	Engaging in higher-level thinking Gaining perspective

Table 3 presents the thematic analysis of the desired outcomes in the Understanding by Design framework, representing the initial stage of the backward design process. Six distinct categories have been identified within this theme, including describing achievements, asking essential questions, setting objectives, identifying big ideas, determining transfer statements, and formulating understanding statements. Notably, within the category of describing achievements, participants expressed the concept of "knowing and being able to do" as key components of their desired outcomes within the understanding-based design template. Their responses indicate an appreciation for the holistic development of knowledge and skills. One participant statement serves as a summary of the entire process and showcases the participants' perspective on the desired outcomes generated through Understanding by Design:

The first stage is determining the desired outcomes. In this stage, achievements are identified and categorized as knowledge (knowing) and skill (being able to do) gains. Next, the big idea is determined. The big idea should encompass all our achievements and be intriguing and engaging. After determining the big idea, understanding statements are written. Then, the places where transfer is required are identified. This includes determining how it can be transferred to real life, to a different unit within the same lesson, and to different lessons. (F-MAT-5)

In the category of asking essential questions, it has been determined that preparing questions that arouse curiosity and prompt critical thinking in students is necessary. The section on setting objectives and the coding of desired objectives are included under the category of setting objectives. Participants have expressed that big ideas should encompass the achievements and be appealing to students. An example is provided below:

In the subheadings of this stage, writing the achieved gains separately under the categories of knowledge and skill will help the teacher have a clear view of the measurement they will design. Questions with specific answers such as yes or no should not be considered as essential questions. Then, understanding statements that serve as answers to these questions are written. Understanding statements refer to the student's awareness and perspective, in other words, their higher-level thinking that they aim to achieve. The big idea is a short and clear expression of the teacher's permanent philosophy and goal they want to achieve. In the design process, we expect students to transfer their knowledge to other lessons, different units within the same lesson, or their daily lives. (F-CE-2)

In the reflective learning journals and forms completed by the participants, there was a notable emphasis on the significance of big ideas within the Understanding by Design framework. Participants expressed the belief that big ideas should be applicable to real-life situations, other topics, or different lessons, underscoring the need for careful consideration by teachers during the design process. Within the category of understanding statements, participants associated understanding with higher-level cognitive thinking and gaining a broader perspective. The thoughts of one participant highlighting the importance of big ideas within the desired outcomes theme are presented below:

The big idea is the fundamental goal we want to convey to our students in this lesson. It can be a catchy slogan, a theme, or an understanding. To reach the big idea, essential questions are created. These questions stimulate students' curiosity, foster a discussion environment in the classroom, and activate their previous knowledge. The answers to the essential questions are gathered under the understanding statements section. In our next step, the transfer step, we want our students to adapt their achievements to real life, transfer them to a lesson in the following year, or transfer them to a different lesson. (F-SCI-3)

The desired outcomes encompass a range of categories within the Understanding by Design framework, including describing achievements, asking essential questions, setting objectives, identifying big ideas, determining transfer statements, and formulating understanding statements. These subheadings reflect the key elements emphasized in the desired outcomes section of the instructional design template. However, it is notable that the teacher candidates did not place significant emphasis on the completion of students' lessons or the changes that occur at the end of the instructional process, which is an essential aspect of the initial stage of backward design.

**Table 4. The Evidence of Learning After Education Activity**

<b>Theme</b>	<b>Category</b>	<b>Code</b>
Evidence	Assigning performance tasks	Conducting assessments Providing feedback Determining appropriate methods and techniques
	Applying GRASPS criteria	Writing the goal Assigning roles Identifying the audience Determining the situation Defining the product Establishing standards
	Determining other forms of evidence	Preparing test questions Utilizing alternative assessments

Results related to the theme of evidence are presented in Table 4. Three different categories were created under the evidence theme. The fifth theme, evidence, consists of the categories of assigning performance tasks, applying GRASPS criteria, and determining other evidence. Similar to the desired outcomes theme, it was determined that theoretical knowledge is frequently observed in participant statements under the evidence theme. In the category of assigning performance tasks, participants emphasized the importance of providing frequent and timely feedback to students during the performance task. An example statement from a participant who prioritizes performance in this stage is as follows:

The fundamental components of Understanding by Design are attainment, transfer, and understanding. If the student truly understands, they can transform it into performance. Each unit should have a performance task, and homework as a performance task should not be given. (F-CE-1)

Furthermore, in the coding process, it was determined that performance tasks should not be given as homework but rather should be carried out in the classroom in order for the teacher to observe and determine appropriate techniques and methods. This way, according to the participants, the teacher can provide more accurate feedback. The following is an example text under the evidence theme:

Here, design is done through GRASPS. These consist of aim, role, audience, situation, product, and standards in order. There should be a scenario in the performance task. In this scenario, the student should be able to find the answers to fundamental questions. The teacher should not assign the performance task as homework; it should be done in class, and the teacher should observe every stage and provide feedback to the students. If the student knows where they made a mistake, they can have the opportunity to correct it, and the information in the student's mind becomes more permanent. In the other evidence category, classical or alternative assessment tools are used. (F-SCI-2)

In the category of applying GRASPS criteria, participant statements included the Turkish acronym for GRASPS: writing the goal, assigning roles, determining the audience, identifying the situation, specifying the product, and setting the standards. Participants generally listed these components in order as theoretical explanations. As for the category of determining other evidence, participants mentioned it as a different assessment tool. Here is a participant statement under the evidence theme:

The second stage is the evidence stage. Evidence is determined through performance tasks and other additional evidence. In this work, in the goals section, the road the student should take, the audience to be addressed, the situation as the context, the product to be produced, and the standards the product should meet are determined. Other evidence is supported if needed, apart from the performance task. (F-SCI-4)

In this stage, a performance task is defined as an instructional and assessment tool that puts the student in front of a problem to be solved or an authentic situation to fulfill a given task. Explanations regarding performance tasks, GRASPS, and secondary evidence are provided by the teacher candidates. However, it is observed that there is no emphasis on creating criteria, evidence, and an assessment checklist in this stage, nor is the connection with the desired outcomes dimension addressed.

Table 5. The Learning Plan Theme After Training Activity

Theme	Category	Code
Learning Plan	Setting WHERETO principles	Disclosing the goal to the student Engaging and warming up Selecting activities to make the student active Providing feedback Determining the assessment process Differentiating instruction Establishing sequence and order
	Planning the lesson	Lesson outcomes Determining the methods and techniques to be used Identifying the tools, materials, and resources to be used Engaging the student Determining the steps of lesson delivery
	Learning process	Achieving desired outcomes  Determining how learning will take place

Table 5 presents the learning plan section, the third stage of backward design, in a tabular form. In this theme, three different categories were created: determining the WHERETO principles, lesson planning, and the learning process.

In the category of determining the WHERETO principles, participants provided coding for these principles, expressing their intended meanings in Turkish. These principles include informing the student about the goal, attracting attention, and warming up, determining activities to make the student active, providing feedback, determining the assessment process, differentiating instruction, and establishing sequence and order. Participants generally expressed the stages of instructional planning in a specific order and sequence. Examples of their explanations are provided below:

This stage is the final stage of understanding by design through planning. We have now determined the desired outcomes and how to assess the student. It is now time to teach these desired outcomes to the students. We use the WHERETO method in this stage. (M-CG-1)

In the category of lesson planning, participants included the lesson outcomes, determining the methods and techniques to be used in the lesson, selecting the tools, materials, and resources, engaging the student in the learning process, and determining the steps of lesson delivery in their unit plans. In the learning process category, the final category of the learning plan theme, the findings from the participants indicated the need to organize learning experiences to achieve the desired outcomes. One participant's statement related to the learning plan theme is provided below:

In the final stage, we generally plan instruction, which is what we initially do in other models as well. Here, various stages come into play, such as informing our students about the goals, attracting their attention, keeping them active, providing feedback, assessment, differentiating instruction, and organizing. Through these stages, we plan instruction aiming for students to achieve lasting learning and the transfer of knowledge. (F-SCI-1)

In this stage of the design process, teacher candidates have reflected on their planned lessons, discussions, and active learning techniques represented by the learning activities indicated in the WHERETO acronym. In the responses of the teacher candidates, there were fewer references to the holistic meaning of the desired outcomes and evidence stages.

**Table 6. Regarding Awareness Contact After Training Activity**

<b>Theme</b>	<b>Category</b>	<b>Code</b>
Awareness	Desire for implementation	Not missing the opportunity to use in past internships
		Using it in professional career
		Using it in the last internship
	Integrating into life	Providing benefits in life
		Being present in every moment of life
		Drawing conclusions about their learning processes
	Importance of planning	Learning being organized and structured
		Teacher making good plans
		Comprehensive and goal-oriented planning

Table 6 presents a thematic analysis of the post-professional development training phase focusing on understanding-based design, revealing a theme and three distinct categories. The theme identified is "awareness," which encompasses the categories of desire for implementation, integration into life, and the importance of planning. Within the category of desire for implementation, participants expressed a sense of missed opportunity in not applying understanding-based design in their previous internships, expressing regret and a solid intention to utilize the understanding-based design model in their upcoming internships and future professional endeavors. In the category of integration into life, participants emphasized not only employing understanding-based design principles during the teaching process but also integrating them into their learning journeys. They articulated that the principles of



understanding-based design, such as big ideas, would serve as guiding principles in various aspects of their lives, yielding personal benefits. The following supporting statements further underscore this conclusion:

We discussed how it would be if understanding-based design were present in every aspect of our lives. We talked about whether we would plan every moment, use it in every moment. We talked about how it could have been beneficial to us in our school life. (F-MAT-5)

These findings provide insights into the participants' increased awareness and commitment to the implementation and integration of understanding-based design principles in both their professional and personal contexts. Findings obtained from reflective journals and forms filled out by participants revealed that there should always be a planned process in teaching, and teachers should engage in goal-oriented and comprehensive planning. Furthermore, it was observed that participants were highly influenced by the topic of understanding-based design and some of its principles. Some statements from participants under the theme of awareness are provided below:

When we do activities in schools, there is a plan, but it is not as comprehensive and goal-oriented as this model. If I had known this model before, I could have designed my presentations and sessions according to this model. Our trainings and consultations would be more goal-oriented, planned, comprehensive, and effective with this model. (M-CG-1)

Upon analyzing the perspectives of the participants, it was evident that understanding-based design is perceived as a more comprehensive and goal-oriented approach compared to other planning methods. Notably, participants emphasized the utility and applicability of understanding-based design not only in their professional lives but also in their personal lives. Furthermore, the evaluation of lesson plans prepared by the participants, utilizing the "design standards rubric," yielded average scores. The average scores are presented in Table 7. These findings demonstrate the participants' awareness and application of understanding-based design principles following the professional development training.

Table 7. Average Scores of Teacher Candidates' Lesson Plans Based on Understanding-Based Design Standards Rubric

Standards for Understanding by Design Unit Plans	Average Scores of Teacher Candidates' Understanding by Design Unit Plans					
	CG	MAT	SSE	CE	SCI	Total
<b>1. Stage - Desired Outcomes</b>	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$
1. Do the understanding statements rely on and explore the big ideas that can be adapted to new situations and are inherent in the essence of the lesson?	3	2.8	2.2	3	2.5	2.7
2. Are the understanding statements supported by essential, curiosity-inducing questions that facilitate meaningful connections?	2.6	2.4	2.2	3	2.3	2.5
3. Do the essential questions (rather than quickly answerable questions) provoke thought, generate discussion, and lead to questioning within the framework of main ideas?	2.4	2.5	2.1	2.7	2.7	2.48
4. Are the knowledge and skill objectives correctly identified?	2.6	2.8	2.3	2.7	2.8	2.64
5. Is the transferable knowledge properly defined?	2.4	2.5	2.5	2.7	3	2.62
<b>Total</b>						<b>2.58</b>

<b>1. What extent do the assessment tools provide fair, valid, reliable, and sufficient measurements for the desired outcomes? Please answer the following questions:</b>							
<b>2. Stage – Evidence</b>							
6.	Do students demonstrate their understanding through authentic (scenario-based) performance tasks?	2.6	2.5	2.3	2.1	3	2.5
7.	Are appropriate criteria-based scoring tools used to assess student products and performances?	1.8	2	2.2	2.5	3	2.3
8.	Are diverse and appropriate additional assessment formats used as evidence of learning?	2	2.2	2.2	2.8	2.8	2.4
9.	Do assessment tools serve the purpose of providing feedback to both teachers and students, as well as for assessment?	2.8	2.2	2.4	2	2.7	2.42
10.	Are students encouraged for self-assessment?	2.4	2.1	2.2	2	2.4	2.22
<b>Total</b>							<b>2.36</b>
<b>How effective and engaging is the learning plan? Please answer the following questions:</b>							
<b>3. Stage - Learning Plan</b>							
11.	Will students know what they are going to learn, why the content they will learn is important, and what is expected of them (unit objective, performance requirements, and evaluative criteria)?	2.6	2.8	2.4	2.1	2.6	2.5
12.	Will students be able to immerse themselves in the big ideas through inquiry, research, problem-solving, and experimentation?	2.8	2.5	2	2.7	3	2.6
13.	Will students have sufficient opportunities to explore and experience the big ideas and become competent?	2.8	2.5	2.2	2.7	3	2.64
14.	Will students have enough opportunities to reconsider, rehearse, repeat, and revise their work in line with timely feedback?	2.2	2.4	2.1	2.5	2.5	2.34
15.	Will students have opportunities for assessment and reflection on their work?	2.4	2.5	1.8	2.4	2.3	2.28
<b>Total</b>							<b>2.47</b>
<b>In your opinion, is the learning plan:</b>							
16.	Suitable and flexible enough to appeal to all students' interests and learning styles? (T)	2.2	2.7	2.1	2.2	2.7	2.38
17.	Sufficiently organized and sequenced to maximize participation and effectiveness? (O)	2.8	2.7	2.2	2.4	2.7	2.54
18.	How well do all three stages of the design align with each other with all their elements?	2.6	2.4	2.3	2.4	2.6	2.46
<b>Total</b>							<b>2.46</b>

The unit plans developed by the teacher candidates were subjected to evaluation by participants, instructors and researchers using the backward design template and stages. The average scores obtained were then presented in Table 7. Based on the results, the highest evaluation score was attributed to the question focusing on integrating big ideas that are adaptable to new situations, lie at the core of the lesson, and necessitate discovery. Conversely, the lowest evaluation score was tied to the question pertaining to student encouragement for self-assessment. In the unit plans, the average scores were presented in descending order, categorized under desired outcomes, learning plan, and evidence. Notably, the evidence stage of the unit plans received lower evaluation scores in terms of criteria such as the use of assessment tools grounded in appropriate evaluation criteria, incorporation of diverse and relevant additional assessment methods as evidence of learning, and encouragement of student self-assessment. In general, the evaluation highlighted comparatively lower scores for aspects such as the unit plans' adaptability and flexibility to encompass all student interests and learning styles, as well as the overall alignment of all elements across the three design stages. The findings underscore the need for improvement in meeting the designated criteria of the unit plans, particularly in relation to assessment tools, additional assessment methods, and self-assessment encouragement.

## **Conclusion and Discussion**

The current study aimed to enhance participants' competence and awareness in Understanding by Design. Consequently, the participants' perspectives on Understanding by Design were assessed before and after the training activity, and their unit designs were evaluated using the design standards rubric, which aligned with the predefined sub-dimensions of the theoretical framework. Initial analysis of the forms completed by the participants, containing open-ended questions, revealed the emergence of a three-dimensional structure encompassing the necessity of design, Understanding by Design and big idea themes. Interestingly, the participants' pre-training explanations displayed a general understanding of the necessity of design in all aspects of life and the learning process, rather than adhering to the theoretical framework of understanding-based design. Noteworthy insights were given by the participants regarding the relationship between lesson preparation and designing. Additionally, the big idea was perceived as unconventional ideas that inspired uniqueness and would not be conceived by others, indicating the participants' first encounter with understanding-based design. Post-training, the desired outcomes section of the unit plans encompassed categories such as writing outcomes, asking essential questions, setting objectives, identifying big ideas, determining transfer statements, and formulating understanding statements. It is important to highlight that while all the specified subheadings within the template were emphasized, there was a lack of emphasis on distinguishing between backward design and other design approaches, as well as changes occurring at the conclusion of the instructional process. In the evidence section, the performance tasks, GRASPS, and secondary evidence were explained by the teacher candidates. Notably, insufficient emphasis was observed regarding the creation of evidence, criteria, evaluation checklists, and establishing coherence by connecting with the desired outcomes dimension. In the learning plan stage, the teacher candidates envisioned the lessons, discussions, and implementation of active learning techniques in their classrooms. The analysis of the participants' views on awareness revealed that understanding-based design was perceived as a comprehensive and goal-directed approach in comparison to alternative planning methods. Moreover, its perceived utility extended beyond professional contexts, finding applicability in personal lives as well. Evaluation of the unit designs highlighted lower scores in the learning evidence section, implying shortcomings in using appropriate criteria for evaluating performance, employing diverse and relevant additional assessment methods for evidence of learning, and fostering student self-assessment. Overall, the general evaluation revealed lower scores concerning the unit plans' adaptability, flexibility in addressing all student interests and learning styles, and the overall alignment of the design stages. Understanding the perspective of teacher candidates, who primarily associate their studies with lesson preparation, especially with regards to comprehending the big idea is of significant importance.

Studies have been conducted to improve teachers' understanding-by design competencies. An 11-week action research conducted by Yurtseven & Altun (2017), the current study provided teachers with the opportunity to pursue their professional development and work as a team. The teachers improved their understanding-by design understanding and competencies. Lumbreras & Rupley (2020) stated that there was improvement in design-related concepts and unpacking standards in lesson design with backward design in a study conducted with teacher candidates. Mctighe (2019) specifically mentioned that new teachers in the profession are more likely to make planning errors. These planning errors include weak planning skills such as excessive dependence on the textbook, creating random activities, and giving more weight to multiple-choice tests. Boozer's (2014) data particularly show that teacher candidates struggle with determining assessment evidence and establishing the relationship between targets/standards

during unit planning. Additionally, the high workload and lack of sufficient time and resources in the schools where teachers work are shown as factors that hinder unit planning (Walters, 2018; Yurtseven & Altun, 2017). Graff (2011) stated that the backward design approach's nature of backward thinking algorithm and preparation stage can be distressing for some participants. Many studies have been conducted to improve teachers' and teacher candidates' understanding-based design competencies and awareness. Specifically, the findings of Mctighe (2019) and Boozer (2014) align with the study's results, indicating that new teachers struggle with creating random activities and writing assessment evidence. Walters (2018) also emphasized the importance of time allocation and resource creation. It is necessary for professional development activities to be designed considering students' needs for leisure, sustenance, and supplies.

Understanding by Design has changed the thinking algorithm and preparation stage in the curriculum and unit planning. In backward design, desired learning outcomes are considered at the first and a backward planning from the future to the present is conducted. The second innovation brought by the model is the planning framework that enables teachers from different disciplines to plan for knowing, doing, transferring, and authentic tasks in the desired learning outcomes. This framework places particular emphasis on the transformation of knowledge into action. A design framework has also been provided to select learning experiences that will lead to the desired learning outcomes. The steps, abbreviated as "Where to," specify the characteristics that learning experiences should have. Understanding-based design is a design model that prioritizes the desired changes in the design of curriculum and unit plans from Tyler (2013) to the present, emphasizing alignment among all dimensions. There is evidence that it is effective in facilitating the transfer of knowledge to new situations, referred to as 21st-century skills for students. Many higher education institutions and K-12 reference institutions use the planning framework. In conclusion, the analyses of the forms filled out before and after the competency and awareness training, as well as the unit plans prepared, demonstrated that the thirty-hour competency and awareness. Training for teacher candidates was beneficial in terms of providing understanding, knowledge, and skill acquisition. The reflections made by the teacher candidates helped both themselves and other participants to better understand the subject and improve their instructional plans. The understanding-based design training activity used in the study is recommended to be used in professional development programs. It is recommended to conduct more practice in the areas of writing performance criteria and developing scoring tools based on appropriate criteria for the evidence section of unit plans, encouraging students for self-assessment, and providing more emphasis on explaining the backward design thinking algorithm.

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