

Teacher Trainers' and Curriculum Development Experts' Perspectives on Information Technologies Curriculum in Teacher Education

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Abstract

This case study had two purposes: (1) to explore the appropriateness of the learning outcomes of information technologies (IT) course curriculum in teacher education programs based on the opinions of curriculum development experts and (2) to evaluate the opinions of the academics about the adequacy of this curriculum. Curriculum development experts (n = 5) evaluated the learning outcomes of the IT course curriculum followed by the education faculties of 25 universities in Türkiye in terms of their qualitative relevance. We also obtained the opinions of 10 academics in these faculties for the evaluation of the IT course curriculum. To collect data, we used the "Qualitative Eligibility Form for Learning Outcomes" and "Evaluation Form for IT Curriculum". We employed descriptive statistics in the analysis of quantitative data while qualitative data were analysed using content analysis. The results showed that most of the learning outcomes in the IT course curriculum were not sufficient for the criteria of formal spelling conformity, necessity, and encouragement of higher-order thinking. The academics' perspectives revealed that course sessions and practical learning activities in the IT curriculum were not sufficient. They suggested that emerging technologies such as artificial intelligence, Web 2.0/3.0 tools, robotics, coding, and augmented/virtual reality should be integrated into the curriculum. The implications for IT curriculum in teacher education programs and recommendations for future research were also discussed.

Keywords: information technologies; curriculum evaluation; pre-service teacher; expert; teacher trainers; bologna process.

About the Article

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Introduction

In the context of digital transformation, developing information and communication technology (ICT) skills is paramount for prospective teachers during their pre-service training (Farjon et al., 2019). The acquisition of these skills has become a significant issue in teacher education for two main reasons. Firstly, technology education is valuable as it enables prospective teachers to use technology more effectively and efficiently in their personal lives and to be aware of associated risks and challenges. However, while basic skills like technology literacy and digital literacy may suffice for other individuals in society, they are not enough for teachers. Secondly, as pre-service teachers' transition from their training programs to real classroom environments, they must possess the skills and understanding to integrate new technologies into the teaching and learning process. This integration is essential for enhancing student learning and retention (Howard et al., 2021). Teachers who have acquired these skills are able to make informed decisions about using technology in educational settings and maintain this understanding even as technologies evolve (Tondeur et al., 2021). Moreover, effective ICT integration into teaching can support the learning process and improve the quality of education.

Several international organizations, such as the Organisation for Economic Co-operation and Development (OECD), the United Nations Educational, Scientific and Cultural Organization (UNESCO), The International Society for Technology in Education (ISTE), and the British Educational Communications and Technology Agency (BECTA), have established standards and indicators to develop teachers' competencies in using technology. For instance, ISTE (2022) proposes technology standards for educators, qualifying them in seven different roles (learner, leader, citizen, collaborator, designer, facilitator, and analyst) subdivided into 24 competencies. The Digital Competence Framework for Educators (DigCompEdu) also provides a scientifically sound structure describing the technology competencies of teachers in Europe (Redecker, 2017). It offers six areas (professional engagement, digital resources, teaching and learning, assessment, empowering learners, and facilitating learners' digital competence) with 22 competencies. Teacher training institutions strive to integrate these standards into their programs to equip pre-service teachers with ICT and digital skills before they enter the profession. Specifically, ICT skills frameworks such as Technological Pedagogical Content Knowledge (Koehler & Mishra, 2005), the Technology Acceptance Model (Davis, 1989), Will-Skill-Tool-Pedagogy (Knezek & Christensen, 2016), and Substitution-Augmentation-Modification-Redefinition (Puentedura, 2012) are incorporated into technology courses during undergraduate education to prepare pre-service teachers for effective technology integration.

Despite the wealth of information and research-supported initiatives, several studies have shown that most teachers struggle to integrate technology into their teaching to achieve specific lesson goals (Fraillon et al., 2020; Pozas & Letzel, 2021). This issue became particularly evident during the Covid-19 pandemic. For instance, a study by Glutsch et al. (2020) revealed that nearly 70% of teachers did not use digital learning applications during emergency remote education due to a lack of ICT competencies or

ineffective policy design. Zimmer and Matthews (2022) found that teachers have anxieties about adapting to evolving technology. Although pre-service teachers today are more familiar with technology than previous generations, they still seem unable to effectively integrate their technological knowledge and skills into education (Jung & Ottenbreit-Leftwich, 2020; Pozas & Letzel, 2021). This inability may stem from various factors such as low technological self-efficacy, motivational orientations, trainer attitudes, and insufficient knowledge and experience (Pozas & Letzel, 2021). However, the primary reason is often the inadequately planned and systematically organized theoretical and practical components of technology courses in undergraduate programs (Wang & Zhao, 2021). Therefore, these courses, which are critical to teacher education (Howard et al., 2021), need to be designed based on systematic processes and curriculum development criteria.

Teacher education programs around the world emphasize creating technology-rich learning environments that enable pre-service teachers to integrate technology into their teaching practices (Antonietti et al., 2022; Tondeur et al., 2020). Consequently, many countries continuously evaluate and update their curricula (Kurent & Avsec, 2023; Qiane et al., 2023; Zhang et al., 2022). The primary reason for this focus is that universities play a crucial role in developing and promoting technological skills (Núñez-Canal et al., 2022). In Türkiye, higher education programs are developed by considering both national standards, such as Development Plans and the Turkish Higher Education Qualifications Framework, and international standards, including the European Higher Education Area Qualifications Framework and the European Lifelong Learning Qualifications Framework.

For the past few decades, the quality of teaching and learning at universities has garnered significant interest from researchers. Consequently, the Bologna Process and accreditation processes have emerged as crucial steps in enhancing the quality of higher education. Studies on the Bologna Process indicate that it has introduced a new perspective to education, aiming to generate better learning outcomes and competencies (Del Pozo Andrés, 2009; Marcelo & Yot-Domínguez, 2019; Penbek et al., 2011).

Significance

As a key element of the curriculum, evaluating the appropriateness of learning outcomes is crucial for determining the characteristics pre-service teachers should acquire and for establishing a more effective connection with the content, educational situations, and assessment elements. Learning outcomes (curriculum outcomes at the macro level) are also a vital part of the accreditation process, which emphasizes specific standards in the context of quality assurance in higher education (Maher, 2004). These outcomes encompass knowledge, skills, attitudes, and abilities that learners are expected to attain by the end of a course or program. Additionally, learning outcomes guide teachers in creating the syllabus and course content, designing teaching methods and techniques, and shaping the assessment and evaluation process. Technology courses in teacher

education programs should be designed according to national and international standards, ensuring that pre-service teachers are well-equipped with technology skills as they enter the profession (Instefjord & Munthe, 2016). When learning outcomes are not established according to specific standards, the curriculum can become ambiguous, difficult to manage and implement, and ultimately ineffective.

The IT course guides pre-service teachers in developing skills such as information and technology literacy, digital literacy, and TPACK (Falloon, 2020). Technology courses in teacher training programs play a crucial role in preparing pre-service teachers for digital privacy and security, as well as their future professional lives (Çebi et al., 2022). In this respect, this study is significant because it demonstrates that the learning outcomes were insufficient according to Industry 4.0 standards (such as ISTE, DigCompEdu) and that the curriculum had deficiencies both in theory and practice. The lack of skills in the professional use of technology among pre-service teachers has consistently been a significant issue, yet there has been insufficient research addressing this problem (Nelson & Voithofer, 2022). Notably, the literature lacks a comprehensive study evaluating the adequacy of achievements in technology curricula within faculties of education, considering both the Bologna adaptation process and the contemporary challenges of Industry 4.0. In this context, the current research focuses on the information technology curriculum, specifically addressing the teaching of fundamental information and communication technologies in teacher training programs. Thus, the outcomes in the curriculum have been assessed, revealing technological deficiencies for the future. Moreover, evaluating outcomes from various universities has enhanced the study's originality. Initially, shortcomings in achievements were pinpointed, followed by evaluations of educational programs with expert opinions to offer guidance for the future. In this regard, the recent study is expected to contribute to teacher curricula and related literature.

Purpose

The purpose of this study was two-fold: (1) to explore the appropriateness of the learning outcomes of information technologies (IT) course curriculum in teacher education programs based on the opinions of curriculum development experts and (2) to evaluate the opinions of the academics about the adequacy of this curriculum. The research questions (RQs) of this study were as follows:

1. What is the distribution of learning outcomes of IT curriculum according to Bloom's Cognitive Domain Taxonomy?
2. What is the qualitative relevance of learning outcomes in the IT curriculum?
3. What are the opinions of academics about the adequacy of IT curriculum?
4. What are problems experienced in the implementation process of IT curriculum according to the opinions of academics?

5. What are the opinions of academics about reflections of Industry 4.0 on IT curriculum?
6. What are the opinions of academics about the adaptation of IT curriculum to the Bologna Process?

Background

IT curriculum for pre-service teachers in Türkiye

Typically, teacher training programs require pre-service teachers to enroll in one or more courses for technology training. Technology education is an important part of teacher education programs (Martin, 2018). Although the content of the teacher training programs in the world is similar, the names of the courses may differ. In the faculties of education in Türkiye, especially the teaching of basic subjects and concepts related to information and communication technologies is given within the scope of the Information Technologies (IT) curriculum.

Between 1989 and 1992, education colleges in Türkiye that trained teachers included the "Computer Use and Teaching I-II" course, with 2 hours per semester during the final year (fourth grade) of the program (CoHE, 2007). By 1998, this course was integrated into the Faculty of Education curriculum under the name "Computer," scheduled for the third semester. It covered basic office programs, classroom computer use, and basic keyboard skills. Initially planned for a single semester, the course consisted of 4 hours and 3 credits, including 2 hours of theory and 2 hours of practice (CoHE, 1998). In 2007, with the rise of the internet and technological advancements, "Computer-I" expanded to include software and hardware concepts, operating systems, office programs, ethics, and internet use. Meanwhile, "Computer-II" focused on fundamental concepts of computer-assisted education, its theoretical foundations, distance education, and the impacts of the internet on children and young people (CoHE, 2007). By 2018, reflecting the broader scope of information and communication technologies, the course was renamed "Information Technologies (IT)." The updated curriculum was designed to include 3 hours of theoretical instruction per week within a single semester of the pre-service teacher education program (CoHE, 2018). Table 1 shows an overview of the topics in the content of the IT curriculum.

Table 1. IT course contents in teacher education (CoHE, 2018)

Information technologies and computational thinking; problem-solving concepts and approaches; algorithms and flowcharts; computer systems; basic concepts of software and hardware; fundamentals of operating systems, current operating systems; file management; utilities (third-party software); word processing programs; calculation/table/graph programs; presentation programs; desktop publishing; database management systems; web design; use of the Internet in education; communication and cooperation technologies; safe internet use; informatics, ethics and copyrights; effects of computers and the Internet on children/young people.

The IT course plays a crucial role in teacher training, providing foundational technological skills and serving as a cornerstone for higher-level technology-related courses. Particularly in the 21st century and post-Covid-19 pandemic era, the significance of this course and similar ones for pre-service teachers has become increasingly apparent. Acquiring technology literacy through these courses is essential for educators as they prepare educational materials and guide their students (Spiteri & Chang Rundgren, 2020). Studies in the literature indicate that pre-service teachers recognize the importance and utility of information technology courses (Haseski, 2019) and acknowledge their contribution to professional development (Yeşildağ & Önlü, 2020).

In Türkiye, the curriculum of IT courses is shaped under the Türkiye Qualifications Framework (TQF) guidelines established by the Council of Higher Education (CoHE). However, there is a lack of detailed curriculum guidelines specifically tailored for faculties of education, outlining specific objectives, content, teaching methodologies, and assessment criteria for instructors. Universities largely define their own course objectives (learning outcomes) based on the contents outlined in Table 1, aligning with the principles of the Bologna Process. Consequently, variations may exist among higher education institutions regarding the achievements and structure of their IT course offerings.

The Bologna Process and Its Reflections in Türkiye

The Bologna Process is an intergovernmental reform initiative aimed at restructuring higher education institutions to enhance cooperation, quality assurance, and mobility across European teaching systems (Zahavi & Friedman, 2019). Its primary objectives include improving the quality of European higher education, facilitating exchange and cooperation within Europe, and promoting international recognition through common standards (Wächter, 2004). Initially conceived to create a European Higher Education Area, the Bologna Process expanded globally through initiatives by organizations such as UNESCO, World Bank, EU, and OECD (European Higher Education Area, 1999). As a result, the number of signatory countries grew to 48, influencing countries beyond Europe (European Commission, 2020). The idea of a European Higher Education Area originated in the Sorbonne Declaration of 1998 and was formalized in 1999 with the Bologna Declaration, signed by education ministers from 29 countries (European Commission, 2020). In Türkiye, the Bologna Process began in 2001, following its adoption by numerous European Union members. The implementation of the Bologna Process within the Turkish higher education system was entrusted to the Council of Higher Education (CoHE).

The Bologna Process provides opportunities for member countries to promote lifelong learning with a competitive approach to renewal and improvement initiatives in higher education (Kroher et al., 2021). The Bologna Process gave these countries chances to revise and update their curriculums to harmonize them with international programs while also laying emphasis on the determination of the objectives in the curriculums properly

and their relationship with each other. Thus, the issue of increasing the employment of graduates by increasing their competencies based on the need gained more importance (Pereira et al., 2020). Accordingly, each member country of the Bologna Process was charged with determining the National Qualifications Framework (NQF) in their education systems based on the European Qualifications Framework (EQF). In addition, each higher education unit was responsible for determining its own curriculum qualifications to be aligned with the NQF. After 2005, the establishment of NQF was initiated in Türkiye and the Higher Education Qualifications Commission (HEQC) was established in 2006 to carry out studies in this direction. In Türkiye, the Higher Education Institution (HEI) synthesized the "European Qualifications Environment and National Qualifications Framework" for each field, and the Turkish Qualifications Framework (TQF) was established and put into force in 2015 (TQF, 2023). Today's technology and opportunities underpin the field-specific competencies in the content of TQF. The degree to which these competencies are acquired is measured as "learning outcomes" during and at the end of each course/module by appropriate and objective methods. With the spread of the Bologna Process, the outcome-based model has started to be adopted in higher education (European Commission, 2020). Learning outcomes are, indeed, an effective academic quality assurance tool that allows educators to review and improve alignment between planned, implemented, and experienced curricula. Articulating appropriate learning outcomes is inarguably essential for the success (Ibrahim et al., 2022) and accreditation process of programs.

Revised Bloom Taxonomy

Bloom's Taxonomy is of great importance in terms of studying educational outcomes in the Bologna Process. Taxonomically, the first classification of the cognitive domain was created by a group of educators led by Benjamin S. Bloom and published in the book "Taxonomy of Educational Objectives, the Classification of Educational Goals, Handbook I: Cognitive Domain." in 1956 (Bloom et al., 1956). The Original Cognitive Domain Taxonomy of Bloom has six major categories ordered from simple to complex thinking in the cognitive domain: (i) knowledge, (ii) comprehension, (iii) application, (iv) analysis, (v) synthesis, and (vi) evaluation. It was created by listing the learning objectives, which include the knowledge, skills and attitudes that students are expected to learn, hierarchically and as prerequisites for each other. In 2001, the Revised Bloom Taxonomy was developed as a two-dimensional framework by Bloom's students: (i) knowledge and (ii) cognitive process. In addition to the structural arrangement, a terminological transition has been made from noun to verb in the Revised Bloom Taxonomy. The cognitive process dimension consists of six categories as remember, understand, apply, analyze, evaluate, and create respectively (Anderson & Krathwohl, 2001). These are briefly as follows (Krathwohl, 2002):

Remember: Retrieving relevant knowledge from long-term memory involves recognizing or recalling information to generate or retrieve definitions, facts, or lists, as well as reciting previously learned material (Recognizing and recalling).

Understand: Interpreting the meaning of instructional messages, encompassing oral, written, and graphic communication (Interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining).

Apply: Carrying out a procedure in a specific context (Executing and implementing).

Analyze: Analyzing material by breaking it down into its constituent parts and understanding how these parts relate to one another and to the overall structure or purpose (Differentiating, organizing, and attributing).

Evaluate: Forming judgments based on established criteria and standards (Checking and critiquing).

Create: Combining elements to create a novel, coherent whole or to produce an original work (Generating, planning, and producing).

The structure of the knowledge dimension was expressed as three types: factual, conceptual, procedural, and metacognitive (Anderson & Krathwohl, 2001). Factual knowledge is the basic knowledge that students need to know. Conceptual knowledge is the relationships between concepts in a structure, how the concepts are related, and how the concepts function together. Procedural knowledge is knowledge about how any process or work should be done. Metacognitive knowledge includes understanding cognition broadly, including awareness and knowledge of one's own cognitive processes (Krathwohl, 2002). Revised Bloom Taxonomy offers educators a method to cultivate a comprehensive grasp of specific objectives, enabling them to enhance assessment, instruction, and the crucial connection between them (Anderson, 2005). Appendix 1 shows the two-dimensional structure of Bloom's Revised Cognitive Domain Taxonomy. The learning outcome is displayed in the cell that is the intersection of the row containing the knowledge dimension and the column containing the cognitive process dimension. Importantly, this taxonomy has been widely used in the writing of cognitive domain outcomes and has been proposed as a guiding tool in designing learning outcomes in the Bologna Process (Booker, 2007).

Method

This study adopted a case study from qualitative research methods. Yin (1989) states that the case study particularly focuses on current events. Case study is a method used when we want to examine an event or phenomenon in depth (Yıldırım and Şimşek, 2011). A topic or event addressed in this research design is examined in depth by addressing it within its unique environment and conditions (Merriam & Tisdell, 2015).

Firstly, IT course packages of faculties of education were examined with the document review method, and the qualitative suitability of objectives was evaluated according to expert opinions. Thus, we tried to reveal the existing situation. At this stage, the opinions

of the academics who are the implementers of the information technologies curriculum were taken and evaluated with a questionnaire.

Participants

In the first phase of study, in the context of the Bologna Process, questions have been prepared to be able to carry out the study of IT courses in universities. Expert opinions were then obtained for these questions. Curriculum development experts (n=5) formed a working group as persons who will evaluate information packages of informatics courses in programs of education faculties of 25 universities in Türkiye. At first, universities that publish their learning outcomes on their websites are identified. Afterward to reach these documents, universities that had faculties of education with active students were determined by using the stratified sampling method. A total of 25 state universities, five of which are in the Black Sea Region, four in the Mediterranean Region, four in the Central Anatolia Region, four in the Southeastern Anatolia Region, four in the Eastern Anatolia Region, two in the Marmara Region, and the last two in the Aegean Region were included in the study. Since course information forms were not published on the Bologna websites of some universities, equality in the number of universities by region could not be achieved. Curriculum development experts (n=5) who were Ph.D. graduates in the field of curriculum and instruction evaluated these information packages according to certain standards. Two of these specialists were female and three of them were men.

In the second phase of the study, the group consisted of 10 academics (4 females, 6 males) who were curriculum practitioners and teacher trainers. These participants were selected from the faculties of education in 25 universities across various regions of Türkiye, using criterion sampling from purposeful sampling types. The criteria for selection included having taught IT courses and working in faculties of education. This is due to the selection of specialists who have knowledge of the IT curriculum outcomes. Among the participants, 2 were associate professors, 5 were assistant professors, and the rest were instructors.

Procedure

This study was conducted in the fall semester of the 2022-2023 academic year between 5 September and 10 February 2023. Before conducting the study, approval was obtained from the Social Sciences and Humanities Ethics Committee of the institution where researchers were working (Protocol Number: 2022-SBB-0109) and the study was carried out in accordance with principles of the 2008 Declaration of Helsinki. As the first step, learning outcomes evaluation criteria were set by taking the opinions of four field experts and an independent expert who reviewed them. In line with the first purpose of the study, as researchers, we examined information packages and course contents of IT courses in pre-service teacher programs of 25 universities. Learning outcomes of the information technologies course in the Bologna information packages were reduced into a single file by coding the university they belong to as U1, U2, U3, and so forth. This file

was then sent to curriculum development experts via e-mail together with the "Qualitative Eligibility Form for Learning Outcomes" which was developed based on the determined criteria. Curriculum development experts were informed about the purpose and content of the study, and their voluntary participation was ensured beforehand.

The evaluation form which was created in line with the second purpose of the study was sent to academics via Microsoft Forms. They were contacted before the application process and informed about the research process in detail. In addition, attention was paid to the voluntary participation of all participants. Average time to respond to the form was 24 minutes (Min=10, Max=35). Figure 1 shows the research procedure.

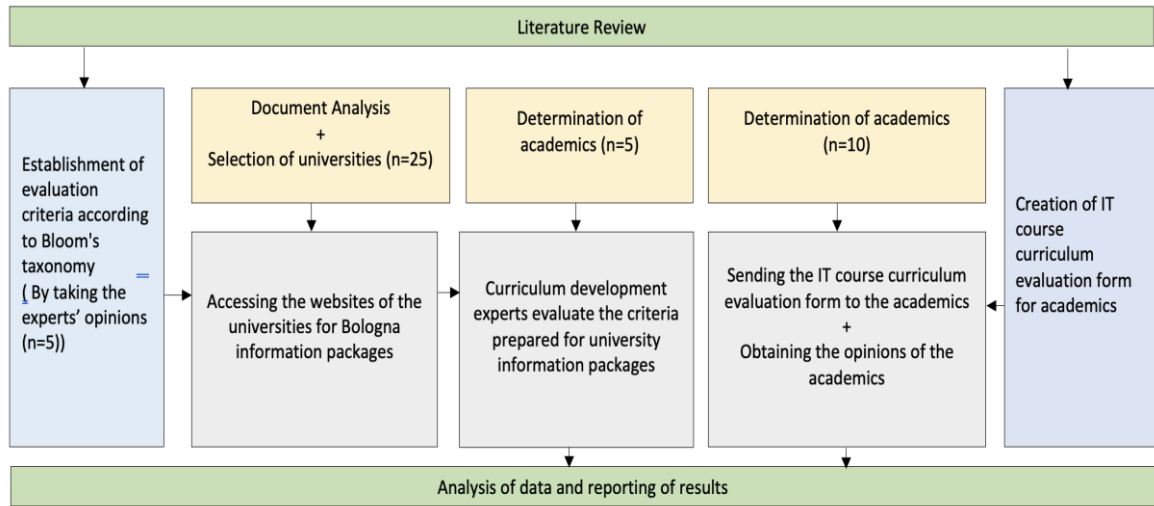


Figure 1. Research procedure

Data Collection

Bologna Information Packages for IT courses: We accessed IT course information packages on university websites related to the Bologna information system. This course is a compulsory, common course taught for 3 hours theoretically (5 ECTS) in the first semester in all undergraduate programs to train pre-service teachers. The content of the IT course renewed by CoHE (2021) includes the following topics: Computational thinking, problem-solving, algorithms and flowcharts, computer systems, software and hardware, operating systems, file management, utilities, word processing, presentation, computing, desktop publishing and database management programs, web design, informatics ethics, internet use in education, and effects of computers and the Internet on children/young people. In line with this framework, teacher training institutions create information technologies course information packages themselves. At the higher education level, training and seminars are given for the creation of course information packages for academics and academics of course create course information packages by writing the learning outcomes themselves.

Qualitative Eligibility Form for Learning Outcomes: This form was prepared by researchers for curriculum development experts to evaluate learning outcomes included in information technologies course information packages. Form consisted of three parts. The first part was aimed at determining the distribution of learning outcomes according to the steps (remembering, understanding, applying, analyzing, evaluating, and creating) in the cognitive dimension of the Revised Bloom's Taxonomy. The second part consisted of an area where specialists could score on a 7-point Likert-type scale ranging from 1- "Not completely appropriate" to 7- "Completely appropriate" to determine the qualitative appropriateness of learning outcomes based on certain criteria. Relevant literature was examined in detail to determine qualitative suitability criteria that learning outcomes should have (Bloom et al., 1956; EC, 2015; EQF, 2022; OECD, 2019; TQF, 2023). A total of 18 criteria were determined by taking the opinions of five field experts (two in the field of Curriculum and Instruction and one in the field of Computer and Instructional Technologies). Curriculum development experts were asked to give qualitative points to learning outcomes of information technologies course according to these criteria. An information guide was also prepared to guide curriculum development experts in filling out the form. The European Qualifications Framework User Guide was taken as a reference while creating this guide and the content of criteria was explained in the guide (EC, 2015). In addition, suitability of competencies to the technological pedagogical content knowledge (TPACK) model (Koehler & Mishra, 2008) was examined in light of Bloom's new taxonomy (Krathwohl, 2002). The TPACK model allows a course to be delivered by integrating technology into it (Santos & Castro, 2021). Apart from these standards, the "UNESCO Information Technology Competences Framework for Teachers" created by UNESCO (2018) to help teachers use information technologies effectively was also taken into account since these competencies were crucial for determining qualitative suitability criteria. In the last section of the form, there was a field where experts could write sample learning outcomes that would not meet criteria.

Evaluation Form for IT Curriculum: This form was also developed by researchers to obtain opinions of academics who taught or were teaching this course for evaluation of IT course curriculum in teacher education. The form consisted of two parts. The first part of the form included an informative text about the purpose of the research and questions about demographic information of participants (university, gender, title, age, and seniority). In the second part, there were seven open-ended questions for evaluation of IT course curriculum by teacher trainers. Opinions of three academicians (2 from the field of Curriculum and Instruction and 1 from the field of Computer and Instructional Technologies) were resorted to for creating questions in form and the form was finalized in line with the feedback of these experts. Whether survey questions were understandable or not was piloted on trainer (an academic who was giving an IT course) independent of the study group of the current study. The data obtained from this application were not included in the analysis as it was just for the revision purpose. The open-ended questions of form were as follows:

- What do you think about the adequacy of the duration of the IT course? Please explain.
- In your opinion, how should IT courses be delivered (face-to-face, distance education, or blended learning)? Please explain its reason.
- Which third-party software/programs should be given to students within the scope of IT courses in teacher education? Please explain.
- What are deficiencies you see in the IT course curriculum? Which learning outcomes, subjects, or contents can be added or removed? Please explain.
- What are general deficiencies or problems that you observed in the IT course? What are your suggestions for these deficiencies and problems? Please explain.
- How do you evaluate IT course curriculum in the context of Industry 4.0?
- How do you evaluate the Bologna Process for IT course? (In terms of creating learning outcomes, standardization studies, etc.)

Data Analysis

To ensure validity and reliability of the study, all ethical issues were taken into consideration. First, permission from the ethics committee and other relevant institutions was obtained for conducting the study. Then, the opinions of three academics were taken in the creation of both data collection tools and learning outcomes evaluation criteria. Two of experts had doctoral degrees in Curriculum and Instruction and the other one in Computer and Instructional Technology. In the study, the average of scores given by curriculum development experts for the qualitative appropriateness of learning outcomes was taken and results were tabulated and interpreted accordingly. A mean value close to 7 indicates that the qualitative suitability of learning outcomes according to the relevant criterion is high, while a value close to 1 indicates that it is weak.

The data obtained from the second form were analyzed through content analysis which allows one to look at the subject under consideration from an inclusive perspective (Kazu & Çam, 2019). In the process of analyzing the data, participants were coded independently of their personal information such as name, title, etc. and attention was paid to the principle of confidentiality in an ethical sense. The data obtained from the opinions of academics were coded by two independent experts, and similar codes were combined under relevant themes.

Findings

Evaluation of the qualitative suitability of IT course learning outcomes according to expert opinions.

The learning outcomes of IT course in education faculty programs of 25 universities were evaluated by curriculum development experts according to both Bloom's Revised Taxonomy and the qualitative appropriateness of learning outcomes. Table 2 shows average values of the qualitative suitability of objectives according to criteria.

Table 2: Distribution of averages of goals according to cognitive domain of the Revised Bloom's Taxonomy and qualitative suitability criteria

University	Cognitive Domain							Qualitative criteria for learning outcomes																		
	Remember	Understand	Apply	Analyze	Evaluate	Create	Total	Conformity to formal writing	Learner orientation	Relativity to need	Supporting affective characteristics	Clarity	Generality and limitation	Adjacency	Content-interlocking	Logical consistency	Observability-measurability	High-level learning	Incentive	Durability, functionality	Change openness-Timeliness	Educational buildability	Flexibility	Dynamism-continuity	Accessibility	Fusion
U1	3	2	3	-	-	-	8	3.50	5.75	3.75	2.25	4.75	5.75	4.50	4.25	5.00	4.75	3.50	4.75	4.25	6.25	5.25	4.25	6.00	5.25	4.65
U2	2	-	5	-	-	-	7	3.25	5.25	3.25	2.50	4.25	4.25	4.25	3.25	3.25	4.50	3.50	3.50	3.75	5.00	4.75	4.00	5.25	5.00	4.04
U3	5	1	2	-	-	-	8	3.50	4.75	4.25	3.00	3.75	3.00	3.25	3.25	4.25	4.25	3.75	4.00	4.00	5.50	4.25	3.75	5.00	4.75	4.01
U4	2	1	4	-	-	-	8	1.50	2.25	3.25	2.75	3.25	3.25	2.25	3.25	3.50	2.75	2.50	2.50	4.50	4.75	4.25	3.50	4.75	3.75	3.25
U5	2	1	5	-	-	-	8	4.50	5.25	4.25	3.00	4.50	5.75	5.00	3.25	6.25	6.00	4.25	5.50	3.75	6.25	5.50	4.00	6.25	5.75	4.94
U6	4	-	1	-	-	-	5	1.50	2.75	2.75	2.50	3.75	2.25	2.25	3.50	5.50	4.25	2.75	3.75	3.75	5.50	2.50	3.25	2.75	3.00	3.24
U7	2	2	2	-	-	-	6	3.00	2.50	2.75	2.25	3.25	3.25	3.25	3.25	3.25	3.50	3.50	4.00	3.25	3.50	3.50	3.25	3.75	3.75	3.26

U8	2	2	5	-	-	-	9	3.50	4.00	3.75	2.50	3.50	4.25	4.25	4.75	5.25	3.75	3.25	4.25	3.25	4.50	4.25	4.00	4.25	4.50	3.99
U9	2	2	4	-	-	-	8	1.25	3.00	3.25	3.50	3.25	3.50	3.75	3.50	4.00	3.25	3.50	3.75	3.25	3.75	4.00	4.25	4.50	4.25	3.53
U10	13	-	8	-	-	-	21	3.25	4.75	4.25	3.50	4.75	4.75	4.75	4.75	5.25	4.50	4.25	5.25	4.75	5.75	5.00	5.75	5.75	6.00	4.83
U11	1	1	2	-	-	-	4	4.00	4.50	3.25	2.50	3.25	3.75	2.75	2.75	3.25	3.75	2.50	3.50	3.00	3.75	3.75	3.50	3.50	3.50	3.38
U12	4	1	4	-	1	-	10	3.75	5.75	5.50	3.25	3.75	3.75	4.25	4.50	3.50	4.25	3.25	3.50	4.25	4.50	4.25	3.25	5.50	5.25	4.22
U13	4	1	5	-	-	-	10	1.25	4.75	4.50	2.50	2.75	3.25	2.25	4.75	3.25	3.50	2.75	3.50	3.75	4.25	4.50	4.00	4.25	3.50	3.51
U14	2	-	1	-	-	-	3	1.50	2.75	2.25	0.75	1.50	1.75	1.75	1.50	2.50	2.50	1.75	2.25	2.75	3.00	2.75	2.75	2.75	3.50	2.24
U15	3	-	-	-	-	-	3	2.00	3.50	1.75	0.50	1.75	1.50	2.25	2.25	2.25	2.25	1.75	2.00	2.00	2.00	3.00	2.75	3.00	2.75	2.18
U16	2	-	-	-	-	1	3	3.25	4.25	3.25	1.25	2.75	3.25	2.25	2.25	2.50	2.50	2.00	2.50	2.50	2.75	3.25	3.25	3.50	3.50	2.82
U17	4	1	2	-	-	-	7	2.00	2.25	2.50	1.75	2.00	3.50	3.75	3.25	3.00	3.75	2.50	3.50	4.25	4.25	4.25	4.25	4.75	4.50	3.33
U18	2	1	3	-	-	1	8	1.25	3.25	3.25	3.00	3.25	2.75	3.25	3.50	3.25	4.50	4.75	5.00	5.25	5.25	4.75	5.00	5.50	4.25	3.94
U19	3	4	6	-	-	-	14	5.50	4.75	4.25	2.75	5.75	5.75	4.75	3.75	4.25	6.00	4.75	6.50	5.75	6.25	5.75	4.25	6.25	6.00	5.17
U20	-	3	6	-	-	-	9	4.75	5.25	4.25	1.00	5.00	5.25	4.50	5.50	5.25	5.50	3.50	4.75	5.50	5.50	5.50	4.25	6.50	5.25	4.83

U21	2	3	2	-	-	1	8	4.50	5.75	5.50	1.50	5.50	5.50	5.75	5.25	5.50	6.25	4.75	5.25	5.75	6.25	6.00	5.25	6.25	5.00	5.31
U22	-	2	2	1	-	-	5	3.75	5.50	3.25	2.50	4.25	4.25	4.25	3.25	3.25	4.75	4.00	3.75	4.50	4.50	5.00	4.25	4.75	4.25	4.11
U23	1	1	9	-	-	-	11	3.75	4.50	3.25	3.25	4.25	3.50	4.25	3.50	4.25	4.50	3.75	4.75	3.75	4.50	4.25	4.50	4.75	3.50	4.04
U24	-	2	5	-	-	-	7	5.25	5.75	3.00	2.50	4.75	3.50	3.75	4.50	4.75	5.75	4.75	5.50	5.25	6.25	5.50	5.25	5.25	5.25	4.81
U25	2	1	3	-	-	-	8	2.00	4.75	2.75	2.25	3.75	3.00	3.75	3.25	4.25	5.25	3.75	3.00	3.75	4.00	4.50	3.75	3.50	3.25	3.58
Tota l	2.68	1.28	3.56	.04	.04	.12	7.92	3.09	4.30	3.52	2.36	3.73	3.77	3.64	3.63	4.02	4.26	3.41	4.02	4.02	4.71	4.41	4.01	4.73	4.37	3.89

Table 2 shows that the number of learning outcomes in course information packages of universities for IT courses varied between 3 and 21 ($M=7.92$). It can be inferred that the number of learning outcomes was not evenly distributed according to universities. With regard to Bloom's revised domain taxonomy, findings indicated that learning outcomes were mainly at the application stage ($M=3.56$), while there were fewer learning outcomes in analyze ($M=.04$), evaluate ($M=.04$) and create ($M=.12$) steps. This finding also supports the results on the dimension of encouragement to high-level learning ($M=3.41$, $SD=.92$) as the qualitative measure and shows that learning outcomes of universities for high-level thinking skills related to IT courses were generally insufficient. The learning outcome "Evaluates the impact of Information Technologies on individuals" from a U5-coded university can be a reference finding that emphasizes high-level learning.

The average of overall qualitative suitability of learning outcomes of 25 universities according to all criteria was calculated as 3.89 ($M_{\min}=2.28$, $M_{\max}=5.31$, $SD=.85$). It is noteworthy that the lowest qualitative suitability averages with learning outcomes were 2.18, 2.24 and 2.82, and belonged to U15, U14, and U16 coded universities ($n=3$), respectively. It was determined that the measurement with the lowest mean of qualitative suitability for the cognitive domain was to support the affective characteristics of pre-service teachers ($M=2.36$, $M_{\min}=.50$, $M_{\max}=3.25$, $SD=.82$). This finding suggests that learning outcomes are cognitive domain-weighted, leading to weaker development of affective domain features.

In terms of measurement of suitability for formal writing, learning outcomes of IT courses of universities were quite inadequate ($M=3.09$, $M_{\min}=1.25$, $M_{\max}=5.50$, $SD=1.31$). Accordingly, this finding revealed that formal writing of learning outcomes was not appropriate in most universities. Following are some examples of learning outcomes that refer to this finding:

"To learn the concepts of copyright and cybercrime" (U4)

"To comprehend in detail the basic hardware and software components and functions in a computer system" (U4)

"Learn the basic hardware and software components of a computer." (U6)

"They are expected to design and evaluate ICT-supported teaching activities" (U14)

Dynamism and continuity ($M=4.01$, $SS=.75$) and association ($M=4.37$, $SD=.95$) measurements of learning outcomes were higher than average scores. The highest mean of qualitative suitability was about accessibility ($M=4.73$, $SD=1.14$). Curriculum development experts' opinions displayed that learning outcomes in IT curriculum were dependent on need ($M=3.52$, $SD=.91$), content ($M=3.63$, $SD=.96$), adjacency ($M=3.64$, $SD=1.05$), and clarity ($M=3.73$, $SD=1.08$) criteria, and this showed that qualitative suitability for generality-limitation ($M=3.77$, $SD=1.18$) criterion was not met

sufficiently. Learning outcomes did not meet the needs of age, the renewed faculties of education were not interlocked with program content and intelligibility was weak. Findings also showed that the mean of qualitative suitability of accessibility ($M=4.73$, $SD=1.14$), educational formability ($M=4.71$, $SD=1.18$), and flexibility ($M=4.41$, $SD=.93$) criteria were higher. Below are examples of learning outcomes of universities with the highest average scores according to qualitative suitability criteria:

"Prepares posters, banners, web pages, etc. using desktop publishing programs" (U23)

"It explains for himself and others what precautions he should take against the Internet." (U20)

"Uses word processing, spreadsheet, presentation, and database programs for their own purposes" (U21)

Findings on the opinions of the academics of the IT course curriculum

The first research question about the second purpose of the study was "What are the opinions of academics about the adequacy of the information technology course curriculum?". 7 participants stated that the time allocated to the information technologies course in the program was insufficient, and three participants stated that they found course hours sufficient. One academic who stated that hours of course were insufficient expressed this opinion as follows:

"I think HEI recommends that the topics in the content should be conveyed theoretically, considering a 3-hour duration sufficient. However, technology courses such as IT are practice-based courses, and this duration is definitely not enough for the specified content. For pre-service teachers to be able to practice, the duration of the course should be 4 hours at least, 2 hours theoretical and 2 hours practical" (P-8)

Concerning this research question, academics were asked to express their opinions about implementation methods of the course to identify how the IT course should be delivered. 6 (60%) of academics stated that courses should be given remotely (for the theoretical part) and face-to-face (for the practical part). The other 2 of them were in favor of face-to-face (for both theoretical and practical parts) and the rest 2 of them stated that it should be taught remotely (for both theoretical and practical parts). 9 of academics stated that the curriculum was partially sufficient and needed to be updated, while only one academic stated that it was sufficient. In addition, 9 academics reported that the IT course was necessary for professional development, while one academic reported that it was not.

Apart from its delivery method, academics emphasized that content on artificial intelligence ($n = 7$), Web 2.0 tools ($n = 6$), visual and video editing tools ($n=4$), robotics ($n=4$), MOOCs ($n=2$), cyber security ($n=2$), mobile learning ($n=1$), digital citizenship ($n=1$), and connectivity ($n = 1$) should be added to the IT curriculum. In reference to this finding, the opinion of trainers was as follows:

"Video editing and visual editing, utilities in daily life, pdf editing, cutting, scheduling time, note-taking, exam reading, Zoom, and Google Meeting programs can be taught... Cybersecurity, robotics, and coding should also be taught; Massive Open Online Courses like Udemy and Udacity should be introduced." (P-6)

The second research question was "What are problems experienced in the application process of an information technologies course program according to the opinions of academics?". In line with the data obtained, these problems were determined as "lack of equipment and infrastructure", "crowdedness of classrooms", "student-based problems", and "inadequacy of applied activities". Opinions referencing these findings were as follows:

"There are too many students in all departments in the faculty of education. I sometimes tell children that those who know this subject may not come that week... Because there is no cooler in the laboratory, it gets very hot and after a certain time the lessons faint... Physical conditions need to be improved. Class sizes need to be reduced..." (P-6)

The third research question about the second purpose of this study was "What are opinions of academics on reflections of Industry 4.0 on IT curriculum?" form. Opinions of academics in this direction are related to and consistent with the finding that they should be added to the content in their answers to the second question. Most academics emphasized that there should be acquisitions and content related to artificial intelligence, machine learning, the internet of things, robotics, and coding in the curriculum.

"This is a common deficit of education faculty programs ... For example, there is no elective course where new technologies are taught in detail and integrated with education. Artificial intelligence must be added, there can also be artificial intelligence-supported learning environments, robotic coding... Students should be enabled to experience technology in relation to their real lives..." (P-6)

The fourth and last relevant research question to evaluate the adequacy of curriculum was "What are the opinions of academics about the adaptation of IT course curriculum to the Bologna Process?" The majority of the academics expressed the opinion that standardization should be realized in curriculum.

"... Standardization is achieved by updating the program according to the results of stakeholder evaluations in certain periods. Common needs and assessments for this course for all faculties of education should be analyzed. Standardization efforts without the opinions of academics and students will not be productive." (P-3)

Results and Discussion

This study was conducted to evaluate the learning outcomes of the IT course in the curriculum of the faculties of education in line with the Bologna Process and expert opinions and to identify the adequacy of the curriculum by resorting to the opinions of the academics who were the practitioners of the course curriculum at 25 universities in Türkiye. After examining and collecting the IT course curriculums from the websites of the universities, the researchers sent these data to the curriculum development experts for the inspection of the qualitative suitability of the learning outcomes. The results revealed that the learning outcomes of the IT course were mainly at the knowledge and application levels according to Bloom's revised taxonomy and were insufficient for developing high-level thinking skills. In addition, the vast majority of learning outcomes were not at the desired level in terms of supporting the affective features of the pre-service teachers and formal writing standards. It is expected for learning outcomes to be clear, understandable, and observable as they are the desired characteristics that learners should gain for particular purposes.

Raible and Bastedo (2016) support this finding in their study stating that a learning outcome should be expressed in a clear and understandable way to ensure that it guides the learning process, and students understand and internalize it. In this regard, the quality element was poor in the examined curriculums with their poorly structured learning outcomes that did not meet systematic standards. It was observed that the learning outcomes were not sufficient in number to represent the content and scope of the course and did not have a balanced distribution. The guide prepared by the European Commission (2015) recommends that the learning outcomes for a course should be 10-12, but the findings of this study showed that the number of achievements in the IT curriculum in terms of both the high-level cognitive learning steps such as analysis, synthesis, and evaluation, and the affective domain steps were inadequate. This indicates that the learning outcomes in the curriculum were not evenly distributed and were not of proper quality. In addition to knowledge, affective characteristics such as belief and attitude are important elements for pre-service teachers to acquire technological skills (Taimalu & Luik, 2019). Therefore, it is important to cover affective features in learning outcomes. Since the attitude is also treated as a separate issue in the ISTE (2022) and TPACK standards, care should be taken to create gains, especially for the affective domain while organizing training programs in teacher training institutions. By increasing the affective skills in the technological achievements of the educational programs, the self-efficacy and thinking skills of the pre-service teachers can be strengthened. This is one of the effects of the affective field on the technological skills of pre-service teachers.

In the second stage of the study, the opinions of the academics who teach the IT course were taken and the curriculum was evaluated. In Türkiye, the IT course is given theoretically for 3 hours in teacher training programs. While the academics found the course hours insufficient, they pointed out that it would be an appropriate approach if

the theoretical part of the course was carried out through distance education and the practical part through face-to-face education. In the relevant literature, some studies have revealed that blended learning in higher education has positive effects (Parra-Gonzalez, et al. 2021) and increases students' confidence and motivation in the classroom (Awidi & Paytner, 2019). Similarly, Hendrik and Hamzah (2021) and Pattanaphanchai (2019) suggested that the use of the flipped learning method in programming lessons had a positive impact on student achievement.

As participants in the study, teacher trainers emphasized the addition of topics on novice technologies such as artificial intelligence, robotics, the internet of things, Web 2.0 tools, and video editing as content. With the development of technology, accredited studies are carried out in many countries to increase the adequacy of curriculums in the global sense. Program accreditation is vital for teachers to be ready for future technological applications and to improve their quality (Pedregosa, 2021). However, the crowdedness of the classes, the reluctance of the students, and the inadequate infrastructure and technological adaptation are other problems encountered in the implementation of the curriculum. Technology courses in teacher education programs have a responsibility to prepare students for changing society (Taimalu and Luik, 2019). With the deficiencies listed, it is a challenging process for pre-service teachers to get prepared for the classrooms of the future. However, the teacher trainers found the content of the IT course in the teacher training undergraduate programs updated in 2018 incomplete and reported that subjects such as artificial intelligence, the internet of things, and robotics should be added to the curriculum. From this point of view, it can be said that teacher curriculums should be constantly renewed, and infrastructure controls should be carried out frequently.

Most of the academics in the study stated that they had difficulty understanding the structure of the IT course in the context of the Bologna Process and in establishing the learning outcomes. In particular, they underlined the need to follow a more systematic approach in creating the learning outcomes of the course and to get support from the curriculum development units. In this respect, the necessity of standardization in learning outcomes for the Bologna Process draws attention. The curriculum aspect of the Bologna Process focuses on the transition to outcome-based and student-centered education curriculum (Dahl et al., 2009). This type of standardization will help higher education institutions achieve educational objectives in a short and direct way. In the study conducted by Groosman (2010), teacher educators expressed a positive opinion on national standardization. In this context, the study is consistent with the studies of Grossman (2010) and Altınkaynak (2016). On the other hand, the opinions of the academics who participated in the study noted that the qualitative inadequacy of the learning outcomes was due to the fact that the academics of the course did not have the necessary knowledge and skills in curriculum development and the course information packages were created in this direction. Standardization will enable accessibility to Industry 4.0 competencies through higher education and serve to the achievements of all universities. As a result, 21st-century thinking skills may better develop in students.

Studies arguing that the development of technology qualifications saves a positive effect on 21st-century thinking skills support this finding (Çiftçi et al., 2021; Smyrnova-Trybulska, 2021; Yang & McKenzie, 2018).

Recommendations

It is necessary to update the curriculum of Information Technologies courses in teacher training programs and to integrate current content such as artificial intelligence, the internet of things, and robotics in the context of Industry 4.0 into the curriculum. In particular, learning outcomes as one of the most critical elements of a program can be rearranged taking into account standards in this study. Courses in teacher education programs can be standardized in terms of learning outcomes as well as their content and made more systematic with practitioners' flexible learning approaches. In particular, hours of practice-oriented courses such as information technologies should be increased to provide equal opportunities to pre-service teachers and the infrastructure and capacity of laboratories should be strengthened to support students to benefit from these environments in the most effective way.

The current study has some limitations. Suggestions for these limitations are given below.

1. Teacher training curriculums should be updated frequently by evaluating the benefits of technology.
2. Personal training programs that increase technological competencies can be designed for both pre-service teachers and teachers.
3. For the curriculum to be prepared in the future, attention should be paid to writing affective gains as well as cognitive gains.

For researchers;

1. The number of experts and trainers participating was limited. In future research, more comprehensive findings can be reached by expanding the target group and supporting them with quantitative measurement tools.
2. The learning outcomes of only the IT course were examined in the scope of this study. In future studies, a broader framework can be offered by integrating it with other technology-oriented courses in teacher education.
3. This study focuses on learning outcomes. Other dimensions of curriculum can be examined more systematically by taking into account other curriculum evaluation models.

4. Compliance of learning outcomes with the Bologna Process and accreditation was evaluated solely based on the opinions of academics. A broader study can be carried out by taking the opinions of students, educators, and administrators at the same time.

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Genişletilmiş Türkçe Özet

Gelişen teknolojinin iş dünyasında nitelikli çalışan ihtiyacını artırması ile eğitim alanında hızlı bir dönüşüm ve gelişim sürecine başlamıştır. Öğrencilerden beklenen üstün bilgi işlemsel düşünme ve teknoloji yeteneğinin sağlanabilmesi için bu alanda etkin dijital yeterliliğe sahip öğretmenlere ihtiyaç duyulmasına sebebiyet vermiştir. Günümüzde özellikle öğrencinin merkeze alındığı eğitim yöntemlerinde teknoloji sınıf ortamına daha fazla entegre edilmeye çalışılmaktadır. Buda öğretmen eğitiminde teknoloji eğitiminin önemini arttıran en önemli faktörlerden biridir. Bu önemin farkında olan pek çok ülke üniversite eğitiminde dijital yeterliliklerin artırılması için bazı çalışmalar gerçekleştirilmiştir. Bunlardan biri de Avrupa Birliği (AB) ülkelerini kapsayan Bologna Sürecidir. Bologna Süreci; önce Avrupa'da bilgisayar ve internet altyapısı ile küreselleşmenin etkisi altında üniversite eğitiminin bir değişim ve yenilenme sürecidir. Bu yenilenme süreci temeli eğitim programlarında gerçekleşmektedir.

Eğitim programının en küçük yapı taşı olan kazanımlar ise bu sebeple dijital yeterliliklerle donatılırken aynı zamanda doğru ifade edilmiş bir şekilde aktarılacak üst biliş seviyesinde olmalıdır. Bu bağlamda durum çalışması olarak desenlenen bu araştırmanın iki amacı bulunmaktadır: Birincisi öğretmen eğitimin programlarında yer alan bilişim teknolojileri (BT) dersi öğrenme çıktılarının uygunluğunun program geliştirme uzmanlarının görüşlerine göre ortaya çıkartılmasıdır. İkincisi ise söz konusu öğretim programının yeterliliğine yönelik öğretim elemanlarının görüşlerine göre değerlendirilmesidir. Bu amaçlar doğrultusunda aşağıdaki sorulara yanıt aranmıştır:

1. Bloom'un Bilişsel Alan Taksonomisine göre BT öğretim programının öğrenme çıktılarının dağılımı nedir?
2. BT müfredatının öğrenme çıktılarının niteliksel önemi nedir?
3. Akademisyenlerin BT dersi öğretim programının yeterliliğine ilişkin görüşleri nelerdir?
4. Akademisyenlerin görüşlerine göre bilişim teknolojileri öğretim programlarının uygulama sürecinde yaşanan sorunlar nelerdir?
5. Endüstri 4.0'ın bilişim müfredatına yansımaları konusunda akademisyenlerin görüşleri nelerdir?
6. Bilişim Teknolojileri Öğretim Programının Bologna Süreci'ne uyarlanması konusunda akademisyenlerin görüşleri nelerdir?

Araştırmada tabakalı örnekleme yöntemi kullanılarak toplam yedi bölgeden Türkiye'deki 25 üniversitenin eğitim fakültesi programında yer alan BT dersi öğrenme çıktılarının niteliksel uygunluğu program geliştirme uzmanları (n =5) tarafından değerlendirilmiştir.

Standartlar oluşturulurken ilk etapta doküman incelemesi yöntemi gerçekleştirilmiştir. Böylelikle öğrenme çıktılarının sahip olması gereken kriterler belirlenmiştir. Bu kriterlere dair uzmanlar tarafından verilen frekanslar açıklanmıştır. Düzeyler belirlenirken yenilenmiş Bloom taksonomisi kullanılmıştır. Ayrıca programın değerlendirilmesinde BT dersini veren 10 akademisyenin de görüşü alınmıştır. Veriler “Öğrenme Çıktıları Niteliksel Uygunluk Formu” ve “BT Dersi Öğretim Programı Değerlendirme Formu” kullanılarak toplanmıştır.

Araştırma sonuçları BT dersine yönelik öğrenme çıktılarının çoğunun biçimsel uygunluk, gereksinimlerini karşılama durumu ve üst düzey düşünmeyi teşvik edicilik ölçütlerini karşılamadığını göstermiştir. Kazanımlarda yoğun olarak bilgi, beceri kapsamı yeterlikleri tespit edilmiş, iletişim ve sosyal yetkinliklerin bulunmadığı görülmüştür. Akademisyen görüşlerinden hareketle BT ders saatinin ve bu derste uygulanan etkinliklerin yetersiz olduğu görülmüştür. BT öğretim programına yapay zeka, Web 2.0/3.0 araçları, robotik, kodlama, artırılmış/sanal gerçeklik gibi konuların entegre edilmesi gerektiği görülmüştür. Akademisyenlerin çoğunluğu en son 2018 senesinde güncellenen Öğretmen Yetiştirme Kurumlarının Eğitim Programındaki Bilişim Teknolojileri dersinin yenilenmesi gerektiğini düşünmektedir. Ayrıca uzmanların çoğunluğu Bologna Süreci bağlamında kazanımlarda standartlaşmaya gidilmesi gerektiğini belirtmiştir. Bu tip bir standartlaşma ile eğitim amaçlarına kısa yoldan ulaşabilmeyi sağlama bileceği belirtilmiştir. Çalışma sonucunda öğretmen yetiştirme kurumlarındaki BT derslerinin eğitim programlarının güncellenmesi ve Endüstri 4.0 bağlamındaki içeriklerin programlara entegre edilmesi gerekmektedir ayrıca Yenilenmiş Bloom Taksonomisinin üst basamakları da gözetilerek bir standarta bağlanması ile hem öğretmen adayları hem de öğretmenler için teknolojik yeterlilikleri artıran kişisel eğitim programları tasarlanması önerilmektedir.

Data Availability

The datasets generated during the current study are available from the corresponding author on reasonable request.

Researchers' Contribution Rate

All authors have participated sufficiently in the work to take public responsibility for the content, research design, analysis, methodology, data collection, resources, discussion, conclusion, writing - review & editing.

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