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Defining competencies in curriculum and instruction and developing a new competency model

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This research aims to define competencies and propose a new competency model based on expert opinions. Using the Delphi technique, a qualitative research approach was employed. Data were collected through three rounds of Delphi surveys from 29 experts at universities with doctoral programmes in the field of Curriculum and Instruction (CI), who hold doctoral degrees in this area. In the first round, open-ended questions enabled experts to identify key competencies for CI. The subsequent rounds refined these competencies into a 7-point Likert scale questionnaire. Content and descriptive analysis were applied to the first round, while measures of central tendency and dispersion analysed the second and third rounds. The study culminated in a model encompassing 22 competencies: 5 in knowledge, 10 in skills, and 7 in attitudes and values. The knowledge domain includes sub-competencies such as possessing and deepening knowledge. The skills domain covers areas like teamwork and leadership, knowledge dissemination, independent working, problem-solving, and critical thinking, along with innovative and analytical thinking. The attitudes and values domain comprises professional sensitivity, lifelong learning, and commitment to ethical principles and values. This competency model aligns with the European Qualifications Framework (EQF) and the National Qualifications Framework for Higher Education in Türkiye (NQF-HETR), offering a robust framework for CI doctoral programmes. This model not only enhances the quality of CI education but also ensures alignment with international standards.

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Introduction

Providing high-quality education is paramount for establishing a robust social, economic, and political framework in any society. Achieving this objective necessitates strict adherence to established educational standards. Recent years have witnessed a significant emphasis on enhancing educational quality, with standards serving as a cornerstone in defining the path to these goals and the required competency levels (Ceulemans et al. 2014; Huntly, 2008; Richardson, 1994; Sundberg and Wahlström, 2012). These standards are not merely guidelines but crucial benchmarks that ensure students graduate with the competencies needed to succeed in an increasingly complex world. By meeting these benchmarks, educational systems can produce tangible outcomes that reflect the efficacy of the educational process.

Competency frameworks are typically classified as national, regional, or international. National Qualifications Frameworks (NQFs) are particularly noteworthy, as they are designed to reflect the specific educational needs and objectives of individual countries. NQFs provide a structured approach to defining and linking competencies and learning outcomes across different educational levels. They serve as a guide for educational processes, ensuring consistency in competency development and learning outcomes throughout a learner's educational journey (Huntly, 2008; Telling and Serapioni, 2019). The extent to which these competencies are achieved is measured through learning outcomes, assessed using objective methods during and at the end of each educational module or course (The Council of Higher Education [CoHE], 2009).

NQFs facilitate a clear understanding of learning outcomes across different educational levels, enabling a holistic view of the competencies required at each stage. They support progress and transition between these levels, providing a coherent system for organising and developing competencies. Furthermore, NQFs are dynamic, allowing for the evolution of competencies in response to changing societal and professional demands by supporting the development of new competencies (National Qualifications Framework for Higher Education in Türkiye [NQF-HETR], 2010).

In Türkiye, the Turkish Qualifications Framework (TQF) defines competencies across various educational levels. Established in 2016, the TQF classifies curricula into eight levels, spanning from primary education to higher education. It encompasses competencies gained through both formal education and other learning paths. These competencies are organised into knowledge, skills, and competence, each defined according to their functions, achievements, and credits at a given educational level. This comprehensive structure ensures that competencies are not limited to a single learning area but are instead applicable across a broad spectrum of educational and professional contexts (TQF, n.d.).

The definition and comparison of competencies in higher education are influenced by the objectives of the European Union's (EU) Lisbon Strategy and the Bologna Process (Brine, 2008). The Bologna Process has prompted member states to develop national competency frameworks aimed at enhancing transparency, recognition, and mobility within their higher education systems (CoHE, 2010). Consequently, higher education institutions now actively engage in competency studies for their associate, bachelor's, master's, and doctoral programmes. These defined competencies are publicly available through University Bologna information packages in Türkiye, contributing to a shared understanding of the expected outcomes and standards across the higher education landscape.

Professionals in the field of Curriculum and Instruction (CI) play a crucial role in defining competencies. Their expertise is vital in articulating precise competency definitions, especially in higher education programmes. Recognising their pivotal role in shaping educational standards and outcomes, this research seeks to identify competencies from the perspective of experts in CI.

A review of the literature reveals that previous studies on competencies have primarily focused on several key areas. One significant area of focus is the Bologna Process and Course Information Packages. Research in this domain examines how competencies are integrated into the course and programme descriptions within the Bologna framework. Studies by Çınkır and Yıldız (2018) and Fer et al. (2019) highlight the systematic approach to embedding competencies into higher education curricula, which is crucial for maintaining consistent educational standards across European higher education institutions.

Another important area of research is teacher competencies. Numerous studies have explored the competencies required for effective teaching, reflecting a broad consensus on the skills and knowledge necessary for educators. For instance, Biçer (2021), Gerosa et al. (2024), Huntly (2008), Nouri et al. (2021), Sever and Bostancı (2020), and van Werven et al. (2021) have all contributed to our understanding of the critical competencies needed for the professional development of teachers. These studies emphasise the importance of equipping educators with the necessary skills to foster student learning and development effectively.

Research has also addressed competencies in various fields, highlighting the diverse requirements across different professional and academic domains. Aleksić et al. (2022), Geagea and MacCallum (2020), Homberg et al. (2020), Hvidberg et al. (2021), Kahramanoğlu and Al (2019), and Yakar and Karakuş (2020) have underscored the unique competencies needed in specific disciplines, emphasising the tailored approach necessary for different fields. This body of research illustrates the importance of understanding the specific demands of various professions to develop relevant and effective competency frameworks.

Furthermore, studies have investigated how competencies vary across educational levels, providing insights into the specific needs and expectations at each stage of higher education. Cline (2008), Lunde et al. (2023), Şahin et al. (2018), and Üstün et al. (2016) have all contributed to this area by offering detailed analyses of the evolving competency requirements as students' progress through different levels of education. These studies highlight the importance of aligning competency development with the educational journey of students to ensure they are adequately prepared for each subsequent stage.

Finally, research focusing on master's degree competencies in CI has been extensive, often involving needs analysis and the evaluation of existing graduate programmes. Studies by Atik Kara et al. (2020) and Ökmen et al. (2019) have aimed to identify the competencies necessary for master's programmes, contributing significantly to the development of advanced educational standards. This research is crucial for ensuring that graduate programmes in CI are designed to meet the specific needs of students and the demands of the field.

While these studies have significantly contributed to our understanding of competencies in the context of the Bologna Process, teacher education, and specific subject areas, there is a notable gap in research focusing on defining competencies within the field of CI at the doctoral degree level. By gathering insights from expert opinions, this study seeks to provide a comprehensive framework for understanding and developing competencies in this field. Key questions guiding this research include:

- According to expert opinions, what competencies should be acquired in CIDP?
- According to expert opinions, how should a competency model for CIDP be?

Method

Research model. The research employed the Delphi technique to establish competencies for CIDP and proposed a new competency model based on expert opinions. According to various scholars (Bordoloi et al. 2023; Brady, 2015; Fletcher and Marchildon, 2014; Garrod and Fyall, 2005; Reid, 2020; Wiersma and Jurs, 2005), the Delphi technique is often classified as a qualitative research method due to the subjective nature of data derived from expert opinions and the way this data is reported. Likert questionnaires with competencies were developed and utilised in subsequent rounds. In each round, the experts provided their feedback on the competencies, which were then refined based on their responses.

Data sources and study group. For participant selection in the Delphi technique, the purposive sampling method was preferred (Hasson et al. 2000; Lang, 1995). Experts were purposefully chosen using criterion sampling to determine CIDP competencies. The selection criteria for this study were designed to ensure the inclusion of experts with substantial and relevant experience in the field of CI. Graduating from a CIDP was fundamental, as it ensured that participants had attained an advanced level of academic knowledge and expertise specific to CI. These individuals possess a deep understanding of curriculum design, instructional strategies, and educational assessment, enabling them to provide informed insights into the competencies required for doctoral programmes in CI. Their firsthand experience with the doctoral process provides valuable perspectives on the challenges and requirements at this advanced level of education.

Working in the field of CI at a university with a CIDP ensured that participants were actively engaged in current educational practices, research, and policy development, offering practical perspectives that bridge the gap between theory and application. These professionals not only understand the theoretical underpinnings of CI but also have practical insights into how doctoral programs should be structured and delivered. Additionally, the willingness to participate in the research was crucial for collecting high-quality data. This criterion ensured that participants were genuinely interested and motivated to provide thoughtful and candid responses, respecting the ethical principles of voluntary participation and informed consent. Collectively, these criteria enhanced the reliability and validity of the research findings, making these experts the most qualified to determine the competencies required at the doctoral degree in CI (as illustrated in Fig. 1).

Initially, the websites of universities in Türkiye offering Ph.D. programmes in CI were reviewed to gather academic CVs and contact information. By screening CVs against the inclusion criteria, an expert pool of 268 academicians was identified. An email invitation outlining the research aim and methodology was sent to these experts. Thirty-four experts agreed to participate in the study. However, five of them did not respond to the Delphi questionnaires sent to them. Therefore, the research commenced with the participation of 29 experts. Due to the withdrawal of one expert, the second and third rounds were conducted with 28 experts. Additionally, the Delphi questionnaires, which lasted three rounds, were completed with the same group of experts. Table 1 provides the demographic details of the experts involved in the Delphi rounds.

According to Table 1, 29 experts participated in the Delphi rounds. Seventeen (58.6%) were female, and 12 (41.4%) were male. The most common academic degrees among the participants were Associate Professor (44.8%) and Assistant Professor (37.9%). The age group with the most participants was 35–39 years (34.5%), followed by 45–49 years (24.1%). The least represented age group was 40–44 years (3.4%). Most participants had between 6–11 years of experience (31%), and a significant number had 24 or more years of experience (24.1%). Regarding experience in CI, the majority had 6–11 years (44.8%), with only a few having 0–5 years (6.9%). Finally, 16 experts (55.2%) had experience in defining competence.

Data collection process and tools. Considering the experts' competency status, professional experience, and academic titles, consulting their opinions independently of time and place was deemed more functional and rational. Therefore, the e-Delphi technique was employed, which shares similar characteristics with the classical Delphi method but allows data collection via email and online questionnaires (Sheridan, 2005; Topper, 2006) Google Forms and JotForm were used to gather data throughout the research. Table 2 summarises the data collection process for each Delphi round.

The first round of the Delphi questionnaire was designed to assess CIDP competencies and consisted of six questions, including two main questions and four probes. The primary questions aimed to gather comprehensive insights from experts in the field. The first question asked, 'What competencies do you think a student who graduated with a doctoral degree in CI should have?' Experts were encouraged to list as many competencies as they deemed relevant. They were also prompted to provide detailed competencies related to knowledge, skills, competence, attitudes, and values through additional probe questions.

The second question inquired, 'In which competency domains do you think competencies can be expressed differently from the NQF-HETR?' Experts were invited to suggest domains that might

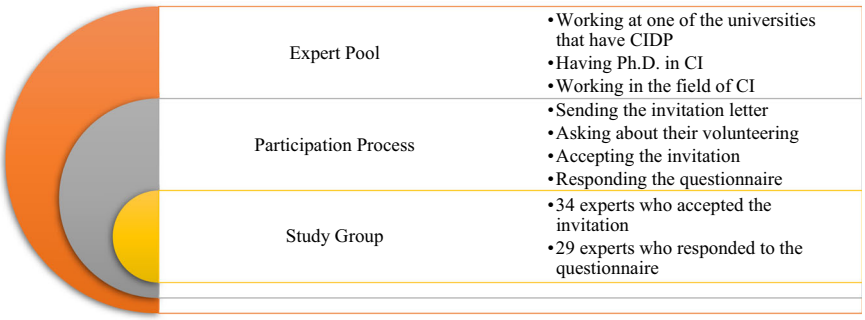

Fig. 1 The formation of the expert group.

differ from those defined in the European Qualifications Framework [EQF], (2017), the NQF-HETR (2011), and General Competencies for Teaching Profession [GCTP], (2017). The responses collected from the first round were then utilised to develop 7-point Likert-type questions. These refined questionnaires were subsequently used to gather data in the second and third rounds of the Delphi process.

Data analysis

Delphi 1st round data analysis process. This research focused on developing a conceptual framework for competencies using the Delphi technique. The Delphi technique, which begins with open-ended questions, aims to establish an inductive framework through content analysis (Powell, 2003). In the first round, experts responded to six open-ended questions. These responses underwent a two-stage analysis process involving four steps, incorporating both content analysis and descriptive analysis techniques. The first three steps utilised content analysis, while the final step was conducted through descriptive analysis. The MAXQDA 2020 qualitative data analysis programme was employed to ensure a systematic process.

Table 1 Demographic characteristics of the experts participating in the Delphi rounds.

Experts' Features		*n*	%
Gender	Female	17	58.6
	Male	12	41.4
Academic Degree	Prof. Dr.	4	13.8
	Assoc. Prof. Dr.	13	44.8
	Assist. Prof. Dr.	11	37.9
	Res. Assist. Dr.	1	3.4
Age	30-34	5	17.2
	35-39	10	34.5
	40-44	1	3.4
	45-49	7	24.1
	50 and above	6	20.7
Experience (Years)	0-5	2	6.9
	6-11	9	31
	12-17	6	20.7
	18-23	5	17.2
	24 and above	7	24.1
Experience in the Field of CI (Years)	0-5	2	6.9
	6-11	13	44.8
	12-17	4	13.8
	18-23	7	24.1
	24 and above	3	10.3
Experience in Defining Competence	Yes	16	55.2
	No	13	44.8
Total	-	29	100

In the first stage, a descriptive analysis was conducted to categorise the competencies identified by the experts. This form of analysis organises data into themes consistent with the research questions or a pre-determined conceptual framework (Patton, 2015). During the descriptive analysis process, competencies were classified into the domains of knowledge, skills, competence, attitudes, and values, as specified in the EQF, NQF-HETR, and GCTP.

In the second stage, content analysis was carried out to reveal meaningful patterns within the identified competencies. This analysis examined the data in depth to identify original concepts, categories, and themes (Patton, 2015). The experts' responses were analysed and separated into sub-codes that accurately reflected the semantic meaning of the words used. These sub-codes were grouped into broader codes (competencies) based on semantic similarity. Subsequently, these codes were categorised into sub-themes (sub-competencies).

Delphi 2nd and 3rd rounds data analysis. In the 2nd and 3rd rounds of Delphi data analysis, Likert-type questions were used to construct the survey questionnaires. These questionnaires were designed to refine competencies by including a text field for feedback on each competency in both rounds. Additionally, the third-round incorporated feedback from experts, encompassing their stated levels of agreement for competencies from the previous round and the statistical information derived from the second round.

To analyse the data from the Delphi questionnaires, measures of central tendency (mode, median, and mean), dispersion (interquartile range [IQR]), and standard deviation were employed to assess the judgements and general tendencies of the expert group (Glenn and Gordon, 2009; Hasson et al. 2000; Rowe et al. 1991). Furthermore, the percentage of agreement among experts on each competency was computed. Given that the Likert-type questions resulted in ordinal data, using measures of central tendency and dispersion was appropriate for analysis (Fish and Busby, 2005). Employing median value and IQR calculations helped mitigate the impact of outliers, which could otherwise skew the results (Giannarou and Zervas, 2014; von der Gracht, 2012; Mullen, 2003).

After selecting the consensus criterion, a consensus level was determined based on the characteristics of the participant group, the research topic, the purpose, and the results (von der Gracht, 2012; Hasson et al. 2000; Powell, 2003). Given that the research focused on identifying the competencies for CIDP, the number of competencies defined by the experts played a significant role in determining the criterion and level of consensus.

A high level of consensus on the determined criteria and competencies was desired. Accordingly, the median value was set to six, and the IQR was set to one. An IQR equal to or less than one indicates a high level of agreement on competencies (Rayens

Table 2 The data collection process for the Delphi rounds.

	1st Round	2nd Round	3rd Round
Number of Invitations	34	29	29
Number of Respondents	29	28	28
Response Rate	85%	97%	97%
Data Collection Instrument and Platform	1st Round Delphi Questionnaire-Google Forms	2nd Round Delphi Questionnaire-JotForm	3rd Round Delphi Questionnaire-JotForm
Number of Items	6	59	47
Collected Data	Competencies for CIDP	Consensus level for each competency (7-point Likert)	Final consensus level for each competency (7-point Likert)
Completion Time (Days)	27	12	25

Table 3 Statistical analysis and consensus criteria of the Delphi rounds.

Round	1st Round	2nd Round	3rd Round
Analysis Type	Descriptive and Content Analysis	Measures of Central Tendency (Mode, Median, Mean), Dispersion (IQR)	Measures of Central Tendency (Mode, Median, Mean), Dispersion (IQR)
Key Statistics	Categorisation of Competencies	Mean Scores, Standard Deviations	Final Consensus Levels
Consensus Criteria and Levels	-	If median ≥6 and IQR ≤1 and 6–7 frequency ≥80%	If median ≥6 and IQR ≤1 and 6–7 frequency ≥90%
Tools Used	MAXQDA 2020	Descriptive Statistics	Descriptive Statistics

and Hahn, 2000). The consensus level is commonly regarded as 80% (Hohmann et al. 2020; Stewart et al. 2017). A total of '6' and '7' responses on the experts' 7-point Likert-type questionnaires were required for at least 80% of the competencies in the second round, and at least 90% of the responses in the third round were accepted as the level of consensus. Table 3 presents a detailed overview of the criteria and consensus levels used in each round of the Delphi process.

Credibility and transferability of the research. Ensuring the credibility and transferability of the Delphi study was paramount, and several rigorous steps were taken to address these aspects comprehensively. Prior to initiating the research, a thorough literature review was conducted, providing a solid foundation for the study and grounding it in existing knowledge. This review ensured that the methodological processes were clearly explained and justified.

The selection of experts was based on well-defined criteria to ensure that participants possessed substantial knowledge and experience in the field of Curriculum and Instruction (CI). According to the literature, Delphi studies should involve more than ten participants to ensure content validity (Rayens and Hahn, 2000). In this research, twenty-nine experts participated in the first round, with twenty-eight continuing in subsequent rounds. This deliberate and methodical selection process enhanced the credibility of the findings by ensuring that the input was both informed and relevant.

Before the main Delphi surveys, pilot studies were conducted with experts who met the research participation criteria. This pilot study, involving five experts, aimed to assess the Delphi process, ensuring clarity and relevance of the questions and the overall feasibility of the data collection procedures. Feedback from the pilot study led to minor adjustments in the questionnaires and data collection methods, refining the process and addressing potential issues early in the research. This step significantly enhanced the study's reliability and credibility.

The iterative rounds of the Delphi method, with feedback provided to experts in subsequent rounds, played a crucial role in enhancing the trustworthiness of the findings. This process allowed participants to reconsider their positions based on group feedback, facilitating a deeper consensus and a more robust set of findings. To ensure a comprehensive and unbiased analysis, researcher triangulation was employed. Analyses and interpretations were conducted separately and simultaneously by the researchers, with final decisions made collaboratively. This approach incorporated multiple perspectives, enhancing the study's reliability and credibility.

Robust qualitative measures, including thematic analysis and triangulation, were employed to ensure that the consensus was based on a credible analysis of expert opinions. Descriptive and content analysis techniques were performed using MAXQDA, ensuring the confirmability of the analyses. The research process for generating themes, subthemes, and codes was meticulously documented and supported by expert feedback. Thematic analysis helped identify common themes and patterns, while triangulation ensured the reliability of the findings by cross-verifying data from multiple sources.

Throughout the study, transparency was maintained by documenting all steps of the research process and providing detailed descriptions of the data collection and analysis procedures. Reflexivity was practiced by acknowledging the researchers' potential biases and their influence on the research process, further enhancing the study's credibility. To further ensure credibility, member checking was conducted where the findings were shared with the experts for their feedback and validation. This step helped verify the accuracy of the interpretations and ensured that the findings accurately reflected the experts' views. By implementing these rigorous steps, the study ensured its credibility and transferability, providing a robust and reliable framework for understanding and developing competencies in the field of CI.

Limitations of the research. While the Delphi technique offers several advantages, it also has limitations. One potential issue is the risk of groupthink, where experts align their opinions with the perceived consensus. To minimise this, the study ensured anonymity and allowed independent revision of opinions. Expert selection can also introduce bias, as chosen experts might share similar viewpoints. Despite rigorous criteria, this can limit the diversity of perspectives. The reliance on expert judgement makes the findings inherently subjective, though the structured Delphi process helps mitigate this. The iterative nature of Delphi can be time-consuming and lead to participant fatigue, affecting engagement in later rounds. Additionally, the initial open-ended questions generate large volumes of qualitative data, which can be challenging to analyse and synthesise objectively. Finally, the online format of the e-Delphi method, while useful for reaching dispersed experts, may limit participation from those less familiar with online tools. Despite these challenges, the Delphi technique remains valuable for achieving consensus on complex issues, and the study's measures effectively address these limitations.

Results

Findings and interpretations of the Delphi 1st round. Data analysis of the experts' responses in the first Delphi round generated new codes and subthemes for CIDP competencies, organised into predetermined themes. Table 4 provides a sample of this procedure.

Table 4 shows the experts' views: 'Has knowledge of development measurement instruments.', 'Has knowledge about data collection methods in the research process.', 'Has expertise in converting knowledge and experience into published formats (paper, article, book chapter, etc.).', 'Knows the principles of reporting scientific research.', 'Has knowledge of ethical principles.' and 'Has knowledge about project preparation stages.' These subcodes form this competency: *'Has knowledge of scientific research, methods and principles of writing reports.'*

Table 4 Example of generating new codes and subthemes in the 1st Delphi round.

Theme (Competency Domain)	Subtheme (Subcompetency Domain)	Code (Competency)	Subcode	Number
KNOWLEDGE	CONSOLIDATION of KNOWLEDGE	Has knowledge of scientific research, methods, and principles of report writing.	*1. Has knowledge of development measurement instruments.*	6
			2. Has knowledge of data collection methods in the research process.	3
			3. Has knowledge about transforming knowledge and experience into publication formats (papers, articles, book chapters, etc.).	3
			4. Knows the principles of reporting scientific research.	2
			5. Has knowledge of ethical principles.	2
			6. Has knowledge of project preparation stages.	1
			Total	17

Table 5 The number of consensus competencies and the consensus rates in the 2nd round.

Competency Domains	Total Number of Competencies	Number of Consensus Competencies	Consensus Rate
Knowledge	18	12	67%
Skill	15	11	73%
Competence	10	8	80%
Attitudes and Values	15	15	100%
Total	58	46	79%

According to the experts, students should be familiar with data collection tools and possess the knowledge to convert data into publications in line with scientific-ethical principles. Additionally, experts expect students to be knowledgeable about project preparation stages as a competency. This competency, which refers to students' knowledge of conducting scientific research and publishing their findings, was appropriately included in the subtheme 'possessing knowledge' under the theme 'knowledge'.

Through this procedure, 767 expert opinions were coded. These were classified into 148 distinct codes based on semantic similarity and coherence. After re-evaluation by two experts, they were consolidated into 58 competencies: 18 in the knowledge domain, 15 in skills, 10 in competence, and 15 in attitudes and values.

The competencies were further refined into the following subcompetency domains: *knowledge:* possessing knowledge, deepening knowledge, *skills:* teamwork and leadership, sharing knowledge, innovative thinking, working independently, problem-solving, and critical thinking, *competence:* analytical thinking, communication and negotiation, interpreting practices, collaboration, and *attitudes and values:* professional sensitivity and professionalism, commitment to ethical principles and values, lifelong learning.

Findings and interpretations of the Delphi 2nd round. The Delphi 2nd round questionnaire included the competencies identified from the 1st round analysis, focusing on determining CIDP competencies. Experts were asked to indicate their level of agreement across four competency domains: knowledge, skills, competence, and attitudes and values. Table 5 summarises the consensus findings from the 2nd round.

As shown in Table 5, consensus was achieved for 46 out of the 58 competencies, while 12 did not reach consensus (see Appendix 1). Competencies lacking consensus were excluded from further analysis. The consensus rate in the 2nd Delphi round exceeded 60% across all domains, indicating substantial agreement among experts for the majority of competencies.

Findings and interpretations of the Delphi 3rd round. The Delphi 3rd round questionnaire, derived from the 2nd round analysis, asked experts to reassess their agreement on 46 competencies across four domains: knowledge, skills, competence, and attitudes and values. Table 6 summarises the findings from the 3rd round.

Table 6 shows that consensus was achieved on 31 out of 46 competencies, with 15 not reaching consensus (see Appendix 2). Competencies without consensus were excluded from the final model. The consensus rate exceeded 50% in all domains, reflecting substantial agreement among experts for most competencies in the 3rd Delphi round.

Upon reviewing the 2nd and 3rd round questionnaire analyses (Appendixes 1 and 2), the average values of competencies increased by 0.64 at the lowest and 0.07 at the highest. The IQRs for 10 competencies decreased (ranging from 1 to 0.25), remained unchanged for 32, and increased for 5 competencies (ranging from 1 to 0.75). The overall percentage of responses rating competencies as 6 or 7 increased by 25 points for six competencies, remained the same for five, and decreased for five.

Table 6 The number of consensus competencies and the consensus rates in the 3rd round.

Competency Domains	Total Number of Competencies	Number of Consensus Competencies	Consensus Rate
Knowledge	12	6	50%
Skill	11	8	72.72%
Competence	8	3	37.5%
Attitudes and Values	15	14	93.33%
Total	46	31	67%

Table 7 The number of consensuses on competencies in Delphi rounds.

Competency Domains	1st Round	2nd Round	3rd Round
Knowledge	18	12	6
Skill	15	11	8
Competence	10	8	3
Attitudes and Values	15	15	14
Total	58	46	31

The Delphi process was conducted over three rounds. Table 7 illustrates the consensus trends across these rounds.

The table demonstrates a significant reduction in the number of competencies classified under 'knowledge' from the first to the third round. Similarly, competencies in the 'skill' and 'competence' domains decreased in subsequent rounds. The 'attitudes and values' domain showed stability between the first and second rounds but slightly declined in the third round, indicating a refining consensus process.

During the 2nd and 3rd rounds, several competencies were refined based on expert feedback. In the 'knowledge' domain, eight competencies were revised, four in the 'skill' domain, two in 'competence', and two in 'attitudes and values'. Notably, competencies in the 'attitudes and values' domain remained consistent, indicating a strong initial consensus. No changes were required in the third round, reflecting a solidifying agreement.

Findings and interpretations of the CIDP competencies model. The Delphi third-round questionnaire was completed by 28 experts. Their responses to the competencies were analysed based on the predefined criteria and consensus levels for this round. This analysis identified a total of 31 competencies: 6 in the knowledge domain, 8 in skills, 3 in competence, and 14 in attitudes and values. Subsequent evaluations by the researchers led to refinements in these competencies.

Upon evaluation, it was found that one of the three competencies in the domain of competence, *'Be capable of expressing their own opinions in scientific discussions about curriculum and instruction by synthesizing them with references from the literature.'* was similar to *'Transform scientific studies into publications related to their field used by interested people and scientists.'* in the domain of skills. Therefore, the word 'present' was added to the competency in the skills domain and removed from the competence domain.

Similarly, it was considered that including the expressions *'Discuss with their colleagues the basic/current issues and problems related to curriculum and instruction and offer original solutions to the problems.'* and *'Analyse possible problems encountered during the implementation of learning-teaching models, strategies, methods, and techniques and develop effective solutions.'* in the domain of competence would be more acceptable in the domain of skills and were thus transferred to this domain. Consequently, the competence domain was removed from the model since there were no competencies left in this category.

In the domain of attitudes and values, the expression *'Have the social skills (effective communication, leadership, entrepreneurship, reconciliation, solidarity, etc.) required in the practice and research process.'* was thought to be more suitable for the domain of skills. It was rephrased as *'Use social skills such as effective communication, leadership, entrepreneurship, reconciliation, solidarity, etc., in the practice and research processes.'* and transferred to this domain. Following a re-evaluation, 31 competencies were refined and 9 were removed. Thus, a total of 22 competencies were obtained: 5 in knowledge, 10 in skills, and 7 in attitudes and values. Table 8 presents the suggested model and the competencies.

Discussion, conclusion and suggestions

The findings indicate a refinement and narrowing of competencies through the Delphi rounds. Initially, experts identified a broad range of competencies, especially in 'knowledge' and 'skills'. As discussions advanced, the number of agreed-upon competencies decreased, focusing on the most critical ones. The stability in the 'attitudes and values' domain across the rounds highlights a strong foundational agreement among the experts from the outset. This stability suggests that competencies in this area were clearly defined and broadly accepted from the beginning of the Delphi process. Conversely, the significant decrease in the 'knowledge' competencies indicates these were subject to more extensive scrutiny and refinement, aligning more closely with the practical and conceptual framework agreed upon in later rounds.

The minimal changes observed in the third round underscore the convergence of expert opinions, leading to a consensus that reflects a shared understanding of the competencies' meanings and implications. This convergence is crucial for ensuring the defined competencies are robust, relevant, and reflective of the collective expertise and insights of the Delphi participants. Overall, the Delphi process effectively facilitated a collaborative and iterative refinement of competencies, resulting in a well-defined and agreed-upon set of competencies crucial for the field. This process demonstrated the importance of iterative feedback and the value of expert consensus in shaping comprehensive and applicable competency frameworks.

This study delves into the competencies essential for CIDP, highlighting the dynamic interplay between knowledge, skills, and attitudes and values. These competencies are crucial not only for academic success but also for professional development in the rapidly evolving world of education. The findings align closely with institutional frameworks such as the EQF (2017), NQF-HETR (2011), GCTP (2017), and the study of Lunde et al. (2023), each underscoring the need for a multidimensional approach to competency development.

The competency model proposed in this research represents a balanced approach across the domains of knowledge, skills, and attitudes and values, specifically tailored for CIDP. Unlike traditional frameworks, this model offers a more holistic and integrative perspective, ensuring that graduates are not only deeply knowledgeable in their academic fields but also equipped with

Table 8 CIDP competencies model.

Competency Domains	Subcompetency Domains	Competencies
Knowledge	Possessing Knowledge	Has the knowledge of the methods and principles needed in the process of designing, implementing, and reporting scientific research. Has knowledge of the steps of the process related to gaining knowledge, skills, and value in the education-teaching process.
	Deepening Knowledge	Analyses the fundamental steps and procedures of the curriculum development process. Analyses current national/international developments, new approaches, and trends that may directly or indirectly affect the field of curriculum and instruction. Discusses the dynamic and multidirectional relationship between curriculum development and the teaching process.
Skill	Teamwork and Leadership	Uses curriculum development steps, processes, and principles by its role in the curriculum development studies that it leads or takes part in. Uses social skills such as effective communication, leadership, entrepreneurship, reconciliation, solidarity, etc., in the practice and research processes.
	Sharing and Dissemination Knowledge	Contributes to the knowledge and practices in this field by evaluating national/international scientific studies and innovations related to curriculum development and teaching processes. Presents and transforms scientific studies into publications related to their field used by interested people and scientists.
	Working Independently and Autonomously	Concludes the research process by scientific research steps and methods defining an original research problem independently in the field of curriculum and instruction. Evaluates the effectiveness and functionality of curricula critically and analytically by using curriculum evaluation models.
	Problem Solving and Critical Thinking	Analyses the possible problems encountered during the implementation of models, strategies, methods, and techniques in the field of learning-teaching and develops effective suggestions. Uses the knowledge and skills in the field of curriculum and instruction to solve complex problems.
	Innovative and Analytical Thinking	Discusses the basic/current issues and problems related to the field of curriculum and instruction with colleagues and proposes original solutions to the problems. Designs and develops learning-teaching models/methods for use in the implementation of education-teaching processes in different conditions.
Attitudes and Values	Professional Sensitivity and Professionalism	Has a high sensitivity to glorify the value of a profession and makes the qualifications needed for this profession a way of life. Has the necessary personal characteristics (curiosity, self-discipline, self-criticism, self-esteem, flexibility, determination, open-mindedness, independent thinking, etc.) to perform the practices and studies in the field effectively. Assumes active responsibility for studies that will help solve and develop problems/issues in the field.
	Lifelong Learning	Has the sensitivity to follow developments in education, teaching, and research. Has a strong motivation for research, learning, and self-development.
	Commitment to Ethical Principles and Values	Prioritizes social needs, scientific values, and ethical principles in the practices and research related to the field. Has the basic human values (justice, diligence, truthfulness, honesty, tolerance, self-confidence, respect, responsibility, etc.) required to be a scientist.

critical thinking, problem-solving, and ethical decision-making skills (Aleksić et al. 2022; Huntly, 2008; Telling and Serapioni, 2019).

In the domain of knowledge, CIDP graduates are expected to possess and deepen their understanding of their field comprehensively. This encompasses both theoretical and practical knowledge, mirroring the emphasis on advanced knowledge and research capabilities highlighted by NQF-HETR (2011). Additionally, the competency of acquiring and deepening knowledge reflects the necessity for doctoral graduates to continually expand their knowledge and contribute to their fields through original research. This aligns with the Organization for Economic Co-operation and Development (OECD)'s focus on lifelong learning and knowledge development (OECD, 2018).

In terms of skills, the model emphasises the effective application of knowledge, including curriculum development, communication skills, conducting scientific research, and producing innovative solutions. These competencies are similar to those highlighted in the global competencies lists by the Council of Ministers of Education Canada (CMEC), (2016) and the Partnership for 21st Century Learning (P21, 2019). Effective communication and collaboration skills are increasingly recognised as vital for success in academia and beyond. Given that doctoral students are seen as pioneers in innovation and research and development, these skills are crucial for their professional growth and contributions to their fields (Alves et al. 2023; Maviş Sevim and Emmioğlu Sarıkaya, 2020).

The inclusion of attitudes and values in the model underscores their essential role in guiding the application of knowledge and skills. Professional sensitivity, adherence to ethical principles, and a commitment to lifelong learning are crucial for ongoing development and maintaining ethical standards. These competencies ensure that graduates are not only proficient but also capable of applying their skills responsibly. This aligns with the OECD's emphasis on integrating knowledge, skills, and values, advocating for these competencies to be deeply embedded within the educational process (OECD, 2018; Şahin et al. 2018; Yüksel, 2004). For this integration to be effective, a supportive

educational environment is necessary. Such an environment implies that academics should serve as role models in demonstrating competencies related to 'attitudes and values'. Özbek and Yeşil (2009) also highlight the importance of this approach. Academics should guide doctoral students not only in their studies but also in their conduct throughout the educational process. Fostering an environment conducive to acquiring competencies related to 'attitudes and values' helps students internalise these competencies naturally.

The practical implications of the model are profound. Integrating comprehensive competencies in knowledge, skills, and attitudes and values allows doctoral programmes to develop curricula that better prepare students for the multifaceted challenges they will encounter in both academic and professional settings. This holistic approach fosters the development of well-rounded, innovative, and competent individuals who can succeed in diverse contexts. For instance, the emphasis on lifelong learning and ethical decision-making ensures that graduates are equipped to contribute significantly to their fields and continue learning throughout their careers. This is critical in today's rapidly changing world where adaptability and continuous learning are key to sustained success (P21, 2019).

Given the constraints of this research, such as its reliance on expert opinions which may not capture the full diversity of perspectives in the field, several recommendations for future research are proposed to enhance the applicability and generalisability of the findings:

- This study focuses on competencies for CIDP. Future research should explore competencies across different levels of higher education, including undergraduate and master's programmes. This would help identify commonalities and unique requirements at various stages of the educational process, contributing to the development of integrated competency models that support lifelong learning.
- As the research was conducted at a national level, the generalisability of the findings may be limited. Future studies should involve international experts to understand how competencies are perceived and developed in different cultural and educational contexts. Including a global perspective will enhance the model's validity and applicability across various education systems.
- This study utilised the Delphi technique. Future research could employ diverse data collection methods such as surveys, case studies, or ethnographic approaches to provide a broader perspective on CIDP competencies. For instance, longitudinal studies tracking competency development over time could offer valuable insights into how these competencies evolve and are applied in real-world settings.
- Future research should include students, faculty, and employers to uncover which competencies are implicitly developed in CIDP and how they are acquired. Interviews or focus groups with these stakeholders can provide richer, nuanced views on competency development and its practical implications. Engaging stakeholders ensures that the competency model reflects the needs and experiences of those involved in the educational process.
- Future research should conduct longitudinal studies to observe how competencies develop over time and impact academic and professional outcomes. Additionally, applying the competency model in different educational contexts and cultures will provide insights into its adaptability and effectiveness. Such understanding will aid in refining the model to ensure broader applicability and effectiveness.
- Future research should examine the differences between competencies developed implicitly through educational experiences and environments, and those explicitly taught through structured curricula. While this study captures a wide range of competencies, future research should delve into how specific competencies are naturally acquired versus those that require targeted instructional strategies.

In conclusion, this study presents a detailed competency model for CIDP that integrates knowledge, skills, and attitudes and values. By addressing gaps identified in previous frameworks and providing a balanced and comprehensive approach, it plays a crucial role in preparing well-equipped doctoral graduates ready to tackle complex educational challenges and contribute meaningfully to their fields. To fully realise the potential of this competency model, ongoing research and development are essential. Future studies should explore the implementation and impact of this model in various educational contexts and monitor how competencies evolve over time to provide insights into their long-term effects. Additionally, adapting the model to accommodate cultural and institutional differences will be critical to ensuring its broad applicability and effectiveness. This continuous process will help create an educational environment that not only meets the needs of today's globalised world but also anticipates the requirements of the future, fostering graduates who are knowledgeable, skilled, ethical, and adaptable in both their professional and personal lives.

Data availability

The authors confirm that the data supporting the findings of this study are available upon reasonable request. Interested researchers are encouraged to contact the corresponding author for access to the data. This availability aims to promote transparency and to support further research in the domains of curriculum development, instructional methodologies, competency-based education, and the Delphi process utilised for competency identification. By providing access to this data, the authors hope to facilitate a deeper understanding of programme competencies and enhance the methodological approaches in defining and refining educational competencies.

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Author contributions

This study originated from a doctoral thesis conducted by Mehmet Kart under the supervision of Hüseyin Şimşek. Conceptualisation and Design: Mehmet Kart and Hüseyin Şimşek; Methodology and Data Collection: Mehmet Kart; Data Analysis: Mehmet Kart and Hüseyin Şimşek; Writing—Original Draft Preparation: Mehmet Kart; Writing—Review and Editing: Mehmet Kart and Hüseyin Şimşek; Supervision and Guidance: Hüseyin Şimşek. Both authors have read and approved the final version of the manuscript.

Competing interests

The authors declare that there are no conflicts of interest regarding the publication of this article. This research was conducted independently, without any financial or personal relationships that could influence the study's findings or interpretations. The authors have no financial, professional, or personal affiliations that might be perceived as affecting the objectivity or integrity of the research presented.

Ethical approval

Some findings from this research were presented at the III International Cappadocia Social Sciences Student Congress held in Kırşehir from 16-18 June 2021. The research adhered strictly to scientific and ethical standards throughout. Ethical approval was granted by the Kırşehir Ahi Evran University Social and Humanities Scientific Research and Publication Ethics Committee on 4 March 2021, under approval number 2021/1.

Informed consent

Informed consent was obtained from all participants through an online platform, ensuring that no face-to-face interaction was necessary. Participants were presented with a detailed informed consent form that explained the nature, purpose, and potential implications of the research. By ticking a designated box, participants confirmed their voluntary consent to participate, being fully informed of their right to withdraw from the study at any time without consequences. This process ensured that all participants were aware and agreed to contribute to the research willingly.

Additional information

Supplementary information The online version contains supplementary material available at https://doi.org/10.1057/s41599-024-03917-2.

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