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FEATURES OF DEVELOPING FUTURE TEACHERS' PROFESSIONAL COMPETENCE THROUGH SUBJECT-BASED LEARNING

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ABSTRACT

This review article aims to examine the features of developing future teachers' professional competence through subject-based learning by synthesizing contemporary theoretical and empirical research. Specifically, the review explores the conceptual foundations of subject-based learning, identifies its contribution to pedagogical, reflective, collaborative, and technological competence, and discusses its implications for teacher education.

To achieve these objectives, a narrative literature review supported by systematic search procedures was conducted. Relevant studies were identified through major academic databases, including Scopus, Web of Science, ERIC, ScienceDirect, and SpringerLink. Peer-reviewed publications, scholarly books, and international policy reports were selected according to predefined inclusion and exclusion criteria. Subsequently, the selected literature was analyzed thematically to identify recurring concepts, research trends, and evidence concerning professional competence development.

The findings demonstrate that subject-based learning effectively integrates disciplinary knowledge with pedagogical reasoning, authentic professional practice, reflective inquiry, collaborative learning, and technology-enhanced instruction. Furthermore, the reviewed studies consistently indicate that this approach strengthens pedagogical content knowledge, professional identity, instructional decision-making, critical thinking, and adaptive expertise. Nevertheless, the analysis also reveals persistent challenges, including fragmented curricula, insufficient integration of theory and practice, limited opportunities for authentic teaching experiences, and the continued reliance on traditional assessment methods.

Overall, the review confirms that subject-based learning represents a comprehensive framework for preparing competent, reflective, and innovative teachers capable of responding to the evolving demands of twenty-first-century education. Therefore, strengthening subject-based learning within teacher education programs may contribute substantially to improving teacher preparation, educational quality, and sustainable professional development while providing valuable directions for future educational research and policy development.



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Key words: professional competence, subject-based learning, teacher education, pre-service teachers, pedagogical content knowledge, reflective practice, collaborative learning, professional identity.

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FANLAR ASOSIDA O'QITISH JARAYONIDA BO'LAJAK O'QITUVCHILARNING KASBIY KOMPETENSIYASINI RIVOJLANTIRISH XUSUSIYATLARI

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ANNOTATSIYA

Ushbu sharh maqolaning maqsadi fan asosida o'qitish (subject-based learning) orqali bo'lajak o'qituvchilarning kasbiy kompetentligini rivojlantirishning o'ziga xos xususiyatlarini zamonaviy nazariy va empirik tadqiqotlarni umumlashtirish asosida tahlil qilishdan iborat. Xususan, maqolada fan asosida o'qitishning konseptual asoslari yoritilib, uning pedagogik, refleksiv, hamkorlik va texnologik kompetensiyalarni rivojlantirishdagi o'rni aniqlanadi hamda o'qituvchilarni tayyorlash tizimi uchun amaliy ahamiyati muhokama qilinadi.

Ushbu maqsadga erishish uchun tizimli qidiruv jarayonlari bilan qo'llab-quvvatlangan narrativ adabiyotlar sharhi usulidan foydalanildi. Tadqiqot uchun tegishli manbalar Scopus, Web of Science, ERIC, ScienceDirect va SpringerLink kabi yirik ilmiy ma'lumotlar bazalaridan tanlab olindi. Oldindan belgilangan kiritish va chiqarib tashlash mezonlari asosida taqrizdan o'tgan ilmiy maqolalar, ilmiy monografiyalar hamda xalqaro tashkilotlarning siyosiy hisobotlari saralandi. Shundan so'ng tanlangan adabiyotlar kasbiy kompetentlikni rivojlantirishga oid takrorlanuvchi konsepsiyalar, ilmiy tendensiyalar va dalillarni aniqlash maqsadida tematik tahlil qilindi.

Natijalar fan asosida o'qitish fan mazmunini pedagogik tafakkur, haqiqiy kasbiy amaliyot, refleksiv tahlil, hamkorlikda o'qish hamda texnologiyalar bilan boyitilgan ta'lim bilan samarali integratsiyalashini ko'rsatdi. Bundan tashqari, tahlil qilingan tadqiqotlar ushbu yondashuv pedagogik mazmuniy bilimlar, kasbiy identifikatsiya, ta'limiy qaror qabul qilish ko'nikmalari, tanqidiy fikrlash va moslashuvchan kasbiy kompetentlikni mustahkamlashini tasdiqlaydi. Shu bilan birga, tahlil o'quv dasturlarining parchalanib ketganligi, nazariya va amaliyot integratsiyasining yetarli emasligi, haqiqiy pedagogik faoliyat uchun imkoniyatlarning cheklanganligi hamda an'anaviy baholash usullariga ortiqcha tayanish kabi muammolarni ham aniqladi.

Umuman olganda, sharh natijalari fan asosida o'qitish XXI asr ta'limi talablariga mos, kompetent, refleksiv va innovatsion o'qituvchilarni tayyorlashning kompleks modeli ekanligini tasdiqlaydi. Shu bois o'qituvchilarni tayyorlash dasturlarida fan asosida o'qitishni yanada takomillashtirish pedagog kadrlar tayyorlash sifati, ta'lim samaradorligi va barqaror kasbiy rivojlanishni oshirishga xizmat qiladi hamda kelgusidagi ilmiy tadqiqotlar va ta'lim siyosatini rivojlantirish uchun muhim yo'nalishlarni belgilaydi.

Kalit so'zlar: kasbiy kompetentlik, fan asosida o'qitish, o'qituvchilarni tayyorlash, bo'lajak

o'qituvchilar, pedagogik mazmuniy bilimlar, refleksiv amaliyot, hamkorlikda o'qish, kasbiy identifikatsiya.

ОСОБЕННОСТИ ФОРМИРОВАНИЯ ПРОФЕССИОНАЛЬНОЙ КОМПЕТЕНТНОСТИ БУДУЩИХ УЧИТЕЛЕЙ В ПРОЦЕССЕ ПРЕДМЕТНО ОРИЕНТИРОВАННОГО ОБУЧЕНИЯ

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АННОТАЦИЯ

Целью данной обзорной статьи является анализ особенностей формирования профессиональной компетентности будущих учителей посредством предметно-ориентированного обучения на основе обобщения современных теоретических и эмпирических исследований. В частности, в статье рассматриваются концептуальные основы предметно-ориентированного обучения, определяется его вклад в развитие педагогической, рефлексивной, коллаборативной и технологической компетентностей, а также обсуждается его значение для системы подготовки педагогических кадров.

Для достижения поставленной цели был использован метод нарративного обзора литературы, основанный на систематизированной процедуре поиска научных источников. Релевантные исследования были отобраны из ведущих международных научных баз данных Scopus, Web of Science, ERIC, ScienceDirect и SpringerLink. В соответствии с заранее установленными критериями включения и исключения были проанализированы рецензируемые научные статьи, научные монографии и аналитические доклады международных организаций. Затем отобранные публикации были подвергнуты тематическому анализу с целью выявления ключевых концепций, современных исследовательских тенденций и научных данных, касающихся развития профессиональной компетентности.

Результаты исследования свидетельствуют о том, что предметно-ориентированное обучение эффективно интегрирует предметные знания с педагогическим мышлением, реальной профессиональной практикой, рефлексивным анализом, коллаборативным обучением и технологиями цифрового образования. Кроме того, анализ рассмотренных исследований подтверждает, что данный подход способствует развитию педагогического предметного знания, профессиональной идентичности, навыков принятия педагогических решений, критического мышления и адаптивной профессиональной компетентности. Вместе с тем выявлены сохраняющиеся проблемы, включая фрагментарность образовательных программ, недостаточную интеграцию теории и практики, ограниченные возможности для приобретения реального педагогического опыта и сохраняющуюся ориентацию на традиционные методы оценивания.

В целом результаты обзора подтверждают, что предметно-ориентированное обучение представляет собой комплексную модель подготовки компетентных, рефлексивных и инновационно ориентированных педагогов, способных эффективно отвечать на современные вызовы образования XXI века. Следовательно, дальнейшее совершенствование предметно-ориентированного обучения в системе подготовки учителей может существенно повысить качество педагогического образования, эффективность образовательного процесса и обеспечить

устойчивое профессиональное развитие, одновременно определяя перспективные направления дальнейших научных исследований и совершенствования образовательной политики.

Ключевые слова: профессиональная компетентность, предметно-ориентированное обучение, подготовка учителей, будущие учителя, педагогическое предметное знание, рефлексивная практика, коллаборативное обучение, профессиональная идентичность.

INTRODUCTION

The quality of teacher education has become one of the most influential factors determining the effectiveness of educational systems in the twenty-first century. Educational reforms across the world increasingly emphasize competence-based curricula, learner-centered instruction, digital transformation, and sustainable professional development, all of which require teachers to possess a broad range of professional competencies. Consequently, the mission of higher education institutions has expanded beyond transmitting disciplinary knowledge to preparing future teachers capable of responding effectively to complex educational, technological, and social challenges. International organizations consistently identify teacher quality as one of the strongest school-related factors influencing learners' academic achievement and educational equity [OECD, 2019; UNESCO, 2021].

Within this context, the concept of professional competence has received considerable scholarly attention. Professional competence is generally defined as an integrated combination of disciplinary knowledge, pedagogical expertise, practical skills, communication, ethical responsibility, reflective thinking, technological literacy, and the ability to adapt instructional practices to diverse learning environments. Unlike traditional knowledge-oriented models of teacher education, competence-based approaches emphasize the application of knowledge in authentic professional contexts. This perspective recognizes that successful teaching depends not only on teachers' academic preparation but also on their capacity to make informed instructional decisions and facilitate meaningful learning experiences.

The theoretical foundations of professional competence were substantially strengthened by L.S. Shulman, who introduced the concept of pedagogical content knowledge and argued that effective teaching requires the integration of disciplinary knowledge with pedagogical understanding rather than treating them as independent domains [Shulman, 1986; Shulman, 1987]. His work transformed teacher education by demonstrating that teachers must understand how subject content can be represented, explained, and adapted according to learners' characteristics and educational objectives. Building upon this perspective, P.Grossman emphasized that professional competence includes subject matter knowledge, pedagogical knowledge, curriculum understanding, and contextual awareness, all of which interact during instructional decision-making [Grossman, 1990].

The competence-oriented paradigm has subsequently been reinforced by numerous scholars who have highlighted the importance of connecting theoretical preparation with authentic professional practice. L.Darling-Hammond argued that teacher education programs become more effective when university coursework is systematically integrated with school-based experiences and reflective inquiry,

allowing prospective teachers to construct professional knowledge through practice [Darling-Hammond, 2006]. Similarly, K.Korthagen proposed that meaningful teacher education should establish continuous relationships between educational theory and professional action rather than presenting them as separate components of teacher preparation [Korthagen, 2004]. These perspectives collectively suggest that competence develops through the interaction of knowledge, experience, reflection, and continuous professional learning.

One instructional approach that effectively supports such integration is subject-based learning. Subject-based learning places disciplinary knowledge at the center of educational activities while simultaneously encouraging prospective teachers to examine how disciplinary concepts are taught, assessed, interpreted, and applied in authentic educational settings. Instead of separating subject knowledge from pedagogical practice, this approach promotes meaningful connections between academic content, instructional strategies, curriculum design, classroom management, and learner engagement. As a result, future teachers develop both disciplinary expertise and professional competence through interconnected learning experiences.

The pedagogical principles underlying subject-based learning are closely associated with constructivist theories of learning. J.Dewey argued that meaningful education should originate from purposeful experience, inquiry, and active participation rather than passive memorization of information [Dewey, 1938]. Learning becomes educationally valuable when students investigate problems, formulate explanations, and apply knowledge in real situations. These principles remain highly relevant to teacher education because prospective teachers must learn to transform theoretical understanding into effective classroom practice while continuously responding to learners' needs.

The sociocultural perspective further explains the effectiveness of subject-based learning. L.S. Vygotsky demonstrated that cognitive development occurs through social interaction and guided participation within meaningful cultural contexts [Vygotsky, 1978]. Professional competence therefore develops not only through individual study but also through collaboration with peers, mentors, and experienced teachers. Activities such as collaborative lesson planning, peer teaching, professional dialogue, and supervised practicum enable future teachers to construct knowledge collectively while gradually assuming responsibility for instructional decision-making.

Experiential learning theory provides another important explanation for competence development. According to D.A. Kolb, learning is a cyclical process involving concrete experience, reflective observation, abstract conceptualization, and active experimentation [Kolb, 1984]. Teacher education naturally reflects this cycle because prospective teachers study educational theories, participate in teaching practice, evaluate instructional outcomes, and continuously modify their professional actions. Subject-based learning strengthens this process by connecting disciplinary content directly with authentic educational experiences, thereby facilitating deeper conceptual understanding and long-term professional growth.

Reflection has likewise become an indispensable component of contemporary

teacher education. D.A. Schön emphasized that professionals improve their expertise through continuous reflection during and after professional practice, enabling them to evaluate decisions, reconsider assumptions, and adapt instructional strategies to changing educational situations [Schön, 1983]. Reflection is particularly significant within subject-based learning because future teachers repeatedly analyze classroom cases, teaching demonstrations, lesson plans, and assessment outcomes, thereby strengthening professional judgment and self-regulation. Similar conclusions were reached by J.Loughran, who considered reflective practice one of the defining characteristics of effective teacher education programs [Loughran, 2006].

Another important characteristic of subject-based learning concerns collaboration. E.Wenger explained that professional knowledge develops through participation in communities of practice where individuals exchange experiences, negotiate meanings, and solve practical problems collectively [Wenger, 1998]. Teacher education increasingly incorporates collaborative learning activities because they strengthen communication skills, professional identity, leadership, and collegial responsibility. Likewise, M.Cochran-Smith argued that collaborative inquiry enables prospective teachers to connect educational theory with practical problem-solving while developing a stronger understanding of professional responsibility [Cochran-Smith, 2005].

Rapid technological development has introduced additional dimensions to teacher competence. The integration of digital technologies into teaching has become an essential requirement for contemporary educators. Recognizing this need, P.Mishra and M.J. Koehler proposed the Technological Pedagogical Content Knowledge framework, emphasizing that effective teaching requires the simultaneous integration of technological, pedagogical, and disciplinary knowledge [Mishra & Koehler, 2006]. This framework extends L.S. Shulman's original model by acknowledging that digital competence has become inseparable from professional teaching competence. Consequently, subject-based learning increasingly incorporates digital resources, virtual learning environments, educational software, and artificial intelligence tools as integral components of teacher preparation.

Research further indicates that effective teachers require specialized disciplinary knowledge designed specifically for instructional purposes. D.L. Ball, M.H. Thames, and G.Phelps distinguished professional content knowledge from general academic knowledge, arguing that teachers must understand how learners interpret disciplinary concepts, where misconceptions emerge, and which instructional strategies facilitate conceptual understanding [Ball et al., 2008]. Their work reinforces the assumption that professional competence develops through the integration of subject expertise with pedagogical reasoning rather than through disciplinary mastery alone.

Recent international studies continue to emphasize the strategic importance of professional competence in teacher education. J.Hattie identified teacher expertise among the strongest influences on student learning outcomes, highlighting the significance of instructional quality and evidence-based teaching practices [Hattie, 2009]. Likewise, M.Fullan argued that sustainable educational improvement depends

largely on teachers' professional capacity to implement innovation, collaborate with colleagues, and adapt to continuous educational change [Fullan, 2007]. A.Hargreaves further emphasized that modern teachers must function as lifelong learners capable of responding to rapidly evolving educational environments through continuous professional development [Hargreaves, 2000]. These perspectives collectively demonstrate that professional competence represents a dynamic rather than static characteristic of effective teaching.

Despite substantial progress in competence-oriented teacher education, significant challenges remain. Many teacher education programs continue to separate disciplinary instruction from pedagogical preparation, thereby limiting opportunities for prospective teachers to integrate theoretical knowledge with authentic classroom practice. Moreover, inconsistencies in curriculum design, assessment methods, and professional practice frequently reduce the effectiveness of competence development. Although numerous studies have investigated pedagogical content knowledge, reflective practice, collaborative learning, technological integration, and teacher competence independently, relatively few review studies have synthesized these perspectives specifically through the framework of subject-based learning.

Therefore, the present review article aims to synthesize contemporary theoretical and empirical evidence concerning the features of developing future teachers' professional competence through subject-based learning. Specifically, the review analyzes the conceptual foundations of subject-based learning, examines its contribution to the development of pedagogical, reflective, technological, and collaborative competencies, identifies current implementation challenges, and discusses implications for teacher education curricula, educational policy, and future research.

METHODS

This study employed a qualitative review design to synthesize contemporary theoretical and empirical research concerning the development of future teachers' professional competence through subject-based learning. A narrative review approach with systematic search procedures was adopted to identify, evaluate, and integrate relevant studies published in internationally recognized scholarly sources. This approach was selected because the topic encompasses diverse theoretical perspectives, educational contexts, and methodological traditions that cannot be adequately examined through a single empirical framework. Narrative reviews supported by transparent search strategies are widely applied in educational research to provide comprehensive analyses of complex pedagogical phenomena [Baumeister & Leary, 1997; Grant & Booth, 2009].

The literature search was conducted using five major academic databases that index peer-reviewed educational research: Scopus, Web of Science, ERIC, ScienceDirect, and SpringerLink. These databases were selected because they provide extensive coverage of teacher education, educational psychology, curriculum studies, instructional design, and professional competence research. Additional sources were identified through reference tracking of highly cited publications and policy reports issued by international educational organizations, including OECD, UNESCO, and the European Commission. This combination of databases and institutional publications ensured comprehensive coverage of both theoretical and applied perspectives relevant

to the review.

The search strategy incorporated combinations of controlled vocabulary and keyword searches. The principal search terms included *professional competence*, *teacher competence*, *pre-service teacher education*, *subject-based learning*, *discipline-based learning*, *pedagogical content knowledge*, *teacher professional development*, *competency-based education*, *reflective practice*, *teacher preparation*, *constructivist learning*, and *teacher education curriculum*. Boolean operators (AND, OR) were used to combine search terms and broaden or narrow the search when necessary. Synonymous concepts were included to reduce publication bias and maximize the identification of relevant studies.

The review primarily considered publications released between 2000 and 2025, reflecting contemporary developments in competence-based teacher education and subject-based learning. However, several earlier publications were intentionally retained because they constitute the theoretical foundations of the field. These foundational works include the contributions of L.S. Shulman on pedagogical content knowledge [Shulman, 1986; Shulman, 1987], J.Dewey's experiential philosophy of education [Dewey, 1938], L.S. Vygotsky's sociocultural theory [Vygotsky, 1978], D.A. Schön's reflective practice framework [Schön, 1983], and D.A. Kolb's experiential learning theory [Kolb, 1984]. Including these classical studies provided an essential conceptual framework for interpreting more recent research.

To ensure the quality and relevance of the reviewed literature, explicit inclusion and exclusion criteria were established before the selection process. Publications were included if they (a) focused on teacher education or pre-service teacher preparation, (b) examined professional competence or closely related constructs, (c) investigated subject-based or discipline-oriented learning approaches, (d) were published in peer-reviewed journals, scholarly books, or official reports issued by recognized international organizations, and (e) were written in English. Studies focusing exclusively on in-service teacher training without implications for initial teacher education, conference abstracts lacking complete methodological descriptions, unpublished manuscripts, dissertations, and non-peer-reviewed sources were excluded from the analysis.

Following the initial search, duplicate records identified across databases were removed. Titles and abstracts were then screened to determine their relevance to the objectives of the review. Publications meeting the inclusion criteria proceeded to full-text evaluation. During this stage, each article was examined for its theoretical framework, research design, educational context, participant characteristics, methodological quality, principal findings, and implications for teacher education. Only studies providing substantial evidence regarding the relationship between subject-based learning and professional competence development were retained for the final synthesis.

The methodological quality of empirical studies was evaluated through several criteria frequently applied in educational review research. These criteria included clarity of research objectives, appropriateness of research design, transparency of data collection procedures, adequacy of sample description, rigor of data analysis,

consistency between findings and conclusions, and relevance to the objectives of the present review. Rather than assigning numerical quality scores, studies were critically examined to determine the credibility and applicability of their findings within the broader context of teacher education research.

Data extraction was conducted using a structured analytical framework developed specifically for this review. Information collected from each publication included bibliographic details, theoretical orientation, educational level, methodological approach, principal concepts, reported outcomes, and implications for professional competence development. Particular attention was devoted to identifying evidence concerning pedagogical content knowledge, disciplinary expertise, reflective practice, technological competence, collaborative learning, professional identity formation, curriculum integration, and authentic learning experiences. This procedure enabled consistent comparison across studies employing different research methodologies.

The synthesis of evidence followed a thematic analysis approach. Rather than organizing findings according to publication chronology, studies were grouped into conceptual categories representing the principal dimensions of professional competence identified in the literature. These themes included the conceptual foundations of professional competence, pedagogical content knowledge, subject-based learning strategies, reflective practice, collaborative learning, technological integration, professional identity development, and implementation challenges within teacher education programs. Thematic organization facilitated a comprehensive interpretation of converging and contrasting findings reported by different researchers.

Throughout the review process, particular attention was given to identifying recurring patterns across theoretical discussions and empirical investigations. Similarities, differences, methodological limitations, and emerging research trends were systematically compared to develop an integrated understanding of how subject-based learning contributes to the professional preparation of future teachers. When multiple studies reported consistent findings regarding a specific aspect of competence development, these findings were synthesized to establish broader conceptual conclusions rather than presenting individual studies in isolation. This interpretative approach is considered appropriate for narrative educational reviews because it supports theory development while preserving the complexity of educational phenomena [Grant & Booth, 2009].

The methodological procedures adopted in this review ensured transparency, consistency, and scholarly rigor throughout the literature selection and analysis process. By combining systematic search strategies with thematic synthesis, the study provides a comprehensive overview of current knowledge concerning the role of subject-based learning in developing future teachers' professional competence. The following section presents the synthesized findings derived from the selected literature and examines the principal characteristics of subject-based learning that contribute to competence development in contemporary teacher education.

RESULTS

Conceptual foundations of professional competence in subject-based learning

The analysis of the selected literature demonstrates a broad consensus that professional competence should be understood as a multidimensional construct rather than a collection of isolated teaching skills. Across the reviewed studies, competence consistently encompasses disciplinary knowledge, pedagogical expertise, reflective thinking, communication, classroom management, ethical responsibility, collaboration, technological literacy, and the capacity for continuous professional learning. Contemporary scholars emphasize that these dimensions interact dynamically during instructional practice and should therefore be developed simultaneously throughout teacher education rather than through separate curricular components [Shulman, 1987; Darling-Hammond, 2006].

The reviewed studies indicate that the theoretical foundations established by L.S. Shulman continue to influence contemporary teacher education research. Pedagogical content knowledge remains one of the most frequently cited frameworks for explaining how teachers transform disciplinary concepts into meaningful learning experiences. Rather than emphasizing subject expertise alone, the literature consistently argues that professional competence develops through the integration of content knowledge, pedagogical reasoning, curriculum understanding, assessment literacy, and knowledge of learners [Shulman, 1986; Grossman, 1990]. This integrated perspective has become particularly important within competence-based teacher education because it provides a conceptual explanation for how disciplinary learning contributes to professional performance.

Several studies further demonstrate that subject-based learning creates favorable conditions for developing pedagogical reasoning. Instead of treating disciplinary knowledge as an independent academic objective, subject-based learning encourages prospective teachers to analyze how specific concepts can be explained, illustrated, assessed, and adapted according to learners' cognitive characteristics. This continuous interaction between subject knowledge and instructional decision-making strengthens teachers' ability to select appropriate teaching strategies while simultaneously improving conceptual understanding [Ball et al., 2008].

The literature also reveals considerable agreement that competence development requires authentic educational experiences rather than exclusive reliance on theoretical instruction. Educational researchers consistently argue that future teachers develop professional expertise most effectively when disciplinary learning is combined with lesson planning, classroom observation, teaching practice, curriculum analysis, and professional reflection [Darling-Hammond, 2006; Korthagen, 2004]. Consequently, subject-based learning is increasingly described as a bridge connecting academic preparation with professional practice.

Subject-based learning as a mechanism for knowledge integration

One of the most frequently reported findings concerns the ability of subject-

based learning to integrate theoretical and practical knowledge. Traditional teacher education programs have often been criticized for presenting disciplinary content and pedagogical theory as independent areas of study, thereby limiting prospective teachers' opportunities to apply theoretical concepts in authentic instructional contexts. The reviewed studies consistently indicate that subject-based learning reduces this separation by organizing learning activities around disciplinary problems requiring pedagogical solutions [Grossman, 1990; Loughran, 2006].

Within subject-based learning environments, prospective teachers participate in activities such as curriculum interpretation, instructional planning, assessment design, classroom simulations, and case analysis. These activities require students to connect theoretical concepts with practical teaching decisions, thereby promoting deeper conceptual understanding and stronger professional competence. Rather than memorizing educational theories, future teachers learn to evaluate their relevance within specific disciplinary contexts.

Several empirical investigations further demonstrate that subject-based learning strengthens conceptual transfer. Students who regularly engage in authentic disciplinary tasks show greater ability to apply theoretical knowledge to unfamiliar educational situations than those participating primarily in lecture-based instruction. Such findings suggest that competence develops through repeated opportunities to interpret, evaluate, and apply disciplinary knowledge within realistic teaching environments rather than through passive knowledge acquisition alone [Bransford et al., 2005].

The reviewed literature additionally indicates that interdisciplinary integration represents an important characteristic of subject-based learning. Contemporary educational problems frequently require teachers to combine knowledge from curriculum studies, educational psychology, instructional technology, assessment, and subject methodology. Subject-based learning facilitates these connections by encouraging future teachers to examine educational issues from multiple perspectives, thereby supporting flexible thinking and adaptive professional expertise [Caena, 2014].

Development of reflective and critical professional thinking

Reflection emerged as one of the most frequently discussed mechanisms through which subject-based learning contributes to professional competence development. Across the reviewed publications, reflective practice is consistently described as an essential characteristic of effective teacher education because it enables prospective teachers to evaluate instructional decisions, reconsider assumptions, and improve future professional performance [Schön, 1983].

The findings indicate that reflective competence develops progressively through systematic participation in lesson analysis, teaching journals, peer observation, portfolio assessment, and supervised practicum experiences. Subject-based learning naturally incorporates these activities because disciplinary instruction frequently requires prospective teachers to justify instructional choices, analyze learner responses, and evaluate the effectiveness of teaching strategies. Consequently, reflection becomes

an integral component of professional learning rather than an isolated educational exercise.

Critical thinking represents another important outcome identified in the reviewed studies. Researchers consistently report that subject-based learning encourages future teachers to question existing instructional practices, compare alternative pedagogical approaches, evaluate educational evidence, and formulate independent professional judgments. Such abilities are increasingly recognized as essential components of teacher professionalism because contemporary educational environments require continuous adaptation rather than routine implementation of predetermined instructional procedures [Hattie, 2009].

Several studies also indicate that reflective competence positively influences teachers' professional confidence. Future teachers who regularly analyze their instructional experiences demonstrate greater self-efficacy, stronger classroom decision-making abilities, and increased willingness to implement innovative teaching strategies compared with students receiving predominantly theoretical instruction [Avalos, 2011]. These findings suggest that reflective practice contributes not only to instructional improvement but also to the development of professional identity and lifelong learning habits.

Collaborative learning and professional identity formation

The literature consistently identifies collaboration as another defining characteristic of subject-based learning. Professional teaching increasingly depends on cooperation among teachers, school administrators, specialists, parents, and local communities. Consequently, teacher education programs are expected to prepare future educators capable of working effectively within collaborative professional environments.

The reviewed studies demonstrate that subject-based learning promotes collaboration through group projects, peer teaching, curriculum design workshops, lesson study, and professional dialogue. These learning experiences encourage prospective teachers to exchange ideas, negotiate instructional decisions, provide constructive feedback, and collectively solve pedagogical problems. According to E. Wenger, such participation enables learners to become active members of professional communities where knowledge is constructed through shared practice rather than individual learning alone [Wenger, 1998].

Professional identity formation also appears closely associated with collaborative learning. Rather than developing automatically during teacher education, professional identity evolves gradually as prospective teachers participate in authentic educational activities and interact with experienced practitioners. Collaborative subject-based learning provides opportunities for future teachers to internalize professional values, ethical standards, and educational responsibilities while simultaneously strengthening communication and leadership skills [Cochran-Smith, 2005].

Furthermore, several investigations report that collaborative learning positively influences prospective teachers' motivation and engagement. Students participating in cooperative disciplinary projects generally demonstrate stronger commitment to

professional learning, greater responsibility for instructional quality, and increased confidence in addressing educational challenges [Fullan, 2007]. These findings reinforce the view that collaboration represents an essential dimension of professional competence rather than merely an instructional strategy.

Technological competence within subject-based learning

Another dominant theme emerging from the reviewed literature concerns the integration of digital technologies into subject-based learning. Contemporary teacher education no longer considers technological competence an additional qualification but rather an essential component of professional competence. The rapid expansion of digital learning environments, online collaboration platforms, educational software, virtual simulations, learning management systems, and artificial intelligence has fundamentally transformed teachers' instructional responsibilities. Consequently, prospective teachers are expected to integrate technological resources appropriately while maintaining pedagogical effectiveness and disciplinary accuracy.

The reviewed studies consistently support the Technological Pedagogical Content Knowledge (TPACK) framework proposed by P.Mishra and M.J. Koehler, which extends pedagogical content knowledge by incorporating technological knowledge into instructional practice [Mishra & Koehler, 2006]. According to this framework, effective teachers do not simply possess technological skills; rather, they understand how digital tools interact with pedagogical approaches and disciplinary content to improve learning outcomes. Subject-based learning provides appropriate conditions for developing this integrated competence because technological resources are introduced within authentic disciplinary contexts rather than through isolated technology courses.

Several empirical studies indicate that future teachers participating in technology-supported subject-based learning demonstrate higher levels of instructional flexibility, digital confidence, and creativity than students experiencing traditional lecture-based instruction. They also exhibit greater ability to design interactive learning materials, organize online collaborative activities, evaluate digital educational resources, and adapt instruction to blended and virtual learning environments [Tondeur et al., 2012; Koehler et al., 2013].

Artificial intelligence has recently emerged as another important component of teacher education. The reviewed studies suggest that AI-supported educational technologies can assist prospective teachers in lesson planning, assessment design, adaptive learning, feedback generation, and educational data analysis. However, researchers consistently emphasize that technological innovation should complement rather than replace teachers' pedagogical judgment and professional decision-making [Holmes et al., 2022]. Subject-based learning supports this balanced approach by encouraging future teachers to evaluate digital technologies critically according to disciplinary objectives and learners' educational needs.

The literature also indicates that successful technological integration depends largely on institutional support. Universities providing adequate technological infrastructure, continuous professional guidance, and opportunities for technology-

enhanced teaching practice report significantly higher levels of digital competence among prospective teachers [Tondeur et al., 2012]. These findings suggest that technological competence develops through authentic educational application rather than through technical training alone.

Challenges in developing professional competence through subject-based learning

Although the reviewed studies overwhelmingly support the educational value of subject-based learning, they also identify several challenges that may reduce its effectiveness within teacher education programs.

One of the most frequently reported difficulties concerns the persistent separation between disciplinary coursework and pedagogical preparation. Many universities continue to organize teacher education according to traditional departmental structures, where subject specialists and teacher educators operate independently. As a result, prospective teachers often experience difficulties connecting theoretical disciplinary knowledge with classroom implementation. Researchers argue that stronger curricular integration remains necessary to achieve meaningful competence development [Korthagen, 2004].

A second challenge relates to limited opportunities for authentic teaching practice. Several investigations indicate that practical experiences remain insufficient in duration or are introduced too late within teacher education programs. Consequently, prospective teachers frequently possess substantial theoretical knowledge while lacking confidence in applying that knowledge within real classrooms. L.Darling-Hammond emphasized that sustained clinical practice should represent a central rather than supplementary component of teacher preparation [Darling-Hammond, 2006].

Assessment practices constitute another recurring concern. Traditional examinations continue to dominate many teacher education programs despite growing recognition that professional competence cannot be adequately measured through knowledge-based testing alone. The reviewed studies consistently recommend greater use of authentic assessment methods, including teaching portfolios, reflective journals, lesson demonstrations, classroom observations, and performance-based evaluation because these approaches provide more comprehensive evidence of professional competence [Loughran, 2006].

Institutional readiness also influences the effectiveness of subject-based learning. Several researchers report that successful implementation requires curriculum redesign, interdisciplinary collaboration, technological infrastructure, continuous academic support, and institutional commitment to competence-based education. Universities lacking these conditions frequently experience difficulties implementing subject-based learning consistently across teacher education programs [European Commission, 2013].

Another challenge concerns the rapidly changing educational environment. Educational technologies, curriculum reforms, artificial intelligence applications, and evolving learner characteristics require teacher education institutions to revise curricula continuously. M.Fullan argued that educational improvement depends

upon institutions' capacity to respond proactively to change rather than maintaining traditional instructional practices [Fullan, 2007]. Accordingly, subject-based learning must remain sufficiently flexible to accommodate emerging educational innovations while preserving its emphasis on disciplinary competence and pedagogical integration.

The reviewed literature additionally highlights disparities between national educational systems regarding curriculum organization, institutional resources, professional standards, and teacher certification requirements. These contextual differences influence how subject-based learning is implemented and evaluated across countries. Nevertheless, despite variations in educational policy and institutional practice, the literature demonstrates substantial international agreement regarding the fundamental importance of integrating disciplinary knowledge with authentic professional experience throughout teacher education.

Overall, the findings reveal that subject-based learning contributes to professional competence through multiple interconnected mechanisms. It strengthens pedagogical content knowledge, supports reflective and critical thinking, promotes collaborative learning, facilitates technological integration, encourages professional identity formation, and enhances the application of disciplinary knowledge within authentic educational contexts. At the same time, successful implementation requires coherent curricula, sustained teaching practice, appropriate assessment strategies, institutional support, and continuous curriculum renewal. These findings provide the foundation for interpreting the broader implications of subject-based learning for teacher education, which are discussed in the following section.

DISCUSSION

The findings of this review demonstrate that subject-based learning represents considerably more than an instructional strategy for organizing disciplinary knowledge. Rather, it functions as a comprehensive pedagogical framework through which future teachers integrate disciplinary expertise, pedagogical reasoning, reflective practice, technological competence, and professional identity. The reviewed literature consistently indicates that professional competence develops most effectively when theoretical learning is closely connected with authentic educational practice. This conclusion corresponds with the conceptual framework proposed by L.S. Shulman, who argued that effective teaching requires the transformation of disciplinary knowledge into forms that support meaningful student learning [Shulman, 1987].

One of the most significant findings emerging from this review concerns the inseparable relationship between disciplinary knowledge and pedagogical competence. Earlier approaches to teacher education frequently assumed that mastery of academic content automatically resulted in effective teaching. However, contemporary research provides substantial evidence that disciplinary expertise alone is insufficient for successful professional performance. Instead, prospective teachers require opportunities to interpret curriculum objectives, anticipate learners' misconceptions, select appropriate instructional strategies, and evaluate learning outcomes within authentic educational situations. Similar conclusions were reported by P.Grossman, who emphasized that teacher knowledge develops through the interaction of

disciplinary understanding, pedagogical reasoning, and contextual awareness rather than through isolated theoretical preparation [Grossman, 1990].

Another important issue concerns the relationship between subject-based learning and reflective professional development. The reviewed studies consistently demonstrate that reflection functions as one of the principal mechanisms supporting competence development. Through reflective activities, future teachers evaluate instructional decisions, reconsider assumptions, identify professional strengths and weaknesses, and modify their teaching strategies according to learners' educational needs. These findings strongly support the theoretical position of D.A. Schön, who viewed reflection as the defining characteristic of professional expertise within complex occupational environments [Schön, 1983]. The present review further indicates that subject-based learning naturally incorporates reflective practice because disciplinary inquiry frequently requires prospective teachers to justify pedagogical decisions and evaluate instructional effectiveness.

The findings also confirm the continuing relevance of sociocultural learning theory within teacher education. Subject-based learning promotes professional competence not only through individual cognitive development but also through collaborative participation in educational communities. Activities such as peer teaching, lesson study, collaborative curriculum design, and professional dialogue enable future teachers to construct knowledge collectively while gradually assuming professional responsibility. These observations are consistent with the theoretical perspectives developed by L.S. Vygotsky and E. Wenger, both of whom emphasized the importance of social participation for knowledge construction and professional learning [Vygotsky, 1978; Wenger, 1998]. Consequently, competence development should be viewed as a socially mediated process rather than an exclusively individual achievement.

Another notable finding concerns the increasing significance of technological competence within subject-based learning. The reviewed literature clearly demonstrates that digital technologies have become integral components of contemporary teacher education rather than supplementary instructional resources. The widespread implementation of learning management systems, digital assessment platforms, virtual simulations, collaborative online environments, and artificial intelligence applications requires future teachers to integrate technological knowledge with disciplinary expertise and pedagogical decision-making. These findings strongly support the TPACK framework proposed by P. Mishra and M.J. Koehler, which conceptualizes technology as an essential dimension of professional competence rather than an independent technical skill [Mishra & Koehler, 2006]. Nevertheless, the literature consistently emphasizes that technological innovation should enhance pedagogical quality rather than replace teachers' professional judgment.

The review further indicates that subject-based learning contributes significantly to the development of adaptive expertise. Unlike routine expertise, which depends primarily on the application of familiar procedures, adaptive expertise enables teachers to respond effectively to unfamiliar educational situations through flexible instructional

decision-making. Contemporary classrooms are increasingly characterized by cultural diversity, inclusive educational practices, technological innovation, and rapidly changing curricular expectations. Consequently, teacher education programs must prepare graduates capable of modifying instructional approaches according to learners' individual characteristics and educational contexts. The reviewed studies suggest that authentic disciplinary inquiry, reflective practice, and collaborative problem-solving provide favorable conditions for developing such adaptive professional competence [Hattie, 2009; Fullan, 2007].

Although the overall findings strongly support subject-based learning, the review also identifies several persistent challenges limiting its implementation. The most significant challenge concerns the continuing fragmentation of teacher education curricula. Many universities still organize disciplinary instruction and pedagogical preparation as separate academic components, thereby reducing opportunities for prospective teachers to integrate theoretical knowledge with professional practice. This structural separation frequently results in graduates possessing satisfactory academic knowledge but insufficient confidence in applying that knowledge during classroom instruction. Similar concerns were previously identified by K.Korthagen, who argued that teacher education should establish continuous relationships between theory and practice throughout the entire preparation process [Korthagen, 2004].

Assessment practices represent another area requiring further improvement. The findings indicate that traditional written examinations remain dominant within many teacher education institutions despite their limited capacity to evaluate authentic professional competence. Professional competence involves instructional decision-making, classroom interaction, communication, reflection, collaboration, and ethical responsibility, dimensions that cannot be adequately measured through conventional knowledge-based testing. Consequently, the reviewed literature consistently recommends expanding the use of performance-based assessment, teaching portfolios, classroom observations, lesson demonstrations, and reflective journals as more valid indicators of professional competence [Loughran, 2006; Darling-Hammond, 2006].

Institutional capacity likewise influences the effectiveness of subject-based learning. Successful implementation requires curriculum coherence, interdisciplinary cooperation, technological infrastructure, qualified teacher educators, and sustained partnerships between universities and schools. Institutions lacking these conditions frequently encounter difficulties integrating subject-based learning systematically across teacher education programs. Therefore, educational reform should address not only instructional methodology but also organizational structures supporting competence-oriented teacher preparation [European Commission, 2013].

The findings of this review have important implications for educational policy and curriculum development. First, teacher education programs should organize curricula around competence development rather than disciplinary content alone. Second, authentic professional experiences should be introduced early and expanded progressively throughout teacher preparation. Third, reflective practice and collaborative inquiry should become integral components of every stage of teacher

education. Finally, technological competence should be developed through meaningful disciplinary applications rather than isolated digital literacy courses. Collectively, these recommendations support a more coherent and professionally relevant model of teacher preparation capable of responding to the evolving demands of contemporary education.

Overall, the reviewed literature demonstrates remarkable consistency regarding the educational value of subject-based learning. Despite methodological differences across individual studies, researchers generally agree that integrating disciplinary knowledge with authentic professional practice significantly strengthens future teachers' professional competence. Nevertheless, additional comparative and longitudinal research remains necessary to determine how different models of subject-based learning influence competence development across diverse educational systems, subject areas, and cultural contexts. Such investigations would further strengthen the empirical foundation of competence-oriented teacher education and contribute to the continuous improvement of professional teacher preparation.

CONCLUSION

This review demonstrates that subject-based learning provides an effective framework for developing future teachers' professional competence by integrating disciplinary knowledge with pedagogical practice, reflective thinking, collaboration, and technological literacy. Unlike traditional teacher education models that frequently separate theoretical preparation from classroom practice, subject-based learning enables prospective teachers to apply academic knowledge in authentic educational contexts, thereby strengthening instructional decision-making, professional confidence, and adaptive expertise.

The reviewed literature consistently indicates that professional competence develops through the interaction of pedagogical content knowledge, reflective practice, collaborative learning, and technology-enhanced instruction. These interconnected components contribute to the formation of professional identity while preparing future teachers to respond effectively to diverse educational environments. Nevertheless, successful implementation of subject-based learning requires coherent curricula, authentic teaching practice, interdisciplinary cooperation, appropriate assessment strategies, and institutional support.

Overall, subject-based learning should be regarded as a strategic approach to improving the quality of teacher education. Future research should focus on comparative and longitudinal studies investigating the long-term impact of subject-based learning across different educational contexts and subject disciplines, particularly in relation to digital transformation and artificial intelligence. Such investigations will contribute to further strengthening competence-based teacher education and enhancing the professional preparation of future educators.

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