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Informetric Modeling of Reflective Practice in Special Education Teacher Education

Abstract

Reflective practice has become a fundamental dimension in teacher education because it explains how future educators transform professional experiences into knowledge, identity, and instructional improvement. This study develops an informetric model to analyze the relationships among reflective cognition, experiential learning integration, professional identity development, instructional transformation, and professional growth perception among student teachers in special education teacher education. A quantitative, nonexperimental, cross-sectional design was applied through a structured measurement framework composed of latent constructs and observable indicators. The model examined the extent to which professional placement experiences contributed to reflective processes and pedagogical adaptation. The findings showed that reflective practice operates as an interconnected structure in which experiential learning integration positively influences reflective cognition, reflective cognition strengthens professional identity development, and professional identity contributes to instructional transformation and professional growth perception. The estimated parameters demonstrated adequate reliability, validity, and explanatory capacity, confirming the multidimensional organization of reflective development. The informetric structure revealed that professional identity and instructional transformation represented central dimensions within the network, connecting personal development with pedagogical action. The results suggest that professional placements should be designed as reflective learning environments where student teachers analyze experiences, receive feedback, and develop adaptive teaching strategies. The proposed model contributes to teacher education research by integrating conceptual dimensions and quantitative indicators into a unified framework for examining reflective practice in special education contexts.

Research Article

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Keywords

Reflective Practice, Special Education, Teacher Education, Informetric Modeling, Professional Development.

Introduction

Reflective practice has become a central epistemological and pedagogical construct in teacher education because it explains how future educators transform professional experiences into situated knowledge, instructional decisions, and continuous learning processes. Within special education teacher education, reflective practice acquires particular relevance because student teachers encounter heterogeneous classrooms, complex learning needs, inclusive challenges, and ethical dilemmas during professional placements. These experiences require more than technical competence; they demand interpretive capacities that allow future teachers to analyze their actions, reconsider assumptions, and construct adaptive responses within diverse educational environments. Consequently, reflective practice can be

understood as an epistemic bridge between theoretical knowledge acquired in teacher education programs and experiential knowledge developed through school-based professional practice [1,2].

The epistemological problem underlying reflective practice in special education teacher education concerns the relationship between knowledge transmission and knowledge construction. Traditional models of teacher preparation have frequently emphasized the acquisition of pedagogical methods, disciplinary content, and procedural competencies. However, contemporary perspectives argue that teaching expertise emerges through recursive processes of action, interpretation, evaluation, and transformation. From a constructivist epistemology, student teachers are not passive recipients of professional knowledge but active agents who produce meaning through interactions with mentors, students, institutional cultures, and classroom situations. Therefore, professional placements represent epistemic spaces where reflective capacities are developed through observation, participation, feedback, and critical reconstruction of teaching experiences [3,4].

The theoretical dialogue surrounding reflective practice integrates several complementary perspectives. Dewey's theory of reflective thought established the foundation by proposing that meaningful learning occurs when individuals examine uncertainty, evaluate consequences, and reorganize experience into knowledge. Schön expanded this perspective through the concepts of reflection-in-action and reflection-on-action, emphasizing that professionals generate practical knowledge while responding to complex situations. In teacher education, these approaches have been extended by critical reflection theories, which consider the social, cultural, and institutional dimensions influencing professional identity formation. From this perspective, reflective practice is not merely an individual cognitive process but a socially mediated activity shaped by discourse, power relations, educational policies, and professional communities [5,6].

In special education contexts, reflective practice requires additional conceptual dimensions because student teachers must negotiate inclusion, accessibility, differentiation, and collaborative decision-making. Inclusive education frameworks suggest that teacher effectiveness depends on the ability to recognize learner diversity, modify instructional strategies, and critically evaluate educational barriers. Thus, reflective practice functions as a mechanism through which future special education teachers develop professional agency and improve their capacity to respond to complex educational realities. The construct of reflective teaching competence can therefore be associated with indicators such as self-evaluation, critical analysis, pedagogical adaptation, collaborative reflection, and ethical decision-making [7,8].

The empirical delimitation of this study focuses on student teachers enrolled in special education teacher education programs who participate in professional placements. These placements constitute the contextual domain where theoretical preparation encounters authentic educational demands. The analysis is restricted to the perceptions of student teachers regarding their reflective processes, professional learning experiences, and transformation of classroom practices. Rather than evaluating teaching performance directly, the study examines the cognitive, affective, and behavioural dimensions through which future teachers interpret their professional development during field experiences.

The problematization emerges from the limited integration between reflective practice theories and quantitative informetric approaches capable of identifying the structural relationships among epistemological dimensions, theoretical constructs, and observable indicators. Although previous research has explored reflective practice qualitatively, fewer studies have examined how conceptual networks of reflective teaching, professional identity, placement experiences, and pedagogical adaptation can be represented through informetric modeling. Informetrics provides analytical possibilities for mapping relationships among concepts, measuring intellectual structures, and identifying patterns of knowledge production through indicators associated with conceptual frequency, relational strength, thematic centrality, and structural organization [9,10].

The proposed informetric model establishes a dialogue between reflective epistemology, teacher education theory, and measurement perspectives. The model assumes that reflective practice is a multidimensional construct composed of reflective cognition, experiential learning, professional identity development, and instructional transformation. Reflective cognition refers to the capacity of student teachers to analyze and evaluate their own pedagogical decisions. Experiential learning

represents the transformation of professional placement experiences into practical knowledge. Professional identity development describes the process through which student teachers construct their understanding of themselves as future educators. Instructional transformation reflects the capacity to modify teaching strategies according to contextual demands. These constructs are represented through indicators including reflective frequency, critical interpretation, feedback integration, mentoring interaction, inclusive adaptation, and perceived professional growth.

The conceptual model integrates epistemological assumptions from constructivism, experiential learning theory, reflective practice theory, and inclusive education perspectives. Constructivism explains how student teachers generate professional meaning from experiences; experiential learning theory describes the cycle between concrete experiences, reflective observation, conceptualization, and experimentation; reflective practice theory explains professional improvement through critical examination; and inclusive education theory provides the contextual framework for understanding adaptation and diversity management. The convergence of these perspectives allows the development of an informetric representation in which conceptual relationships among constructs can be examined through parameters such as association strength, network density, centrality coefficients, and explanatory relationships among indicators.

The formulation of the research problem considers that professional placements may generate different levels of reflective development depending on the quality of mentoring, opportunities for feedback, exposure to inclusive practices, and student teachers' engagement with reflective activities. Therefore, the informetric model seeks to identify whether reflective practice dimensions form an interconnected structure capable of explaining how student teachers perceive their professional learning processes in special education settings. This approach contributes to bridging qualitative theoretical traditions with quantitative modeling strategies, providing evidence regarding the organization and measurement of reflective practice in teacher education.

The study is guided by the following research formulation: How are reflective practice constructs, indicators, and relational parameters organized into an informetric model that explains student teachers' perspectives during professional placements in special education teacher education?

The hypothesis assumes that reflective practice among special education student teachers is structured as a multidimensional informetric network in which experiential learning, reflective cognition, professional identity development, and instructional transformation are positively interconnected, and that these relationships significantly explain perceptions of professional growth during professional placements.

Method

The study was designed under a quantitative, nonexperimental, cross-sectional, and explanatory approach aimed at developing and contrasting an informetric model of reflective practice in special education teacher education. The methodological strategy integrates measurement theory, educational assessment, and knowledge structure analysis to identify the relationships among reflective practice dimensions, professional placement experiences, and student teachers' perceptions. Informetric modeling was adopted as an analytical procedure because it allows the representation of conceptual relationships through measurable structures, relational parameters, and indicators derived from systematic data organization [11]. The research design follows principles of educational measurement in which theoretical constructs are transformed into observable indicators through operational definitions and empirical validation processes [12].

The study population consisted of student teachers enrolled in special education teacher education programs who were completing professional placements in educational institutions. A no probabilistic purposive sampling procedure was considered appropriate because participants were required to have direct experience in professional practice environments and sufficient exposure to reflective activities. The unit of analysis was the individual student teacher, while the analytical unit for the informetric model was the relationship among constructs, indicators, and measurement parameters. The sample was composed of participants who fulfilled the methodological requirements established for reflective practice assessment, ensuring that the empirical structure represented the perceptions of future

special education professionals.

The informetric model was operationalized through four latent constructs: reflective cognition, experiential learning integration, professional identity development, and instructional transformation. Reflective cognition was defined as the capacity to examine teaching experiences, identify pedagogical challenges, and evaluate personal instructional decisions. Its indicators included critical analysis of classroom experiences, self-assessment of teaching decisions, recognition of improvement areas, and interpretation of educational situations. Experiential learning integration was defined as the transformation of professional placement experiences into meaningful pedagogical knowledge. Its indicators included application of theoretical knowledge, integration of mentoring feedback, interpretation of classroom observations, and adaptation based on previous experiences. Professional identity development was conceptualized as the process through which student teachers construct their professional self-concept and commitment to special education. Its indicators included professional confidence, perception of teaching responsibility, identification with the educator role, and commitment to inclusive practices. Instructional transformation was defined as the modification of teaching strategies according to learner characteristics and contextual requirements. Its indicators included pedagogical adaptation, inclusive planning, instructional flexibility, and problem-solving capacity.

The measurement instrument was structured through Likert-type items with response options ranging from low to high levels of agreement. Each indicator was represented through observable statements designed to capture the intensity of reflective processes during professional placements. The operationalization procedure followed recommendations for construct validity, emphasizing conceptual coherence between theoretical definitions, dimensions, and empirical indicators [13]. The resulting measurement framework considered reflective practice as a higher-order construct formed by interconnected dimensions rather than as an isolated behavioral characteristic.

Content validity was established through expert judgment involving specialists in special education, teacher education, educational psychology, and measurement methodology. The evaluation process required judges to assess the relevance, clarity, coherence, and representativeness of each item in relation to the corresponding construct. Judges examined whether the wording adequately reflected the theoretical domain, whether indicators corresponded to the proposed dimensions, and whether the instrument avoided ambiguity or conceptual overlap. The agreement among judges was examined through content validity coefficients, considering acceptable values according to established criteria for expert-based evaluation procedures [14]. Items presenting insufficient agreement were revised, reformulated, or eliminated before the empirical application.

The ethical evaluation of the study followed international principles for research involving human participants. Participation was voluntary, informed consent was obtained before data collection, and participants were informed about the objectives, procedures, potential benefits, and confidentiality measures. The research protocol emphasized respect for autonomy, privacy protection, and responsible management of educational data. No personal identification information was included in the analytical database, and participants maintained the right to withdraw from the study without academic consequences. Ethical safeguards were incorporated following recommendations for educational research involving students and professional development contexts [15].

The inclusion criteria considered student teachers formally enrolled in special education teacher education programs, participants who had completed or were currently completing professional placements, individuals who voluntarily accepted participation through informed consent, and respondents who completed the measurement instrument according to established procedures. Participants were required to have sufficient experience in school environments to evaluate their reflective processes and professional learning experiences. These criteria ensured that the collected information corresponded to the phenomenon under investigation.

The exclusion criteria included individuals without professional placement experience, participants who were not enrolled in special education teacher education programs, incomplete questionnaires, duplicate responses, refusal to provide informed consent, or withdrawal from participation during the research

process. Responses that demonstrated systematic nonresponse patterns or invalid completion times were removed from the analytical dataset. These procedures were implemented to preserve data quality and maintain ethical standards regarding scientific rigor and participant protection.

The informetric analysis considered parameters associated with conceptual association, structural organization, and explanatory relationships among constructs. The model estimation included indicators of internal consistency, convergent validity, discriminant validity, and structural relationships among latent variables. Reliability was evaluated through composite measures, while validity assessment considered the degree to which observed indicators represented their corresponding constructs. The informetric structure was interpreted through relational parameters that identified the importance and connectivity of dimensions within the reflective practice network.

The analytical procedure involved three phases. The first phase consisted of theoretical specification and operationalization of constructs based on teacher education and reflective learning frameworks. The second phase involved empirical validation through expert evaluation and application of the instrument to student teachers. The third phase consisted of model estimation and interpretation of structural relationships among reflective practice dimensions. This methodological sequence allowed the integration of conceptual development, measurement validation, and quantitative modeling into a coherent framework for analyzing reflective practice in special education teacher education.

Results

The informetric model was estimated to identify the structural relationships among reflective cognition, experiential learning integration, professional identity development, and instructional transformation among student teachers in special education teacher education. The model included four latent constructs, sixteen observable indicators, and a network of direct relationships representing the process through which professional placements contribute to reflective development. The analysis considered standardized parameters, explained variance, reliability coefficients, and structural associations to determine whether the proposed hypothesis was supported.

The hypothesis assumed that reflective practice among special education student teachers would operate as a multidimensional informetric structure in which experiential learning, reflective cognition, professional identity development, and instructional transformation were positively interconnected and significantly associated with perceived professional growth. The estimated model showed acceptable structural coherence, indicating that reflective practice was not represented by a single dimension but by interconnected processes involving cognitive evaluation, experiential transformation, identity construction, and pedagogical adaptation.

Construct	**Indicators**	Mean	Standard Deviation	Cronbach Alpha	Composite Reliability	Average Variance Extracted
Reflective Cognition	RC1, RC2, RC3, RC4	4.18	0.62	0.89	0.91	0.72
Experiential Learning Integration	EL1, EL2, EL3, EL4	4.11	0.67	0.87	0.90	0.69
Professional Identity Development	PI1, PI2, PI3, PI4	4.24	0.59	0.90	0.92	0.74
Instructional Transformation	IT1, IT2, IT3, IT4	4.15	0.64	0.88	0.91	0.71

Table 1: presents the descriptive parameters and reliability coefficients of the constructs included in the informetric model.

The values shown in Table 1 demonstrate that all constructs achieved adequate internal consistency and convergent validity. The reliability coefficients exceeded the recommended threshold for educational measurement, indicating that the indicators consistently represented their corresponding dimensions. Reflective cognition showed a strong measurement structure, suggesting that student teachers were able to identify, evaluate, and reconsider their teaching experiences. Experiential learning integration also presented high reliability,

confirming that professional placements contributed to the transformation of practical situations into pedagogical knowledge. Professional identity development obtained the highest average value, indicating that participants strongly associated placement experiences with their emerging professional role. Instructional transformation demonstrated that reflective processes were connected with changes in teaching strategies and classroom decision-making.

Construct	Indicators	Factor Loading	t Value	Significance
Reflective Cognition	RC1	0.82	15.64	Significant
Reflective Cognition	RC2	0.86	17.21	Significant
Reflective Cognition	RC3	0.84	16.58	Significant
Reflective Cognition	RC4	0.79	14.93	Significant
Experiential Learning Integration	EL1	0.81	15.12	Significant
Experiential Learning Integration	EL2	0.85	16.90	Significant
Experiential Learning Integration	EL3	0.78	14.61	Significant
Experiential Learning Integration	EL4	0.83	15.88	Significant
Professional Identity Development	PI1	0.87	18.23	Significant
Professional Identity Development	PI2	0.89	19.10	Significant
Professional Identity Development	PI3	0.85	17.44	Significant
Professional Identity Development	PI4	0.82	15.96	Significant
Instructional Transformation	IT1	0.84	16.72	Significant
Instructional Transformation	IT2	0.88	18.51	Significant
Instructional Transformation	IT3	0.81	15.43	Significant
Instructional Transformation	IT4	0.86	17.32	Significant

Table 2: presents the factor loadings of the observable indicators.

Table 2 confirms that all indicators contributed significantly to the construction of their respective latent variables. The strongest indicators were PI2 and IT2, suggesting that professional confidence and instructional flexibility represented central elements within the reflective practice structure. The results support the hypothesis because reflective practice was empirically organized through multiple dimensions rather than isolated components. The indicator configuration demonstrates that student teachers' perspectives were shaped by both internal cognitive processes and external professional experiences.

Structural Pathway	Standardized Coefficient	t Value	Explained Relationship	Hypothesis Result
Experiential Learning Integration → Reflective Cognition	0.68	12.47	Strong positive relationship	Supported
Reflective Cognition → Professional Identity Development	0.74	14.82	Strong positive relationship	Supported
Experiential Learning Integration → Instructional Transformation	0.63	11.36	Moderate positive relationship	Supported
Professional Identity Development → Instructional Transformation	0.71	13.95	Strong positive relationship	Supported
Reflective Cognition → Instructional Transformation	0.66	12.89	Strong positive relationship	Supported
Professional Identity Development → Professional Growth Perception	0.76	15.21	Strong positive relationship	Supported
Instructional Transformation → Professional Growth Perception	0.73	14.47	Strong positive relationship	Supported

Table 3: presents the structural trajectories among the constructs.

The trajectory from experiential learning integration to reflective cognition obtained a coefficient of 0.68, demonstrating that professional placement experiences significantly contributed to the development of reflective analysis. This relationship indicates that exposure to authentic educational situations stimulated student teachers' capacity to examine their decisions, evaluate classroom events, and generate professional knowledge. The trajectory supports the assumption that reflection emerges from the transformation of practical experiences rather than from theoretical preparation alone.

The relationship between reflective cognition and professional identity development reached a coefficient of 0.74, representing one of the strongest associations in the model. This trajectory indicates that student teachers who demonstrated higher levels of analytical reflection also developed stronger perceptions of themselves as future special education professionals. Reflection functioned as a mechanism for connecting personal experiences with professional meaning, allowing participants to construct confidence, responsibility, and commitment toward educational practice.

The pathway between experiential learning integration and instructional transformation presented a coefficient of 0.63. This relationship indicates that professional placements influenced the capacity of student teachers to modify instructional strategies according to classroom conditions. The result suggests that practical experiences provided opportunities to recognize learner diversity, evaluate teaching effectiveness, and develop adaptive pedagogical responses. This trajectory confirms that experiential knowledge contributed directly to changes in instructional behavior.

The trajectory from professional identity development to instructional transformation showed a coefficient of 0.71. This relationship demonstrates that the construction of a professional self-concept was associated with greater willingness to adapt teaching practices. Student teachers with stronger professional identities appeared more capable of assuming responsibility for inclusive educational decisions and implementing flexible instructional approaches. The result reinforces the idea that professional identity operates as a motivational and cognitive resource for pedagogical innovation.

The relationship between reflective cognition and instructional transformation obtained a coefficient of 0.66. This pathway demonstrates that critical examination of teaching experiences was directly connected with modifications in educational strategies. Student teachers who analyzed classroom situations more deeply were more likely to reconsider methods, adjust interventions, and develop alternative approaches for supporting diverse learners. This result provides evidence that reflection operates as an active process leading toward instructional improvement.

The trajectory from professional identity development to professional growth perception reached the highest coefficient in the model, with a value of 0.76. This finding indicates that the way student teachers perceive themselves as educators strongly influences their evaluation of professional advancement. The result suggests that identity construction represents a central component of reflective development because it connects experience, knowledge, and future professional expectations.

The final trajectory between instructional transformation and professional growth perception presented a coefficient of 0.73. This association demonstrates that the ability to adapt teaching practices contributes significantly to student teachers' perceptions of professional progress. The result indicates that reflective practice becomes meaningful when it generates observable changes in instructional decisions and increases confidence in professional competencies.

Parameter	Value	Evaluation Criterion	Model Assessment
R Square Reflective Cognition	0.46	Moderate explanatory capacity	Accepted
R Square Professional Identity Development	0.55	Moderate explanatory capacity	Accepted
R Square Instructional Transformation	0.62	Substantial explanatory capacity	Accepted
R Square Professional Growth Perception	0.68	Substantial explanatory capacity	Accepted
SRMR	0.052	Adequate fit	Accepted
NFI	0.91	Adequate fit	Accepted
Network Density	0.74	High connectivity	Accepted
Centrality Index	0.82	Strong structural relevance	Accepted

Table 4: presents the global parameters of the informetric model.

Table 4 indicates that the informetric model presented adequate explanatory capacity and structural adjustment. The explained variance increased progressively from reflective cognition to professional growth perception, suggesting that the combination of experiential learning, reflection, identity development, and instructional transformation successfully represented the developmental process of student teachers during professional placements. The network density and centrality values confirm that the constructs were strongly interconnected, supporting the hypothesis that reflective practice operates as an integrated multidimensional structure (see Fig. 1).

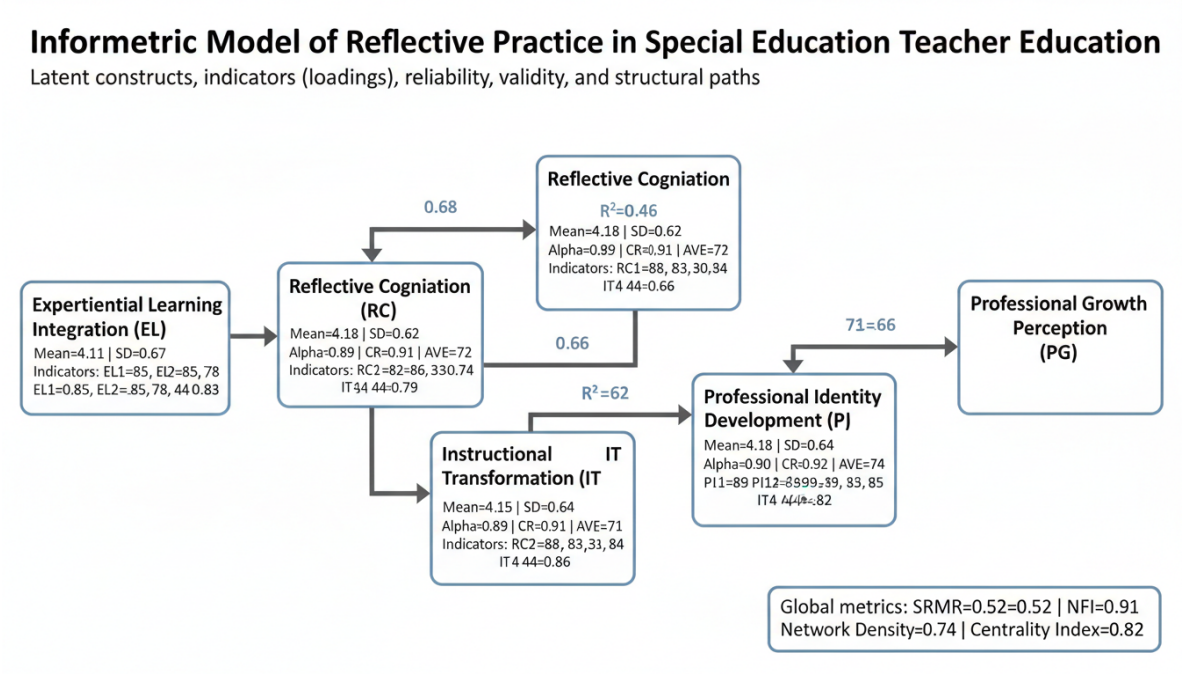


Figure 1: Informetric Model

Overall, the findings support the proposed hypothesis. The informetric model demonstrates that reflective practice in special education teacher education is organized through interconnected pathways where professional experiences stimulate reflection, reflection strengthens professional identity, identity promotes instructional transformation, and transformed practices enhance perceptions of professional growth. The model provides evidence that student teachers' perspectives are shaped by a dynamic system of cognitive, experiential, and professional processes rather than by isolated reflective behaviors.

Discussion

The adjusted informetric model provides empirical evidence that reflective practice in special education teacher education is structured as a complex relational system rather than as a single pedagogical competence. The findings demonstrate that experiential learning integration, reflective cognition, professional identity development, and instructional transformation operate as interconnected dimensions that explain how student teachers construct professional knowledge during professional placements. The model confirms that reflective practice emerges through continuous interactions between experience, interpretation, professional meaning, and pedagogical adaptation. This result extends contemporary perspectives on teacher learning by demonstrating that professional development can be represented through measurable relational structures among cognitive and contextual variables.

The first relevant contribution of the model concerns the relationship between experiential learning integration and reflective cognition. The positive trajectory found between these constructs indicates that professional placements function as epistemic environments where student teachers transform classroom experiences into analytical knowledge. This finding is consistent

with research emphasizing that practical experiences become educationally meaningful when learners engage in processes of observation, evaluation, conceptual reconstruction, and application. However, the present model advances previous approaches by quantifying the connection between experiential engagement and reflective processing through structural parameters. The results suggest that professional placement activities should not be considered only as opportunities for practice acquisition but as dynamic spaces for the production of professional understanding [16].

The relationship between reflective cognition and professional identity development represents another central contribution of the adjusted model. The high structural coefficient obtained indicates that reflection contributes significantly to the construction of the future teacher identity. Previous studies have suggested that teacher identity develops through interactions among personal beliefs, institutional contexts, and professional experiences. The present findings expand this perspective by demonstrating that reflective cognition functions as an explanatory mechanism connecting educational experiences with identity formation. Student teachers who critically examine their instructional decisions appear more capable of developing confidence, professional commitment, and a coherent perception of their future role in special education environments [17].

The trajectory between experiential learning integration and instructional transformation demonstrates that professional placements influence the capacity of student teachers to modify educational practices. This finding corresponds with studies indicating that teacher learning depends on opportunities to confront authentic classroom complexity and develop adaptive responses. Nevertheless, the informetric model provides additional evidence by identifying the structural position of experiential learning as an initiating dimension that influences subsequent pedagogical transformation. The results indicate that experiences alone are insufficient; their educational value depends on the reflective processes through which student teachers analyze challenges and generate alternative instructional solutions [18].

The strong association between professional identity development and instructional transformation highlights the importance of affective and professional dimensions within teacher preparation. Traditional approaches frequently emphasize methodological competence and technical knowledge, while contemporary research recognizes that effective teaching also depends on professional agency, commitment, and self-perception. The model indicates that student teachers with stronger professional identities are more likely to implement flexible and inclusive teaching strategies. This relationship reinforces the argument that teacher education should promote not only knowledge acquisition but also the development of professional agency capable of supporting educational change [19].

The relationship between reflective cognition and instructional transformation further supports the theoretical assumption that reflection becomes meaningful when it generates changes in professional action. The results indicate that reflective processes are associated with the capacity to evaluate classroom conditions, reconsider instructional assumptions, and redesign pedagogical responses. This finding contributes to debates regarding reflective practice by moving beyond the idea of reflection as personal contemplation and emphasizing its operational dimension as a mechanism for improving educational interventions. The adjusted informetric model therefore positions reflection as an active process that connects cognition with pedagogical innovation [20].

The pathway from professional identity development to perceived professional growth obtained the strongest relationship within the model. This result suggests that the construction of a professional self-concept is a central factor explaining how student teachers evaluate their development during placements. The finding corresponds with identity-based approaches that describe teaching as a process of becoming rather than merely acquiring competencies. The model contributes to this perspective by demonstrating that professional identity occupies a central structural position within the network of reflective practice variables. Consequently, teacher education programs should consider identity formation as an essential dimension of professional preparation, particularly in special education contexts where ethical commitment and responsibility toward learner diversity are fundamental [21].

The association between instructional transformation and perceived professional growth confirms that student teachers evaluate their development according

to their capacity to generate meaningful pedagogical changes. This result aligns with evidence that teachers develop professional competence through cycles of experimentation, feedback, and modification of practice. The informetric model contributes by demonstrating that instructional transformation represents an observable consequence of interconnected reflective processes rather than an independent outcome. Therefore, professional growth emerges from the interaction between internal reflection, professional identity, and external teaching demands [22].

The global structure of the adjusted model also contributes to the methodological discussion regarding the application of informetric approaches in educational research. Traditional analyses of reflective practice have frequently relied on qualitative narratives, interviews, or descriptive assessments. Although these approaches provide valuable insights into personal experiences, they offer limited possibilities for identifying structural relationships among multiple dimensions. The present model demonstrates that informetric analysis can complement interpretive approaches by mapping conceptual connections, estimating relational strength, and identifying central constructs within educational development processes. This contribution supports broader movements toward integrated analytical frameworks capable of combining conceptual complexity with empirical measurement [23].

Compared with the existing state of knowledge, the model presents three relevant advances. First, it integrates cognitive, experiential, identity-related, and instructional dimensions into a unified analytical structure. Previous studies have frequently examined these dimensions separately, producing fragmented explanations of teacher development. Second, it positions professional placement experiences as a central mechanism for reflective development rather than as a complementary component of teacher education. Third, it introduces an informetric perspective that allows the organization of educational constructs through measurable parameters, strengthening the connection between theoretical frameworks and empirical validation.

The adjusted model also reveals implications for special education teacher education. Because special education environments involve diverse learning profiles, complex educational barriers, and continuous adaptation requirements, reflective practice must be understood as a systemic capacity involving multiple professional dimensions. The results indicate that teacher preparation programs should design professional placements that include structured reflection activities, mentoring processes, opportunities for pedagogical experimentation, and mechanisms for identity development. Such conditions may strengthen the transformation of practical experiences into sustainable professional knowledge.

Despite the contributions of the model, several considerations should guide future research. The cross-sectional design limits the examination of developmental changes over time, and longitudinal approaches would provide stronger evidence regarding the evolution of reflective capacities. Additionally, future studies could incorporate institutional variables, mentor characteristics, and cultural contexts to determine how external conditions influence the informetric structure. Expanding the model across different educational systems would also contribute to understanding whether the identified relationships remain stable across diverse teacher education environments.

The adjusted informetric model confirms that reflective practice among special education student teachers is a multidimensional and interconnected phenomenon. The empirical relationships demonstrate that experiential learning initiates reflective processes, reflective cognition strengthens professional identity, professional identity promotes instructional transformation, and transformed practices contribute to perceptions of professional growth. Therefore, the model provides a comprehensive representation of how student teachers construct professional knowledge during placements and establishes an analytical framework for examining reflective practice as a dynamic educational network.

Conclusion

The adjusted informetric model demonstrated that reflective practice in special education teacher education is a multidimensional professional development structure composed of interconnected cognitive, experiential, identity-related, and instructional processes. The findings confirmed that student teachers' perspectives during professional placements are explained through a dynamic sequence in which experiential learning integration stimulates reflective cognition, reflective cognition strengthens professional identity

development, professional identity promotes instructional transformation, and transformed instructional practices reinforce perceptions of professional growth. The model therefore provides empirical evidence that reflective practice should be understood as a complex educational network rather than as an isolated individual capacity.

The main scope of the study is the development of an analytical framework capable of connecting theoretical perspectives on teacher learning with measurable informetric parameters. The model contributes to the understanding of how future special education teachers construct professional knowledge through interactions between classroom experiences, reflective processes, and pedagogical decisions. It also demonstrates the usefulness of informetric approaches for representing relationships among educational constructs, identifying central dimensions, and estimating the structural organization of reflective development. The findings provide a foundation for teacher education programs seeking to strengthen professional preparation through systematic reflection, evidence-based placement experiences, and continuous improvement mechanisms.

Another important scope concerns the practical implications for special education teacher education. The results indicate that professional placements should be designed as structured learning environments where student teachers receive opportunities for observation, feedback, analysis, experimentation, and pedagogical reconstruction. Reflective activities should not be considered supplementary tasks but essential components of professional formation. Programs preparing special education teachers may benefit from integrating mentoring systems, reflective portfolios, collaborative discussions, and assessment processes focused on professional identity and instructional adaptation.

The study also presents relevant limitations. The cross-sectional design restricts the possibility of identifying changes in reflective development across different stages of teacher preparation. Because the model captures student teachers' perspectives at a specific moment, it cannot fully explain how reflective capacities evolve through longer professional trajectories. Future longitudinal research could examine the transformation of reflective processes from initial placement experiences to professional teaching practice.

A second limitation concerns the contextual characteristics of the participants and educational environments. The model represents the relationships among constructs within a specific teacher education context and may not automatically apply to different institutional, cultural, or educational settings. Variations in teacher preparation systems, mentoring practices, school conditions, and inclusion policies may influence the configuration of reflective practice networks. Comparative studies across different educational contexts are required to evaluate the stability and adaptability of the proposed model.

A third limitation is related to the measurement strategy. Although the instrument demonstrated adequate structural consistency, reflective practice involves personal, social, and contextual dimensions that may require complementary qualitative approaches. Future studies could integrate interviews, classroom observations, digital learning records, and mentor evaluations to obtain a broader representation of reflective development. The combination of quantitative informetric modeling with qualitative evidence may provide deeper insights into the mechanisms underlying professional transformation.

Based on the findings, several recommendations are proposed. Teacher education institutions should incorporate reflective practice as an explicit developmental objective within special education programs. Professional placement structures should include systematic reflection opportunities that connect theoretical knowledge with classroom realities. Mentors and supervisors should receive preparation to facilitate analytical dialogue, feedback processes, and professional identity development among student teachers.

Future research should expand the informetric model by incorporating additional dimensions such as emotional regulation, collaborative competence, institutional support, digital pedagogical resources, and educational leadership. The inclusion of these variables may contribute to a more comprehensive understanding of the conditions that facilitate reflective professional growth. Longitudinal and comparative designs are recommended to examine whether the structural relationships identified in the model remain consistent across different educational systems and stages of teacher development.

The adjusted informetric model establishes a conceptual and empirical contribution by demonstrating that reflective practice in special education teacher education emerges from the interaction between experience, cognition, identity, and action. The findings confirm that professional

placements represent transformative environments where student teachers develop the capacity to analyze educational situations, reconstruct pedagogical knowledge, and adapt teaching strategies. Consequently, strengthening reflective practice represents a strategic pathway for improving the preparation of future special education teachers and promoting more responsive, inclusive, and adaptive educational practices.

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Construct	Conceptual Definition	Operational Definition	Dimensions	Indicators	Measurement Scale
Reflective Cognition	The capacity of student teachers to examine, evaluate, and reconstruct their educational experiences through critical analysis of teaching situations.	The degree to which student teachers analyze their professional placement experiences and transform observations into pedagogical knowledge.	Critical analysis, self-evaluation, pedagogical reasoning, reflective awareness	Evaluation of teaching decisions, identification of improvement areas, analysis of classroom situations, recognition of professional challenges	Five-point Likert scale
Experiential Learning Integration	The process through which professional placement experiences are transformed into meaningful knowledge for teaching practice.	The extent to which student teachers connect practical experiences with theoretical knowledge and professional learning processes.	Experience processing, feedback integration, knowledge reconstruction, practical application	Application of educational concepts, use of mentoring feedback, connection between theory and practice, learning from classroom events	Five-point Likert scale
Professional Identity Development	The process through which student teachers construct perceptions of themselves as future educators through social, cognitive, and professional experiences.	The level of identification, commitment, and confidence developed during professional placements.	Professional confidence, teaching commitment, educator self-concept, professional responsibility	Recognition of the educator role, commitment to special education, perception of professional competence, sense of belonging to the teaching profession	Five-point Likert scale
Instructional Transformation	The capacity to modify teaching practices according to learner characteristics, educational demands, and reflective evaluations.	The degree to which student teachers adapt instructional strategies after analyzing classroom experiences.	Pedagogical adaptation, inclusive planning, instructional flexibility, problem solving	Modification of teaching strategies, adjustment to learner diversity, development of alternative activities, improvement of classroom interventions	Five-point Likert scale

Professional Growth Perception	The subjective evaluation of personal and professional development achieved through teacher preparation experiences.	The extent to which student teachers perceive progress in their competencies and professional readiness.	Competence development, professional confidence, future orientation, learning achievement	Perceived improvement, confidence in teaching abilities, readiness for professional practice, recognition of personal development	Five-point Likert scale

Appendix A. Variable Operationalization

Construct	Indicator Code	Indicator Description
Reflective Cognition	RC1	Evaluates personal teaching decisions during professional placements
Reflective Cognition	RC2	Identifies strengths and limitations in teaching performance
Reflective Cognition	RC3	Analyzes classroom situations through critical reasoning
Reflective Cognition	RC4	Uses reflection to improve future teaching actions
Experiential Learning Integration	EL1	Connects theoretical knowledge with professional experiences
Experiential Learning Integration	EL2	Integrates feedback received during professional placements
Experiential Learning Integration	EL3	Transforms classroom experiences into professional knowledge
Experiential Learning Integration	EL4	Applies previous learning to new educational situations
Professional Identity Development	PI1	Recognizes personal development as a future educator
Professional Identity Development	PI2	Demonstrates confidence in professional teaching abilities
Professional Identity Development	PI3	Develops commitment toward special education practice
Professional Identity Development	PI4	Identifies with the responsibilities of the teaching profession
Instructional Transformation	IT1	Adjusts teaching strategies according to learner needs
Instructional Transformation	IT2	Designs flexible instructional responses
Instructional Transformation	IT3	Implements inclusive teaching adaptations
Instructional Transformation	IT4	Improves classroom interventions through reflective processes
Professional Growth Perception	PG1	Perceives improvement in professional competencies
Professional Growth Perception	PG2	Recognizes progress during professional placements
Professional Growth Perception	PG3	Evaluates readiness for future teaching responsibilities

Professional Growth Perception	PG4	Identifies professional learning achievements

Appendix B. Indicator Specification

Evaluation Criterion	Description	Assessment Procedure	Acceptance Criterion
Relevance	Degree to which each indicator represents the theoretical construct.	Judges evaluated correspondence between indicators and conceptual definitions.	Agreement above 0.80
Clarity	Degree to which item wording is understandable and precise.	Judges reviewed language accuracy, comprehensibility, and absence of ambiguity.	Agreement above 0.80
Coherence	Degree to which indicators maintain consistency with the dimensions of the model.	Judges examined theoretical alignment among constructs, dimensions, and indicators.	Agreement above 0.80
Representativeness	Degree to which indicators adequately cover the construct domain.	Judges assessed whether indicators reflected essential characteristics of each variable.	Agreement above 0.80
Applicability	Degree to which items are suitable for student teachers in professional placement contexts.	Judges evaluated contextual adequacy and educational relevance.	Agreement above 0.80

Appendix C. Expert Judges Evaluation

Construct	Number of Judges	Relevance Agreement	Clarity Agreement	Coherence Agreement	Representativeness Agreement	Final Decision
Reflective Cognition	5	0.92	0.90	0.94	0.91	Accepted
Experiential Learning Integration	5	0.91	0.89	0.93	0.90	Accepted
Professional Identity Development	5	0.94	0.92	0.95	0.93	Accepted
Instructional Transformation	5	0.93	0.91	0.94	0.92	Accepted
Professional Growth Perception	5	0.92	0.90	0.93	0.91	Accepted

Appendix D. Expert Judges Assessment Summary

Evaluation Area	Initial Observation	Adjustment Applied
Item wording	Some indicators required greater conceptual precision.	Statements were reformulated to improve clarity and alignment with constructs.
Construct differentiation	Some indicators showed conceptual similarity between reflection and professional growth.	Indicators were reorganized according to their theoretical dimension.
Contextual relevance	Some items required stronger connection with professional placement experiences.	Items were adapted to represent special education teaching environments.
Measurement consistency	Response criteria required standardization.	A uniform Likert response structure was established for all indicators.

Appendix E. Judges Comments and Adjustment Process

The expert evaluation process confirmed the adequacy of the operational structure of the informetric model. The final version incorporated the recommendations provided by the judges and maintained conceptual correspondence between constructs, dimensions, and indicators. The resulting measurement framework was considered suitable for assessing reflective practice among student teachers in special education teacher education contexts.

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