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Enhancing comprehensive clinical competence in nursing students through intensive diabetes management training: A mixed-methods study

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Abstract:

BACKGROUND: Diabetes is a major global health challenge requiring specialized nursing care. This study aimed to evaluate the effectiveness of an intensive clinical practicum program in developing nursing students' clinical competence in diabetes management.

MATERIALS AND METHODS: This convergent parallel mixed-methods study was conducted at Islamic Azad University, Najafabad Branch, in the first semester of 2024. A purposive sample of 50 fifth-semester nursing students who had completed relevant diabetes management theory courses was selected using purposive sampling. Data collection included pre- and postintervention performance assessments using a 31-item tool, self-report questionnaires with open-ended questions, and daily reflective journals. Quantitative data were analyzed using paired *t*-tests, Mann–Whitney *U*-test, and Spearman correlations. Inductive thematic analysis, following a five-stage process, was used for the qualitative data.

RESULTS: The results demonstrated a statistically significant impact of the intensive diabetes management training program on improving students' clinical competence. The mean scores in all dimensions, including theoretical knowledge (a 50% increase), clinical skills, communication, and critical thinking, improved significantly ($P < 0.05$). The main qualitative theme was “development of comprehensive clinical competence in diabetes management.”

CONCLUSION: This study demonstrates that intensive clinical practicums effectively develop nursing students' diabetes management competence. Health policymakers should prioritize funding for these programs, given their potential to improve the quality of diabetes care and reduce long-term healthcare costs. Nursing managers should collaborate with educators to provide structured clinical experiences and mentorship opportunities. Standardizing program curricula based on best practices will ensure consistent and high-quality training, ultimately enhancing public health outcomes.

Keywords:

Clinical competence, diabetes mellitus, experiential learning, mixed-methods research, nursing education

Introduction

Diabetes has become a global health crisis, posing significant challenges to healthcare systems worldwide. In 2021, an estimated 537 million adults (aged 20–79)

were living with diabetes, a number projected to reach 783 million by 2045.^[1] This chronic condition diminishes patients' quality of life and imposes substantial economic burdens, with global healthcare expenditures reaching US\$966 billion in 2021.^[2]

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The escalating burden of diabetes necessitates a comprehensive management approach encompassing patient education, blood glucose control, and complication prevention.^[3] Nurses, as integral members of the healthcare team, play a pivotal role in delivering holistic care and patient education.^[4] Research demonstrates that nursing interventions positively impact glycemic control, reduce complications, and improve the quality of life for individuals with diabetes.^[5] Therefore, nurses must be well informed about these interventions to effectively counsel patients. Equipping nursing students with the necessary knowledge and skills is paramount to addressing this critical public health challenge. Integrating knowledge of these therapies into nursing curricula prepares students to provide cutting-edge care. Clinical practicums offer a valuable opportunity to bridge the gap between theoretical knowledge and practical application.^[6-8] However, accurately assessing student learning within these dynamic environments presents significant challenges.

Multidimensional assessment methods, such as self-reporting and task analysis, offer a more comprehensive understanding of student learning.^[9] The use of comprehensive assessment tools further enhances the accuracy and precision of evaluating student progress in clinical settings.^[10] While these approaches are valuable, research gaps remain in the comprehensive evaluation of clinical education programs designed to develop key nursing competencies in diabetes management. Effective clinical education programs are crucial for building a more competent nursing workforce and ultimately improving patient care.^[11] A critical component of such programs is understanding the risk factors associated with different types of diabetes, which is essential for effective prevention and management.^[12,13] However, previous studies often focused primarily on assessing theoretical knowledge and practical skills, neglecting more complex competencies like critical thinking and communication.^[14] Furthermore, the influence of individual factors, such as age and prior experience, on competency development has not been fully explored. To address these gaps and provide a more holistic evaluation, this study offers a novel and comprehensive assessment of an intensive clinical practicum. Specifically, this study employs a mixed-methods approach to examine the practicum's impact on a broader range of competencies, including those often overlooked in previous research.

This study is grounded in Bandura's social cognitive theory^[15] and Kolb's experiential learning model,^[16] with additional insights from the Nursing Educational Framework (NEF) proposed by Choperena *et al.*^[14] Integrating these theories and frameworks provides a comprehensive approach for understanding how clinical competencies develop among nursing students during

intensive clinical practicums. The NEF, which emphasizes a person/family-centered and relationship-based curriculum, aligns well with the social and experiential aspects of learning highlighted by Bandura and Kolb, offering a nurse-driven perspective on educational design.

The primary aim of this study was to evaluate the effectiveness of an intensive clinical practicum program in developing comprehensive clinical competencies in diabetes management among nursing students. By employing a multidimensional assessment approach, this study provides a more nuanced understanding of the program's impact.

The findings of this study are expected to provide valuable insights into how intensive clinical practicums can enhance various nursing skills and serve as a useful guide for nursing educators in designing more effective educational programs. Ultimately, this will contribute to improving the quality of nursing education and care for individuals with diabetes.

Materials and Methods

Study design and setting

This study employed a convergent parallel mixed-methods design to evaluate the effectiveness of an intensive diabetes management clinical practicum program on nursing students' clinical competencies. The study was conducted at the Islamic Azad University, Najafabad Branch, during the first semester of the 2024 academic year.

The quantitative component involved comparing students' self-reported scores on a performance assessment tool (A) before and after the intervention. This tool consisted of 31 items measuring seven core clinical competencies. The qualitative component used two data collection instruments:

- A self-report questionnaire (B) completed by students at the end of the program
- Daily reflective journals, case analyses, and care plans (C) completed throughout the clinical practicum.

This mixed-methods design allowed for a comprehensive evaluation of the program's effectiveness by comparing pre- and postintervention quantitative scores and conducting an in-depth analysis of students' qualitative experiences and feedback.

Study participants and sampling

The study population comprised all full-time nursing students enrolled in the first semester of 2024 at Islamic Azad University, Najafabad Branch. A purposive sample of 50 fifth-semester nursing students who had

completed relevant diabetes management theory courses was selected for this study. Fifth-semester students were chosen because of their established foundation in basic nursing concepts and readiness for advanced clinical experiences. The exclusion criteria included missing more than one educational session and incomplete assessment tools. Sample size was determined using G*Power with a 95% confidence level, 80% power, and a medium effect size.

Intensive clinical practicum program

The intensive clinical practicum program was designed as an integration of Bandura's social cognitive theory, Kolb's experiential learning model, and insights from the NEF proposed by Choperena *et al.* This comprehensive approach guided the development of the program's structure and content to foster clinical competence in diabetes management.

Drawing upon Bandura's social cognitive theory, the program focused on enhancing students' self-efficacy by providing opportunities for mastery experiences, vicarious learning, social persuasion, and managing emotional and physiological states related to diabetes care.^[15] Activities were structured to build confidence in their ability to manage individuals with diabetes.^[15]

The program's stages were structured according to Kolb's experiential learning,^[16] incorporating a cyclical process of:

- Concrete experience: Providing direct patient care experiences in diverse clinical settings
- Reflective observation: Encouraging students to reflect on their experiences, analyze their actions, and identify areas for improvement through reflective journaling and group discussions
- Abstract conceptualization: Integrating theoretical knowledge with practical experiences through lectures, case studies, and evidence-based practice guidelines
- Active experimentation: Applying newly acquired knowledge and skills in clinical settings under the supervision of experienced preceptors.

Furthermore, the program integrated key principles from the NEF proposed by Choperena *et al.*^[14] These principles emphasized:

- Person/family-centered care: Fostering a holistic approach to diabetes management that considers the individual needs, preferences, and cultural backgrounds of patients and their families
- Relationship-based curriculum: Emphasizing the importance of building strong therapeutic relationships with patients to promote trust, collaboration, and adherence to treatment plans
- Nurse-driven perspective: Empowering students to actively participate in the design and implementation

of care plans, promoting autonomy and professional growth.

This integrated approach ensured that the clinical practicum program not only provided students with essential knowledge and skills but also fostered self-efficacy, critical thinking, and a commitment to patient-centered care, aligning with both established learning theories and contemporary nursing education principles.

The 6-day intensive clinical practicum, held over 3 consecutive weeks, was delivered to groups of ten nursing students. The program included diabetes self-management education workshops. The curriculum was designed based on American Diabetes Association (ADA) standards and covered the following topics:

- Diabetes self-care: Diabetic diet, physical activity, self-monitoring of blood glucose, insulin therapy, coping strategies, problem-solving, risk reduction
- Interviewing skills: Assessing children and adults with diabetes and identifying priority problems
- Developing individualized education and care plans: Based on patient assessment
- Blood glucose monitoring equipment: Glucometers, lancets, continuous glucose monitoring (CGM) systems
- Insulin delivery devices: Syringes, insulin pens, insulin pumps, injection sets
- Suitable exercises for individuals with diabetes: Aerobic, stretching, strength training, and balance exercises
- Diabetes nutrition: Carbohydrate counting, glycemic index, body composition analysis
- Insulin therapy: Vials and pens, insulin-to-carbohydrate ratio, insulin sensitivity factor, and correction insulin dosing
- Healthy coping strategies: For diabetes and mental health issues
- Complication prevention: Hypoglycemia, hyperglycemia, long-term complications of diabetes, illnesses, influenza vaccination, dental care, and hospitalization.

This educational program employed a multifaceted approach to enhance nursing students' diabetes management competencies, integrating several key pedagogical strategies:

- Peer teaching: Facilitated by a certified diabetes educator, peer teaching fostered collaborative learning and knowledge sharing among students
- Case-based learning: Simulating real-world clinical scenarios, case-based learning allowed students to apply theoretical knowledge to complex patient situations

- Patient interviews: Patient interviews provided valuable opportunities to develop essential communication and interpersonal skills crucial for patient-centered care
- Hands-on experience with CGM devices: Hands-on experience with CGM devices, including sensors and insulin pumps, provided students with practical experience using modern technologies for diabetes management. This multifaceted approach equipped students with both the theoretical foundation and the practical skills necessary to provide high-quality, patient-centered care for individuals living with diabetes.

To guide the design of the intensive diabetes management practicum, we developed a comprehensive conceptual framework [Figure 1] integrating Bandura's social cognitive theory, Kolb's experiential learning model, and the NEF proposed by Choperena *et al.* This integrated

framework illustrates the intended connections between the educational interventions, the development of clinical competencies, and the expected student learning outcomes, while emphasizing a person/family-centered and relationship-based approach to nursing education.

Data collection tool and technique

This study employed a comprehensive approach to data collection using three distinct tools to capture the multifaceted nature of nursing students' clinical competencies in diabetes management.

- Performance assessment tool (A): This tool comprised 31 items across seven domains, evaluating theoretical knowledge, clinical skills, communication and problem-solving skills, critical thinking, professionalism, self-directed learning, and written and oral reporting. Each item was rated on a 4-point Likert scale from 1 (needs improvement) to 4 (excellent). Students completed this tool at

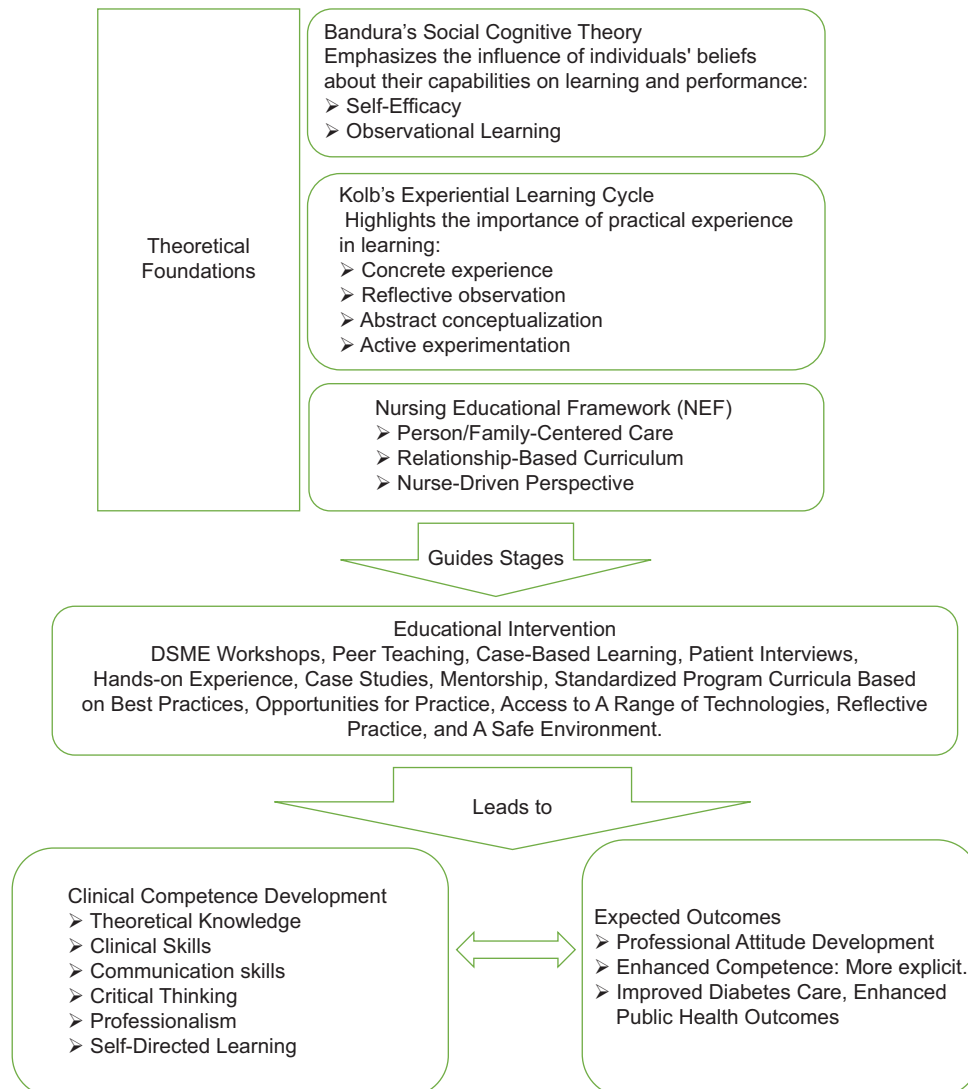


Figure 1: Integrated conceptual framework for developing clinical competence in diabetes management

the beginning and end of the clinical practicum to measure their progress

- Self-report questionnaire (B): This qualitative tool consisted of four main sections: personal information, assessment of knowledge and skills, strengths and weaknesses, and suggestions. The section on assessing knowledge and skills included open-ended questions on theoretical knowledge, practical skills, communication skills, and professional attitudes. Students completed this questionnaire at the end of the clinical practicum
- Daily reflective journal, case analysis, and care plan (C): This comprehensive tool was designed based on Bloom's taxonomy. It included sections such as "what I learned," "daily activity report," "diabetes case interview," "case analysis," and "education/care plan." Students completed this tool daily throughout the clinical practicum. This tool provided a comprehensive assessment of students' learning across all domains and served as a learning log.

Data collection process

Data collection occurred at three distinct time points:

- Prepracticum: Students completed the performance assessment tool (A) using a Likert scale
- During the practicum: Students completed daily reflective journals (C)
- Postpracticum: Students completed the self-report questionnaire (B) and the performance assessment tool (A) again and submitted their final case analysis and care plan in the daily reflective journal (C).

Validity and reliability measures

To ensure the rigor of the data collection tools, several measures were implemented:

- Content validity: Ten experts in nursing education and diabetes management evaluated the relevance of each item. The content validity index exceeded 0.85 for all items, and the content validity ratio was above 0.62, indicating the high relevance and importance of the items in measuring the intended constructs
- Face validity: Twenty nursing students, independent of the main study sample, assessed the clarity, simplicity, and comprehensibility of the instruments. Their feedback informed the necessary revisions
- Reliability: The performance evaluation form (A) demonstrated high internal consistency with a Cronbach's alpha of 0.898. For the qualitative tools (B and C), inter-rater reliability was assessed using Cohen's kappa, yielding a coefficient of 0.82, indicating strong agreement between independent raters.

Ethical considerations

This study was approved by the Ethics Committee of Azad University, Najafabad branch (approval code:

IR.IAU.NAJAFABAD.REC.1403.193). All participants provided written informed consent and were assured of data confidentiality and their right to withdraw from the study at any time. Data were collected and analyzed anonymously.

AI tool disclosure: During the preparation of this manuscript, the author utilized Perplexity AI (<https://www.perplexity.ai>) solely for language editing and grammatical refinement. All content, including the Introduction, Materials and Methods, Results, data interpretation, Conclusions, and clinical insights, was independently generated by the primary author, who bears full responsibility for the accuracy and originality of all manuscript content.

Data analysis

Quantitative data from the performance evaluation form (A) were analyzed using paired *t*-tests to compare pre- and postpracticum scores. The Mann-Whitney *U*-test was employed to examine gender differences in outcomes, while Spearman's correlation assessed the relationships between demographic variables and performance scores.

Qualitative data from forms B and C underwent inductive thematic analysis, following a rigorous five-stage process: familiarization with the data, initial coding, theme identification, theme review and definition, and final reporting. This process was conducted independently by two researchers to ensure reliability.

The trustworthiness of the qualitative data was ensured through the application of Lincoln and Guba's criteria,^[17] including credibility (data triangulation and member checking), dependability (rigorous documentation), confirmability (independent analysis by two researchers), and transferability (detailed description of context and participants).

Results

This study employed a mixed-methods approach, integrating quantitative and qualitative data to evaluate the effectiveness of an intensive diabetes management clinical practicum. Quantitative analysis of pre- and postintervention performance assessments demonstrated significant improvements in students' clinical competence across all domains, including theoretical knowledge, clinical skills, communication, and critical thinking [Tables 1-3]. Concurrently, qualitative analysis of student self-reports and daily reflective journals revealed key themes, including "development of specialized knowledge" and "enhancement of communication and interviewing skills with individuals with diabetes" [Tables 4 and 5].

Table 1: Comparison of mean scores before and after the intervention using paired *t*-test

Variable	Mean±SD		<i>t</i>	Significance level (<i>P</i>)	ES
	Before	After			
Theoretical knowledge	20.00±3.31	30.08±3.93	28.17	<0.001	0.94
Clinical skills	10.54±1.53	16.80±1.70	44.90	<0.001	0.98
Communication and problem-solving	14.08±2.72	19.88±2.69	29.30	<0.001	0.95
Critical thinking	3.30±1.39	5.84±1.00	16.17	<0.001	0.84
Professionalism	15.08±1.63	15.44±0.84	2.35	0.023	0.10
Self-directed learning	4.02±1.19	6.06±1.24	15.88	<0.001	0.96
Structured reporting	4.32±1.15	6.18±1.52	18.78	<0.001	0.88
Overall performance	2.02±0.74	2.94±0.98	16.43	<0.001	0.85

ES=Effect size (partial η^2), SD=Standard deviation**Table 2: Gender differences in nursing students' competencies after program completion**

Variable	Mean±SD		<i>Z</i>	<i>P</i>
	Female	Male		
Theoretical knowledge	31.08±3.21	27.50±4.52	2.83	0.005
Clinical skills	17.31±14.41	15.50±1.74	3.13	0.002
Communication and problem-solving	20.44±2.31	18.43±3.13	2.04	0.041
Critical thinking	5.86±1.07	5.79±0.80	0.51	0.611
Professionalism	15.56±0.65	15.14±1.17	1.11	0.267
Self-directed learning	6.36±1.05	5.29±1.38	2.41	0.016
Structured reporting	6.56±1.40	5.21±1.42	2.94	0.003
Overall performance	3.08±0.97	2.57±0.94	1.85	0.063

P<0.05 are considered statistically significant. Sample sizes=female (*n*=36), male (*n*=14). SD=Standard deviation**Table 3: Spearman's correlation coefficients (*P*) for the relationship between the variables and age/grade point average**

Variable	Age	GPA
Theoretical knowledge	0.336 (0.017)	0.219 (0.126)
Clinical skills	0.206 (0.152)	0.337 (0.017)
Communication and problem-solving	0.129 (0.372)	0.099 (0.494)
Critical thinking	0.252 (0.077)	0.274 (0.054)
Professionalism	-0.111 (0.441)	0.172 (0.233)
Self-directed learning	0.387 (0.006)	-0.014 (0.924)
Structured reporting	0.049 (0.736)	0.102 (0.481)
Overall performance	0.003 (0.983)	0.036 (0.802)

P<0.05 are considered statistically significant. GPA: Grade point average

These findings collectively provide strong evidence that the intensive clinical practicum effectively enhanced students' clinical competence in caring for individuals with diabetes. The findings emphasize the importance of a comprehensive approach to nursing education that integrates theory and practice to foster holistic diabetes management skills.

Quantitative analysis

This study included 50 nursing students residing in various regions of the Isfahan Province, Iran. Participant characteristics included a mean age of 23.5 years (standard deviation = 4.2), with 72% female and 96% single. The sample exhibited a diverse range of ages (20–46 years) and grade point averages (GPAs) (12.15–19.25), enhancing the generalizability of the findings.

Paired *t*-tests revealed significant improvements in all dimensions of clinical competence following the intensive diabetes management clinical practicum (*P* < 0.05). As shown in Table 1, the mean scores significantly increased across all domains, including theoretical knowledge (a 50% increase), clinical skills, communication skills, problem-solving, critical thinking, professionalism, self-directed learning, and structured reporting skills. Large partial eta-squared effect sizes (>0.14) were observed for all variables, indicating a strong effect of the intervention on all dimensions of clinical competence.

As shown in Table 2, the results of the Mann–Whitney *U*-test revealed significant differences between male and female students in some dimensions of clinical competence after the intervention. Female students performed significantly better in theoretical knowledge, clinical skills, self-directed learning, and written and oral structured reporting (*P* < 0.05). However, no significant differences were found between the two groups in terms of critical thinking, professionalism, and overall performance.

To examine the relationship between age, GPA, and different dimensions of clinical competence, Spearman's correlation was used. The results presented in Table 3 indicate significant correlations between some variables.

The findings showed a significant positive correlation between age and theoretical knowledge (*r* = 0.336, *P* = 0.017) and self-directed learning (*r* = 0.387, *P* = 0.006). This indicates that as students' age increases, so does their

Table 4: Main themes and subthemes extracted from the qualitative analysis of the nursing students' self-report questionnaires

Main theme	Subthemes	Supporting evidence
Development of specialized knowledge	Mastery of the diabetes pathophysiology Understanding of diabetes types, knowledge of diabetes complications Awareness of the treatment methods	"I have a complete understanding of the physiology of type 1 and type 2 diabetes and am confident in my knowledge of the control methods"
Enhancement of practical skills	Designing meal plans Accurate blood glucose measurement and insulin administration	"I have a thorough understanding of MyPlate and can create a meal plan for a person with diabetes"
Familiarity with new technologies	Using modern blood glucose monitoring devices Familiarity with insulin pumps Using diabetes management apps	"I was familiar with the glucometer but in this center, I realized the importance and accuracy of glucose measurements by comparing them with laboratory results"
Improved communication skills	Effective patient interviewing Active listening Simplifying the medical information	"Active listening and guiding the patient's conversation to obtain sufficient and useful information is essential in the interview process"
Positive professional attitude	Adherence to professional ethics Responsibility Commitment to lifelong learning	"Adherence to professional ethics is a key component of the nursing profession and related fields"
Identification of the strengths and weaknesses	Improvement in communication skills Need for further knowledge in certain areas	"I learned how to conduct a proper interview, whereas I had difficulty communicating with patients before"
Suggestions for improving education	Integration of theory and practice Use of case studies	"Overall, the clinical practicum was of good quality and provided me with a lot of learning, especially due to the simultaneous combination of diabetes theory and practice"

Table 5: Main themes and subthemes extracted from the qualitative analysis of nursing student s' daily reflective journals

Main theme	Subthemes	Supporting evidence
Development of specialized knowledge in diabetes management	Understanding of the diabetes pathophysiology and diagnostic criteria Understanding of the short-term and long-term complications of diabetes Knowledge of insulin types and their mechanisms of action	"I learned to define diabetes and state the diagnostic criteria for diabetes"
Enhancement of practical skills in caring for individuals with diabetes	Learning insulin injection techniques Familiarity with blood glucose monitoring methods Working with new diabetes management technologies	"I learned how to use blood glucose monitoring devices and understand the results, as well as how to install a continuous glucose monitoring sensor and insulin pump"
Improvement of communication and interviewing skills with individuals with diabetes	Learning interviewing techniques for diabetic patients Developing communication skills with children with diabetes and their parents	"I learned how to properly communicate and interview pediatric patients with diabetes and their parents"
Comprehensive understanding of the role of nutrition and physical activity in diabetes control	Familiarity with dietary principles in diabetes and carbohydrate counting Understanding the importance and methods of physical activity in diabetes control	"I learned that if fasting blood sugar and postprandial blood sugar are high, the individual should exercise in the evening"
Understanding the psychosocial aspects of diabetes	Understanding the psychological challenges of individuals with diabetes Awareness of the need for emotional support for patients and their families	"I realized that diabetes is not only a physical disease but also has a profound emotional and psychological impact on patients"
Familiarity with supportive care structures for individuals with diabetes	Understanding the role of specialized diabetes centers Awareness of educational and support programs	"The Janan Diabetes Charity is a non-governmental organization for the people of Najafabad and surrounding areas, established to support and care for people with diabetes in these areas"

theoretical knowledge and ability to learn independently. These findings may highlight the importance of experience and maturity in developing certain aspects of clinical competence in diabetes management.

Overall GPA also showed a significant positive correlation with clinical skills ($r = 0.337$, $P = 0.017$). This suggests that students with higher GPAs generally possess better clinical skills.

However, no significant correlation was found between age and GPA and other dimensions of clinical competence, such as communication skills, critical thinking, and professionalism. These findings suggest that factors other than age and academic performance play a significant role in the development of these competencies.

Qualitative analysis

Self-report questionnaire

Qualitative analysis of the self-report questionnaires completed by 50 nursing students' revealed significant progress in their knowledge, skills, and professional attitudes regarding diabetes management. Students demonstrated a deep understanding of the pathophysiology, diagnosis, and treatment of diabetes and improved their practical skills in areas such as blood glucose monitoring and insulin administration. Additionally, their positive attitudes toward effective communication with patients and their families were commendable.

Inductive thematic analysis identified seven main themes and 18 subthemes [Table 4]. These themes included the development of specialized knowledge, enhancement of practical skills, and familiarity with new technologies, improved communication skills, a positive professional attitude, identification of strengths and weaknesses, and suggestions for improving education. These findings highlight the students' overall growth in caring for individuals with diabetes.

The overarching theme extracted from the analysis was the "development of comprehensive clinical competencies in diabetes management." This theme highlights the strong connection between specialized knowledge, practical skills, communication abilities, and a holistic understanding of diabetes management. These findings emphasize the importance of a holistic approach to nursing education for providing effective care for individuals with diabetes.

Daily reflective journals

A qualitative analysis of 50 nursing students' daily reflective journals was conducted to gain a deeper understanding of their experiences during the intensive diabetes management clinical practicum. Using inductive thematic analysis, six main themes and 14 subthemes were identified [Table 5]. These findings demonstrate a significant improvement in students' knowledge, skills, and professional attitudes toward caring for individuals with diabetes. Nursing students demonstrated a comprehensive understanding of the pathophysiology, diagnosis, and treatment. Additionally, their practical skills in areas such as blood glucose monitoring, insulin administration, and patient education improved. Furthermore, the students

recognized the importance of effective communication with patients and their families and developed a positive professional attitude toward caring for individuals with diabetes. The overarching theme extracted from the analysis was the "development of comprehensive clinical competencies in diabetes management." This theme highlights the strong connection between specialized knowledge, practical skills, communication abilities, and a holistic understanding of diabetes management. These findings emphasize the importance of a holistic approach to nursing education for providing effective care for individuals with diabetes.

The in-depth qualitative analysis offered a rich understanding of students' learning processes and challenges, which was corroborated by the quantitative findings.

Discussion

This study examined the impact of an intensive clinical practicum program on the development of comprehensive clinical competence in nursing students managing diabetes. Findings revealed significant improvements in students' theoretical knowledge, clinical skills, communication abilities, and critical thinking skills following the program. Notably, individual factors, including age, academic performance (GPA), and gender, were found to significantly influence various dimensions of clinical competence. Grounded in Bandura's social cognitive theory, Kolb's experiential learning model, and integrating insights from the NEF proposed by Choperena *et al.*, these findings underscore the importance of experiential learning, self-efficacy, and person-centered approaches in nursing education. As Nikitara *et al.* highlighted, the role of nurses in diabetes care is multifaceted, demanding both technical expertise and effective communication skills, aspects targeted by this practicum.^[4]

Impact of the clinical practicum program on knowledge and skills

The intensive clinical practicum effectively enhanced students' theoretical knowledge, as evidenced by a 50% increase in the mean scores. This aligns with previous research demonstrating the positive impact of intensive clinical experiences on knowledge acquisition in diabetes care.^[18-20] Park found that an intensive clinical skills course significantly boosted senior nursing students' self-confidence and clinical competence, while Alkubati *et al.* emphasized the need for nursing internship students to have strong knowledge in diabetes care and management.^[19] Furthermore, the program significantly improved students' clinical skills, communication abilities, and critical thinking skills, consistent with Lee's findings on experiential learning.^[7] This is directly

relevant to the gap between education and clinical practice identified by Lee and Sim^[7] and Ngozika *et al.*,^[21] suggesting that well-designed practicums can bridge this gap.

In addition to increased knowledge, participation in the program resulted in significant improvements in students' practical skills, particularly in blood glucose monitoring and insulin administration. This finding is consistent with studies that have shown that intensive practical training and real-world clinical experiences play a crucial role in developing nursing students' clinical skills. Lee and Kim's conceptual analysis of nursing students' clinical competency in simulation-based practical training further supports this.^[22] Applying Kolb's experiential learning model, these practical experiences facilitate active experimentation and reflective observation, translating theoretical knowledge into applied skills.

Improvements in students' communication skills, especially in interviewing individuals with diabetes and providing education, were another significant finding. This aligns with previous research demonstrating that communication skills training is essential for improving the quality of care for patients with chronic diseases, including diabetes. As Yao *et al.* demonstrated, training healthcare professionals in communication skills has a significant positive impact on the clinical care of patients with diabetes and hypertension.^[23] Moreover, Ahn *et al.* highlighted the effectiveness of diabetes education programs for nursing students in improving their communication skills.^[24] Following Choperena *et al.* NEF, this underscores the need for curricula that emphasize patient-centered and relationship-based care.^[14]

The students' familiarity with new technologies in diabetes management, such as insulin pumps and CGM systems, was another important outcome. These modern techniques help the patients manage their glucose levels more effectively.

Gender differences in nursing students' clinical competencies

The findings revealed significant gender differences in various dimensions of nursing students' clinical competencies. Specifically, female students, compared to male students, demonstrated superior performance in communication skills, theoretical knowledge, and self-directed learning. This finding aligns with previous research indicating that female students tend to employ deeper learning strategies and consequently perform better in theoretical domains. As Kondo *et al.* found, interpersonal communication skills are significant for female nursing students.^[25] While acknowledging sociocultural influences, these findings support the need

for tailored educational approaches that address the unique learning needs of both male and female students.

While previous studies have primarily focused on gender differences in communication skills and academic performance, this research indicates that gender differences in clinical skills and self-directed learning are also noteworthy. This finding is consistent with the results of previous studies, such as those by Deng *et al.*, which have confirmed the existence of gender differences in clinical competencies.^[26] Future research could examine the impact of different educational interventions on reducing gender gaps in clinical competencies.

Influence of age and academic performance on nursing students' clinical competencies

This study found that age and academic performance (GPA) significantly influenced nursing students' clinical competencies. Older students generally demonstrated higher levels of theoretical knowledge and self-directed learning. This finding aligns with previous research that has reported a positive correlation between age and self-efficacy in self-directed learning among nursing students. These findings suggest that older students may possess greater maturity, life experience, and intrinsic motivation, facilitating deeper engagement with learning and enhancing their ability to master complex concepts. Wong *et al.*'s systematic review supports this conclusion and highlights the important role of self-directed learning, particularly for more mature students.^[27]

Furthermore, students with higher GPAs typically possessed stronger clinical skills, underscoring the importance of academic performance in developing clinical competencies. Lee and Kim's work highlights that students with strong academic skills can typically carry over the academic findings into improved performance.^[22]

However, the relationship between age, GPA, and clinical competencies is complex and multifaceted. As Zamiri and Esmaeili noted, skills development is heavily reliant on social learning from the community of learners.^[8] Future research should investigate the interplay between individual factors, learning environments, and clinical outcomes.

Importance of developing a professional attitude in nursing students

Another significant achievement of this clinical practicum program was the development of a positive professional attitude and adherence to ethical principles among students. This finding is consistent with the results of a systematic review and meta-analysis by Sharifikia *et al.*, which emphasized the importance of developing a professional attitude alongside knowledge

and clinical skills.^[28] Nabizadeh-Gharghozar *et al.* argued that professional commitment requires valuing patients, understanding accountability, collaboration, and following ethical principles.^[29]

The study's design, based on ADA standards and grounded in Bandura's social cognitive theory, Kolb's experiential learning model, and the NEF, provided a comprehensive and systematic approach to nursing education. The focus on self-efficacy (Bandura) and learning through experience (Kolb) aligns with the principles of the NEF, which prioritizes person-centered and relationship-based care, thus fostering not only competence but also a commitment to ethical practice.

Limitations, strengths, and future research

This study has several limitations that should be considered when interpreting the findings. First, the short duration of the intervention (6 days) may not be sufficient to assess sustained changes in clinical skills. Second, the reliance on self-report measures as the sole assessment method may be subject to respondent bias. Third, the absence of a control group in this study limits the ability to directly compare the results with those of a group that did not receive the intervention. Additionally, the limited sample size and the homogeneity of the sample in terms of university and program may limit the generalizability of the findings to other populations. Furthermore, individual factors such as students' motivation, personality, and prior experiences, as well as variations in the clinical environment, may have influenced the study results. Despite these limitations, this study has several strengths, including the use of a mixed-methods design to provide a comprehensive evaluation of the intervention. The use of both quantitative and qualitative data allowed for a more nuanced understanding of the impact of the clinical practicum on students' clinical competence. This study has significant clinical implications for nursing education in diabetes management. The findings demonstrate that an intensive clinical practicum can significantly enhance nursing students' clinical competence in diabetes care. The significant improvement in theoretical knowledge (50%), clinical skills, communication, and critical thinking highlights the importance of a comprehensive approach in clinical education. This approach can lead to improved quality of care for individuals with diabetes and better prepare nursing students for the complex challenges of healthcare. Educational program designers can use this model to develop specialized practicums in other clinical areas. Although this study offers valuable insights, further research with larger and more diverse samples is warranted to enhance generalizability. Longitudinal studies examining the long-term impact of these educational programs on graduates' clinical performance and patient outcomes are crucial for a comprehensive

understanding of their effectiveness. Future research should also explore the influence of individual factors, such as gender, age, and academic background, on student learning outcomes to personalize educational interventions and optimize patient care.

Conclusion

This study robustly demonstrated the efficacy of intensive diabetes management clinical practicum programs in cultivating comprehensive clinical competence among nursing students. Employing a mixed-methods approach, the research thoroughly evaluated the program's impact on students' theoretical knowledge, clinical skills, communication proficiency, and professional attitudes. The findings underscore the crucial role of experiential learning in developing nursing competencies, confirming that these programs effectively equip students to deliver high-quality care to individuals living with diabetes.

Based on these findings, we offer the following recommendations for health policy makers and nursing managers:

- For health policy makers: National prioritization and funding of intensive clinical practicum programs within nursing curricula are essential. Standardization of these programs based on best practices is recommended, incorporating elements such as peer teaching, case-based learning, and hands-on experience with contemporary diabetes technologies. Furthermore, policy makers should incentivize collaboration between academic institutions and clinical settings to ensure the availability of high-quality mentorship opportunities for nursing students. This includes supporting the development of structured clinical experiences that allow students to apply their knowledge, hone their skills, and cultivate confidence in managing diabetes effectively. Finally, recognizing the increasing global burden of diabetes as highlighted by the IDF diabetes atlas, policy makers should invest in research exploring the cost-effectiveness of these programs and identifying optimal strategies for nationwide implementation and long-term sustainability.
- For nursing managers: Collaboration with academic institutions is vital to create and sustain robust mentorship programs within clinical settings. Nursing managers should actively participate in designing structured clinical experiences that align with best practices in diabetes care, ensuring that students receive opportunities to apply theoretical knowledge in real-world scenarios. This includes providing access to diverse patient populations and exposure to the latest diabetes technologies. Managers should also foster a supportive learning

environment that encourages students to develop their communication skills, critical thinking abilities, and professional attitudes. Furthermore, they should champion the integration of evidence-based practices into clinical workflows, creating a context where students can observe and participate in high-quality, patient-centered care. Finally, nursing managers should advocate for dedicated resources to support both student learning and the professional development of nurse mentors.

Building upon the theoretical framework provided by Bandura's social cognitive theory, Kolb's experiential learning model, and the NEF, future studies could investigate the specific mechanisms through which these programs foster competence and a commitment to ethical, patient-centered care.

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Conflict of interest

There are no conflicts of interest.

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