Original Research Paper

Pharmacy students' work-based learning experiences during in-plant training: a qualitative case study in Nepal

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Abstract

Background: Work-based learning (WBL) is experiential learning that supplements traditional classroom instruction with learning in a real-world setting. In-plant training is a key component of WBL in technical and vocational education. This study explores the experiences of final-year pharmacy students during their in-plant training and assesses its role in developing essential skills and enhancing career opportunities. **Methods:** Qualitative case study methods were employed to examine the experiences of 15 final-year pharmacy students. We used semi-structured interviews for data collection purposes. **Results:** Four positive central themes emerged from the analysis: WBL offered exposure to real-world work environments, skill enhancement, improvement in interpersonal abilities, and the benefits of collaborative learning. **Conclusion:** The study was conducted only at a single institution in Lalitpur, Nepal. In-plant training assisted students in consolidating professional skills and knowledge, strengthening self-reflection and actualization, developing confidence and competence in practice, and improving employability skills.

Keywords: work-based learning; in-plant training; employability; case studies; pharmacy education

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Background

Work-based learning (WBL) is a comprehensive teaching and learning strategy emphasizing students' academic and professional development.[1] WBL enhances traditional classroom instruction by allowing students to learn in real-world environments.[2] On-site experiential learning immerses students in an industry, enabling them to acquire and apply knowledge through active engagement in real work activities.[3,4]

In-plant training is a practical, efficient, and relevant method for providing induction training and upgrading industry training.[5] Such workplace learning programs offer students the chance to experience real workplace practices often absent from traditional classroom settings.[6]

Nepal is a country in South Asia situated between India and China. In Nepal, pharmacy education is a rapidly developing field within technical and vocational education. In 1972, Tribhuvan University's Institute of Medicine (IOM) began offering an intermediate-level pharmacy course. In 1994, Kathmandu University initiated the Bachelor of Pharmacy (BPharm) program in Nepal. At present, the Council for Technical Education and Vocational Training (CTEVT) offers pharmacy assistant training (Diploma in Pharmacy); four universities (Kathmandu University, Tribhuvan University, Pokhara University, and Purbanchal University),[7,8] and Karnali Academy of Health Sciences (KAHS) are conducting Bachelor of Pharmacy programs through different constituent colleges all over Nepal.

Students must complete two and a half months (10 weeks) of mandatory in-plant training in pharmaceutical companies, hospitals, and other professional institutions before graduating.

Experiential learning enables students to cultivate the essential skills and work habits they need to work as successful pharmacists.[9] In-plant training, internships, work shadowing, and hospital/ community placements is significant and important.[10] Students apply their classroom knowledge to address real-world challenges. These experiences not only bridge the gap between theoretical knowledge and practical application but also significantly enhance students' employability upon graduation.

In Nepal, domestic production meets less than 50% of the medicines requirements, and imports account for most products, especially inhalers, injectables, critical care products, anticancer medications, vaccines, and novel molecular products.[11] Nepal can decrease its dependence on imports and guarantee a consistent and dependable provision of vital medications by establishing more pharmaceutical industries.

This study's objective was to investigate the work-based learning experiences of final year BPharm students at an institution in Lalitpur, Nepal during their in-plant training. The paper explores the research question, "What is the perception of final year BPharm students about their in-plant training?"

Methods

This study used a qualitative case study methodology, essential for analyzing current, time- or location-constrained real-life events. Qualitative research is particularly valuable in exploring the nuanced experiences of individuals, allowing for a deeper understanding of their perspectives and the context of their learning. Case study research primarily entails analyzing a scenario, problem, or event from the perspective of people in real-life environments.[12-14] In our study, we investigated the perception of, and learning of, final-year BPharm students during their in-plant training.

Semi-structured interviews were conducted with the respondents. The learners interpreted and reflected on their learning experiences during the training, and constructed meaning from their experiences.[15,16] The researchers were faculty and educators who were not directly involved in teaching the interviewees. Through our interviews with the participants, we were able to understand and articulate how in-plant training prepared individuals for their future career and to meet employers' skills requirements.

We obtained informed written consent from each participant and provided them with an information sheet that outlined the study's purpose and nature. We informed the participants that they could withdraw from the study at any time without compromising their education or lessons. The study upheld the participants' right to privacy and confidentiality throughout. We obtained written ethical permission from the Institutional Review Board.

An interview guide was prepared by the researchers through a review of literature and discussions. The interview guide was pilot-tested among two students. Their understanding of the questions and their responses were noted. Their responses were not included in the final analysis. Of the 20 students, two were involved in pilot-testing the guide. Table 1 shows the interview questions, the probes used, and the final themes. Three respondents did not provide consent. Researchers selected 15 final-year bachelor's in pharmacy students, eight females and seven males, as research participants. We conducted the interviews on the premises of the Health Science Institute where these students were studying from April to May 2022. The second and the third authors provided training to the interviewers in qualitative methodology. The interviews were conducted by the first and the fourth author, and the second author was an observer during the interviews.

Authors one and four recorded each interview using mobile devices. They conducted 15 interviews in Nepali and transcribed the same in Nepali. They translated the text into English, and then an English language expert, who was also proficient in the Nepali language verified the transcript and transcribed the data into Microsoft Word files. Researchers produced and labelled a separate file for each participant. They provided the participant with copies of their individual transcripts, allowing them to evaluate, clarify, or elaborate on their thoughts. Member checking was done, and the study methodology aligned with Yin's five stages of analysis and case study design.[14] An inductive approach was used to generate the codes and the themes.

We meticulously coded each transcript. We used six-step procedures to develop themes.[17] We read the transcript multiple times to gain a comprehensive understanding. We confirmed each theme and its corresponding categories against the data to ensure a consistent pattern within each theme and to ensure that quotes were in context. We

Table 1: Interview guide, probes used, and themes generated during the study.

Questions asked	Probes	Themes generated
Demographics and introduction of participant		
Can you kindly summarize your in-plant training?		
How did the in-plant training help you in developing skills like creativity, collaboration, critical thinking, innovation and resourcefulness?	Would you explain that? Why did you say so? What were you thinking at the time? Tell me about it. Give me an example. Take me through the experience.	Skill development Interpersonal skills improvement
How did the in-plant training help establish relationships between different subjects/concepts you had learned in college and inform you about their real-world application?	Would you explain that? Why did you say so? What were you thinking at the time? Tell me about it. Please give me an example.	Real-world work experience Skill development
What did you learn about the production and quality control processes involved in medicines production? Will this information be useful to you in your future career? Please explain	Why do you say so? Please provide me with an example. Can you provide reasons?	Real-world work experience Skill development
Did the training provide you with opportunities to work and learn from other students and pharmacists and other personnel in the plant? What were your experiences?	Would you explain that? Why did you say so?	Interpersonal skills improvement Collaborative learning
Did the training strengthen your skills to communicate with others? Were your planning and implementation skills strengthened?	Why do you say so? Please provide me with an example. Please explain.	Interpersonal skills improvement Skill development Collaborative learning
Did you get opportunities to communicate your learning preferences to those involved? Was your ability to reflect on the training strengthened?	Would you explain that? Why do you say so? Take me through the experience.	Interpersonal skills improvement Real-world work experience
Did the training influence your lifelong learning skills? Did it influence your future career skills?	Why do you say so? Please provide me with an example(s).	Real-world work experience Skill development
Any other personal, professional and/or social opportunities you experienced during the in-plant training?	Would you explain what you said? Why did you say so? What were you thinking at the time?	Real-world work experience Interpersonal skills improvement Skill development Collaborative learning
Is there anything else that we have not covered that you would like to add at this time?		

discussed and evaluated all thematic categories, leading to the emergence and assessment of themes by all researchers.

Results

This paper describes the experiences of 15 BPharm final-year students who worked as in-plant trainees. In this study, we developed four major themes. Table 1 shows the interview questions, the probes used and the final themes. We describe the themes in detail below.

Real-world work experience

Students had the opportunity to learn by engaging in experiences that differed from traditional classroom methods. All the participants agreed that experience-based learning is important. Most participants expressed their gratitude for the opportunity to work in the pharmaceutical industry,

as they felt there were limited opportunities to gain practical experience in their university laboratories. Through their active and meaningful participation, students learnt from a variety of real-world work experiences. One of the participants explained the significance of gaining real work experience.

"In the classroom, I studied theoretical knowledge about pharmaceutical product production, but I did not get a chance to see the medical production unit. On the other hand, it is a lifetime experience to be directly involved in the production at every stage." (Participant-8)

Based on the participants' responses, we assert that gaining real-world work experience through in-plant training significantly prepared students for potential future challenges in their careers. Out of the 15 participants, 14 reported that these in-plant training courses enabled them to apply their existing knowledge to solve problems. One participant particularly emphasized the importance of being involved in the pharmaceutical production process.

Moreover, while working in the production department of the pharmaceutical industry, they got the opportunity to learn from their supervisors, who had extensive experience. Students said that they also got feedback to improve their cognitive and physical skills for the potential job market in pharmaceutical manufacturing.

In addition to their experience in pharmaceutical manufacturing, the students also gained knowledge about quality control practices. In this context, one of the participants revealed that

"*I actively participated in all aspects of production and quality control work. During the quality control process, I encountered numerous challenges and gained valuable knowledge in chemical, instrumental, and microbiological aspects. Despite having discussed and learned about these aspects in the classroom, I found it difficult to apply the knowledge I had gathered. This part is meaningful to me." (Participant-2)*

The students' perspectives indicated that their theoretical classroom knowledge did not adequately equip them to function in a real-life industrial setting. During their in-plant training, students also acquired skills in pharmaceutical packaging and storage. According to one participant:

"I had the opportunity to participate in pharmaceutical packaging, labelling, and storage in accordance with product-recommended criteria, such as the storage of controlled medicines, which require specific storage conditions and reference materials." (Participant-11)

Besides this, they also learned about pharmaceutical waste management and waste recycling processes during their in-plant training.

"I gained experience in recycling recovered materials and disposing of waste according to its physical nature, i.e., biodegradable and non-biodegradable pharmaceutical waste." (Participant-7)

Improving technical skills

Acquiring technical skills in the pharmaceutical industry is essential for successful professional progression, as it ensures students have the ability to make valuable contributions to the advancement, manufacturing, and oversight of pharmaceutical goods. Proficiency in these technical abilities can lead to career advancements and managerial positions within the industry.

Specifically, research participants received training in four major areas: production, quality control, packaging labelling and storage, and waste management. These were a set of technical skills necessary for the participants to succeed as skilled workers with better job prospects. Most participants emphasized the importance of in-plant training to secure employment upon completion of their course. They highlighted the importance of demonstrating a strong work ethic and effectively applying the skills acquired during their training in their future jobs. One participant mentioned that:

"After joining this in-plant training, I can transfer knowledge of each step of production and quality control, or I can do the job again, repeat the job, and eventually get to the point where I can do it." (Participant-4)

It is imperative for students to acquire a comprehensive understanding of Good Manufacturing Practices (GMP) laws, as they are essential for ensuring the consistent production and control of products in line with quality standards. A participant mentioned:

"My in-plant training has taught me the importance of good manufacturing practices and regulations in

ensuring the regular manufacturing and control of items to quality standards." (Participant-14)

During in-plant training, students obtained information about the materials and technology employed in pharmaceutical packaging. This included understanding barrier qualities, labelling, and serialization. It is critical to ensure compliance with regulatory standards by incorporating child-resistant features, tamper-evident designs, and meeting packaging labeling requirements.

"We learnt about pharmaceutical packaging materials and technologies through in-plant training, including barrier characteristics, labelling, and serialization." (Participant-16).

The students' final report confirmed that all students acquired knowledge about the various production procedures, quality control and quality assurance skills, excellent manufacturing practices, and packaging skills.

Development of interpersonal skills

Students agreed that in-plant training enhanced their interpersonal skills, such as self-confidence, communication, critical thinking, problem-solving, teamwork, and work ethic; these are crucial employability skills obtained from in-plant training. According to one participant:

"My training has improved my soft skills due to direct involvement in the production of pharmaceuticals with the senior pharmacist and other team members, I can work in a team and think differently." (Participant-15).

In-plant training provided an opportunity for students to work in the pharmaceutical industry, which helped them identify their interests and career trajectories. Additionally, the in-plant training exposed students to a wide range of new experiences.

"I participated in every step of the production process, which boosts my self-reliance on my abilities." "I want to get more involved to improve my skills." (*Participant-9)*

The participants acknowledged that in-plant training enabled them to strengthen their knowledge, skills, and attitudes to effectively fulfil their role as production pharmacists. Receiving regular feedback from pharmacists, supervisors, or peers can provide valuable guidance for progress while also validating existing qualities, resulting in enhanced self-confidence.

"Constructive feedback provides insights into areas for growth while also reinforcing strengths, leading to increased self-confidence and enhanced competences." (Participant-13)

Participants recognized that allowing students to showcase their abilities, facilitated by industrial pharmacists, helped them gain confidence and proficiency. These practitioners were highly regarded by the participants.

"My senior pharmacist helped me adjust to the industrial environment to boost my confidence by switching roles, allowing me to work freely, and being there for assistance whenever needed." (*Participant-1)*

Collaborative learning

Students encountered a diverse array of working environments. Often, these unfamiliar environments required them to collaborate with individuals they had not encountered before. In an industrial in-plant training setting, collaborative learning involves the collective effort of peers, mentors and colleagues to improve learning and gain practical experience.

Teams of students frequently worked together on production tasks. This promoted teamwork as individuals exchanged ideas, allocated responsibilities, and collectively resolved issues. Collaborating in teams allowed students to benefit from one another's individual skills, diverse methodologies, and unique experiences.

One participant said:
"Initially, I experienced a sense of emptiness due to the unfamiliar surroundings, not just the classroom and school labs. However, after a few days, I actively engaged with older students and became accustomed to learning in an unfamiliar environment through team assignments." (Participant-10).

The expertise of seasoned pharmacists and other staff members offered valuable guidance, facilitated the exchange of knowledge, and assisted learners in overcoming obstacles. This partnership enriched the process of acquiring knowledge by offering insights from actual experiences. Students received constructive comments on their work which facilitated their learning and personal development.

The iterative process of exchanging feedback among individuals was crucial for improving their professional abilities.

"After two weeks, I stepped out of my comfort zone and took responsibility in front of a large group, under the mentorship of my senior pharmacist and other staff. I forced myself to get used to being louder and sharing my ideas." (Participant-3)

Integrating in-plant training aids in the production of professional pharmacists by providing students with opportunities to work together builds their skills, confidence, and competence. A participant mentioned that:

"Initially, there was a lack of clarity regarding the permitted and prohibited activities. Last, I got an opportunity from a pharmacist to work independently, alone, which helped me increase my confidence." (Participant-14).

Students frequently got the chance to engage in collaborative projects with multiple departments, such as quality control, quality assurance, retail management, marketing, and production. This allowed them to develop a comprehensive grasp of the business and how different roles interact.

Participants mentioned the training supported their development and the consolidation of knowledge, abilities, and attitudes necessary to fulfil their position as registered pharmacists. According to one participant:

"It is possible to engage in all departments of the company by supplying constructive positive feedback and learning opportunities." (Participant-12)

Senior pharmacists are essential for supervising students in technical practice, but they need assistance in carrying out their responsibilities. Providing dedicated time for reflection enhances the training experience and can significantly improve the students' capacity to seek support from the group during fieldwork.

As this study shows, in-plant training is critical for strengthening abilities, increasing autonomy in decision-making, and developing confidence and competence in the workplace, among other things. The following participant's quote supports this claim:

"You gain confidence by doing it alone, but with others watching." (Participant-6)

Discussion

Four main themes were noted. These were real-world work experience, technical skill development, interpersonal skills improvement, and collaborative learning from student participants. The first theme we extracted from the students' experiences was the practice of authentic experiential learning in real work situations, which aligns with the Kolb experiential learning model. Kolb developed this model to explore and develop the crucial connections between education, work, and personal growth.[18] In this study, students' experiences showed that in-plant training provided them with active learning, enhancing their analytical skills and problem-solving skills. In-plant training first immerses students in an experience and then invites them to reflect on that experience to acquire new abilities or ways of thinking. It offers students a chance to experience the world of work, stimulates opportunities for reflection on experience, allows them to think about the learning experience, and finally allows them to perform what they have learned.

Another theme from this study was that students enhanced their skills, i.e., technical skills as well as interpersonal skills, through in-plant training. These skills, also known as employability skills, are multifaceted and have been further examined through many dimensions, such as hard skills and soft skills.[19] In-plant training develops interpersonal skills, including the ability to effectively solve problems. These skills expected and desired by employers include communication skills, teamwork, critical thinking, and leadership.[20,21]

University classrooms may not adequately teach employability skills like communication, cooperation, and problem-solving. However, structured work experience and employer engagement in planning and teaching degree courses have positive impacts on graduates.[22] Students learn the most from challenging situations and the circumstances of real work.[23] Therefore, we expect colleges to provide learning opportunities such as in-plant training, which allows students to apply their skills in real, challenging professional settings and develop employability capital that aligns with market demands. [24]

Current research shows that in-plant training helps students develop their self-confidence and social skills, a positive view of their jobs, career awareness, and independence through collaborative learning. Students who did in-plant training before graduation found it easier to gain employment. They understood the work environment better, thought positively about problems and situations they faced at work, and showed more commitment and flexibility in institutional situations.[25] Researchers have also found that site supervisors can assist students in acquiring implicit knowledge during industrial exposure.[26]

Jackson supports the notion that field exposure through work-integrated learning can enhance self-actualization and self-confidence.[27] Pharmacy internships enhance students' employment opportunity by bridging the gap between curricular course work and application to direct patient care activities.[28] Similarly, findings indicate that in-plant training enhances students' self-reflection and interpersonal abilities. Students agree that in-plant training and practical experience offer and augment communication, critical thinking, teamwork, problem-solving, professionalism, and networking skills.

One further finding derived from this study is that in-plant training enhances collaborative learning. Collaboration cultivates a dynamic educational environment where students drive, participate, and take responsibility for their learning, leading to improved and participatory learning outcomes. Collaborative learning greatly improves active learning by engaging students in interactive and participatory situations, allowing them to actively develop their own understanding and knowledge through social interaction and shared experiences. Active learning methods improve learners' concentration, involvement, and motivation to study, while also promoting a deeper understanding of the learning material.[29]

In-plant training provides pharmacy students and fresh graduates with hands-on experience in real pharmaceutical manufacturing settings. This practical exposure helps them understand the entire drug development and production process, from formulation to quality control, packaging, and distribution. Students learn about good manufacturing practice (GMP), quality control, and regulatory requirements, which are critical in the pharmaceutical industry. This knowledge is essential for ensuring that medicines are safe, effective, and of high quality. Modern pharmaceutical plants use sophisticated technologies and equipment. Training in these environments allows future pharmacists to become familiar with advanced machinery, automation, and analytical instruments, enhancing their technical proficiency. This proficiency contributes to the development of the next generation of industrial pharmacists.

Strengths, limitations, and recommendations

The main strength of this research is its focus on a subject that has not received adequate attention, especially in Nepal. In-plant training is being conducted by multiple institutions but the student perception of this has not been previously published. This study's use of multiple data sources (interview transcripts, in-plant training report by students, and the student log books) is another key strength enhancing the credibility, reliability, and depth of the findings. Using member checking can improve the quality of the study and the research rigor.

In terms of limitations, we conducted this study at a single Health Science College located in Nepal's Lalitpur district. The next limitation is the restricted availability of time and financial resources. A suggestion for future research would be to conduct a quantitative study with a larger sample size in different colleges to examine the relationship between the skills investigated in this study. This study focused solely on the WBL experiences of students. To study this in greater detail, future research should also explore the perspectives of both employers and university professors.

Conclusion

In-plant training for final-year pharmacy students at the Bachelor of Pharmacy level encourages students to relate theory to practice, which is essential for making the transition to becoming a registered pharmacist. These training programs improve the employability skills of students by fostering the practice of authentic experiential learning, the consolidation of professional skills and knowledge, self-reflection and actualization, the development of confidence and competence in practice, and so on. Students are introduced to production and quality control processes in a modern pharmaceutical production plant. They interact with pharmacists and others working in the industry and learn about the latest developments in the industry. They are thus better equipped to link theoretical learning with practice. Therefore, it is crucial to provide students with assistance during their in-plant training to

enhance their skills and facilitate their transition into the registered pharmacist role.

Better coordination between academic faculty and pharmacists in the industry will be helpful. These individuals can meet during the planning phase of the in-plant training (and later during its implementation) to discuss areas to be covered and the format and logistics of the training. Academics can better prepare students if they are aware of the theoretical knowledge required before the training.

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