Experiential Learning in Mathematics: Lessons from the First OJT Implementation for BS Math Undergraduates

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ABSTRACT

This study explored the inaugural implementation of an on-the-job training (OJT) program for Bachelor of Science in Mathematics (BS Mathematics) students at a state university, marking the first time such experiential learning was offered despite the absence of a Commission on Higher Education (CHED) mandate for the discipline. Using thematic analysis of reflection papers and journal logs from 21 students (coded as Students A–U), the research examined their experiences, challenges, skills development, and professional insights. Findings reveal that students regarded the OJT as a transformative experience that strengthened both technical and soft skills, including communication, teamwork, and professionalism. While mathematics knowledge was not directly applied to most tasks, its emphasis on logical reasoning, precision, and problem-solving supported students' adaptation to clerical, data management, and administrative responsibilities. The OJT also expanded students' perspectives on career opportunities, demonstrating the relevance of mathematics graduates in public service, governance, and data-driven policy. Challenges included financial constraints, workplace adjustment, and gaps in technical competencies, but students developed coping strategies such as adaptability, mentorship-seeking, and disciplined work habits. Recommendations include institutionalizing structured OJT programs, strengthening academic–workplace linkages to enhance task relevance, and providing support mechanisms coupled with reflective activities. Overall, the study affirms the value of embedding OJT in mathematics curricula as a bridge between academic training and real-world application, fostering professional readiness and diversified career pathways.

Keywords: BS Mathematics, on-the-job training, experiential learning, thematic analysis, professional development, career pathways

INTRODUCTION

Work-integrated learning (WIL) is broadly conceptualized as the deliberate integration of workplace experiences with formal academic learning, serving as a core pedagogical strategy in higher education to enhance graduate employability and bridge the often-cited divide between theoretical knowledge and practical workplace expectations (Billett, 2011; Patrick et al., 2008). Internship models, commonly referred to as on-the-job training (OJT) in many countries, constitute one of the most prevalent forms of WIL (Jackson, 2015). These structured engagements with host organizations allow students to operationalize classroom-taught knowledge in real-world, context-dependent settings while simultaneously enabling organizations to benefit from fresh perspectives and assistive labor (Mgaya & Mbekomize, 2014). In the Philippine higher education landscape, the institutionalization of WIL varies considerably across disciplines and institutions. While professional and technical degree programs, such as engineering and business, often mandate internships as integral curricular components (CHED Memorandum Order No. 48, s. 2017), pure science and mathematics programs typically offer only episodic or no supervised workplace exposure.

This study examines a pioneering curricular intervention: the inaugural offering of OJT for Bachelor of Science in Mathematics (BS Mathematics) students, implemented as a pilot across selected government agencies, including the Philippine Statistics Authority (PSA), Department of Agrarian Reform (DAR), and Department of the Interior and Local Government (DILG), among others. Mathematics traditionally steers graduates toward careers in teaching, research, or advanced study (Hoyles et al., 2010). Yet, in a labor market increasingly valuing

quantitative literacy, data analytics, and critical reasoning, there is emergent demand for mathematically trained professionals in diverse sectors such as public administration, social policy, and technology (National Mathematical Advisory Panel, 2008; OECD, 2019). Despite this demand, current curricular frameworks and CHED accreditation guidelines do not uniformly mandate OJT for BS Mathematics programs, creating a crucial gap in workplace readiness.

This absence of a formal OJT requirement presents both challenges and opportunities. The challenge lies in potential shortfalls in workplace exposure that limits students' ability to translate mathematical reasoning into operational and organizational contexts (ACME, 2017). Conversely, the opportunity arises through pilot placements that illuminate how mathematics undergraduates assimilate and contribute to public-sector workflows, yielding actionable insights for curriculum development. Drawing on qualitative thematic analysis of students' reflective journals and daily logs collected during their OJT, this research addresses pressing questions: What are the dominant patterns of learning, challenges, and professional insight in these reflections? How effectively does mathematical training prepare students for workplace responsibilities? In what ways does the internship experience supplement or reshape their competencies? And, crucially, what recommendations emerge for optimizing future OJT programs within mathematics curricula?

Three interlocking rationales amplify the timeliness and importance of this inquiry. First, academically, it contributes to the sparse literature on workplace learning among mathematics undergraduates, especially in the developing-country context. Most extant research prioritizes applied and vocational degrees, leaving theoretically oriented disciplines like mathematics comparatively underexplored (Kent & Noss, 2003). Second, from an institutional and policy perspective, it provides evidence-based insights helpful for university administrators and accrediting agencies such as CHED, which currently do not mandate OJT in BS Mathematics curricula. Student reflections illuminating both instructional affordances and implementation challenges offer invaluable data for informed curricular deliberation. Third, from a workforce-planning angle, findings shed light on how government agencies might engage undergraduate talent more effectively, tapping into the analytical strengths of mathematics graduates for roles such as data management, monitoring, and budgeting.

Methodologically, the study adopts a qualitative design rooted in thematic analysis as articulated by Braun and Clarke (2006). Reflective journals and daily logs serve as primary data sources, capturing contemporaneous task details and reflective synthesis across seven analytical categories, including overall experience, application of academic learning, challenges, skill development, and professional insights. This dual-document approach triangulates micro-level task engagement with macro-level meaning-making, preserving student voice through rich quotations and narrative excerpts. Early findings reveal recurrent themes: initial anxiety evolving into professional confidence, predominance of clerical alongside occasional data-analytic tasks, indirect yet meaningful application of mathematical training in problem-solving and precision, and challenges spanning software unfamiliarity to financial and social workplace dynamics. A pronounced inclination towards public-sector careers also emerges, with students developing a nuanced appreciation for government roles and data-driven public service.

Extant literature robustly supports the transformative potential of internships. Empirical studies affirm that internships enhance employability, deepen skill acquisition, and foster professional identity formation (Gault, Leach & Duey, 2010; Jackson, 2015). Additionally, internships cultivate essential soft skills such as communication, adaptability, teamwork, and professionalism which are attributes especially critical for mathematics graduates who often must complement technical prowess with interpersonal competencies in diverse career paths (NACE, 2017). Philippine research on OJT predominantly focuses on fields like engineering and business, where internships are longstanding curricular fixtures (Abat, 2025). These studies consistently underscore benefits including increased confidence, job readiness, and exposure to organizational culture, themes that resonate with experiences of BS Math students in government placements. Yet, research specific to mathematics students remains limited.

Internationally, scholars highlight the unique challenges mathematics graduates face in articulating the practical relevance of their abstract training (Cretchley & Harman, 2010; Kent & Noss, 2003). The workplace mathematical practices, such as centered on data handling, estimation, and technological application, often diverge significantly from academic mathematics, which tends to emphasize formal proofs and theoretical

abstraction (Hoyles et al., 2010). Internship experiences, therefore, serve as vital contexts for students to encounter this "hidden curriculum" and expand their conceptualization of mathematics as a workplace tool. Reflection literature further emphasizes the significance of reflective writing during OJT in providing qualitative insights into students' evolving professional identity, coping strategies, and learning trajectories (Boud, Keogh & Walker, 2013; Dyment & O'Connell, 2011). Through reflective journals, students narrate their transition from initial anxiety to increased confidence, thus enriching understanding of the emotional and cognitive dimensions of experiential learning.

Commonly reported challenges align with findings in both local and international studies, including financial constraints, adjustment to workplace norms, and misalignment between academic content and assigned tasks (Narayanan, Olk & Fukami, 2010). For mathematics majors, a particular concern is the scarcity of explicitly math-related assignments in certain host agencies, which can initially seem disconnected from their field but ultimately foster adaptability and complementary skill development (Wilton, 2012). Crucially, internships influence career aspirations, prompting students to refine their professional goals and broaden career horizons beyond traditional academic roles towards government, corporate, and research opportunities (Callanan & Benzing, 2004).

Globally, mathematics internship programs vary in structure and impact. North American experiences underscore partnerships with industries focusing on actuarial science, finance, and data analytics, reporting enhanced graduate readiness (Laugesen et al, 2022). European programs emphasize applied competencies through placements in engineering, logistics, and IT sectors (Niss, 2010; Kaiser & Schwarz, 2010). Asian contexts, including Singapore and Malaysia, demonstrate advanced industry linkages facilitating applied research roles for math majors (Hoo & Yeak, 2024). By contrast, many developing countries grapple with connecting abstract mathematical education with workplace realities, underscoring the potential contributions of Philippine pilot programs to the global discourse.

In sum, while literature on internships across disciplines is substantial, the literature bridging BS Mathematics and OJT, especially qualitative analyses focused on student reflections in the Philippine setting, remains sparse. This study aims to fill this gap by documenting the lived experiences of BS Math students during their inaugural OJT, providing empirical evidence for curricular innovation and contributing to theoretical understandings of discipline-based WIL. By doing so, it supports efforts to better align undergraduate mathematics education with evolving labor market demands, enhancing graduate employability and public sector engagement.

METHODOLOGY

Research Design

This study employed a qualitative research design, specifically thematic analysis (Braun & Clarke, 2006), to explore the reflections and journals of Bachelor of Science in Mathematics (BS Mathematics) students on their internship or on-the-job training (OJT) experiences. Since this was the first time that OJT was implemented in the BS Mathematics program at the university, a qualitative approach was deemed most appropriate to capture the depth, nuance, and diversity of students' experiences. Thematic analysis allowed the researchers to systematically identify, analyze, and interpret patterns of meaning across student accounts.

Participants and Context

The participants were 22 BS Mathematics students, coded as Students A through U, who completed their OJT in various government agencies and offices across Region VIII. Placement sites included agencies such as the Department of Agrarian Reform (DAR), Department of the Interior and Local Government (DILG), and the Philippine Statistics Authority (PSA).

The program was conducted during the academic year 2024–2025 and was implemented voluntarily, since the Commission on Higher Education (CHED) does not mandate OJT for BS Mathematics under its current CMO (Commission on Higher Education Memorandum Order). This made the initiative a pilot run for the program, providing an opportunity to assess the feasibility, relevance, and impact of OJT for mathematics majors.

Students were required to submit both weekly journals (documenting their daily tasks and reflections on learning) and a final reflection paper structured around seven guiding questions:

1. Overall experience,
2. Tasks and responsibilities,
3. Application of academic learning,
4. Challenges and coping strategies,
5. Skills and growth,
6. Professional insights, and
7. Recommendations for program improvement.

These data sources provided a comprehensive account of student learning processes, challenges, and professional insights.

Data Collection

Data were collected in two forms:

1. Reflection Papers – Submitted at the end of the OJT, guided by structured prompts.
2. Journals – Maintained weekly, recording daily responsibilities, accomplishments, and reflections.

The reflective nature of these sources allowed students to articulate their experiences in their own words. No additional surveys or interviews were conducted, as the focus was on analyzing authentic student narratives produced as part of their academic requirements.

All documents were collected in digital form, anonymized by assigning codes (Student A–U), and stored securely for analysis.

Data Analysis

The data were analyzed using the six-step process of thematic analysis (Braun & Clarke, 2006):

1. Familiarization – The researchers read and reread the journals and reflection papers to gain an overall sense of the data.
2. Generating Initial Codes – Relevant passages were systematically coded, focusing on both semantic (explicit) and latent (implicit) meanings.
3. Searching for Themes – Codes were grouped into potential themes based on recurring patterns, particularly aligned with the seven guiding reflection questions.
4. Reviewing Themes – Themes were refined to ensure coherence, internal homogeneity, and external distinctiveness.
5. Defining and Naming Themes – Themes were clearly defined, capturing the essence of the students' shared experiences.
6. Producing the Report – Themes were organized and illustrated with direct quotations from participants, with minor discussions presented in the results section and deeper analysis reserved for the discussion chapter.

To enhance trustworthiness, peer debriefing was employed, where multiple members of the research team independently coded portions of the data and then compared interpretations. This process reduced subjectivity and strengthened the validity of the thematic categories.

Ethical Considerations

Ethical protocols were strictly observed. Students were informed that their reflections and journals might be analyzed for research purposes, but their participation was voluntary and had no bearing on their academic grades. Informed consent was obtained, and anonymity was preserved by using pseudonyms (Student A–U). Sensitive personal details were excluded from reporting.

RESULTS AND DISCUSSION

We now present the results of the thematic analysis conducted on the reflections and journals of Bachelor of Science in Mathematics (BSMath) students, referred to here as Students A through U, who participated in their first-ever internship or on-the-job training (OJT). Thematic analysis, as described by Braun and Clarke (2006), was used to systematically identify, analyze, and report patterns across the data. The students' reflections were guided by seven structured questions covering their overall experiences, tasks and responsibilities, applications of learning, challenges and coping strategies, skills and growth, professional insights, and recommendations for improving the OJT program. Their journals provided additional context, capturing their day-to-day responsibilities.

The following sections present the themes that emerged from the data, supported by direct quotations from the students. Each theme is organized according to the reflection prompts to maintain clarity and coherence. Only brief interpretation is included here; more extensive discussions and implications are reserved for the next chapter.

Theme 1: Overall Internship/OJT Experience

A recurring description of the OJT experience across students was that of a transformative journey, often marked by a mix of excitement, nervousness, and personal growth. For many, the OJT was their first immersion into professional environments, offering both challenges and opportunities to apply and extend their learning.

Several students framed the experience in metaphorical or emotional terms. Student Q described the internship as *"a roller coaster ride because I learned a lot from it."* Similarly, Student S emphasized its immersive and eye-opening nature: *"My internship at the City DILG was an incredibly immersive, challenging, and enlightening experience. It was far more than just a requirement to fulfill academic credits; it was a deep dive into the real-world machinery of local governance."*

Others highlighted gratitude and pride. Student U shared: *"My experience at DAR has been eye-opening… It taught me how to communicate better, stay organized, and be part of a team. I've grown more confident and ready for future challenges."* Student A echoed this sense of appreciation, writing in their reflection that the OJT was *"an unforgettable experience that gave me the chance to learn more about real-world work."*

While many emphasized growth, some also noted difficulties. Student F acknowledged that *"at first it was overwhelming because I didn't know what to expect, but eventually I became more comfortable."* Student L described balancing excitement with nervousness: *"I was nervous during the first few days, but later on I became comfortable with my tasks."*

Overall, students consistently characterized their OJT as meaningful and impactful, often blending gratitude with acknowledgment of the learning curve they had to navigate.

Theme 2: Tasks and Responsibilities

Students' journals and reflections documented a wide range of tasks, largely administrative, clerical, and technical in nature. While some responsibilities were repetitive, many students still valued them for the skills and discipline they developed.

The majority were assigned encoding, filing, and documentation. For instance, Student T provided detailed records of encoding *"Purchase Orders (POs), Notices of Award (NOAs), Material Requisition Forms (MRQs), Minutes, Attendance sheets, Abstracts, and Project Procurement Management Plans (PPMPs)"* almost daily. Student H likewise reported responsibilities such as *"scanning documents, encoding files, and sorting reports."*

Other students were given field-based or client-facing roles. Student S described a blend of office and fieldwork: *"My responsibilities were a mix of administrative, research-oriented, and field-based work, providing a well-rounded experience."* Meanwhile, Student U was exposed to logistics and supply-related tasks: *"At DAR, I*

handled supply requests, organized materials, and helped prepare for outreach events. I also observed client intake sessions, which challenged me to understand professional processes."

Students often differentiated between routine tasks and those they found most meaningful. Student K, for example, wrote: *"I was tasked mostly with encoding and filing documents, which at first felt repetitive, but I realized accuracy and timeliness are very important in the workplace."* Student M highlighted the learning value of everyday office operations: *"Even though my tasks were simple, like routing documents, I learned the importance of organization and attention to detail."*

Thus, while the nature of work varied, students consistently found value in the responsibilities assigned, whether through technical learning, exposure to real-world processes, or understanding organizational discipline.

Theme 3: Application of Academic Learning

An important objective of the OJT was to assess the extent to which academic preparation in mathematics contributed to workplace readiness. Student responses revealed that while the tasks often did not directly require advanced mathematics, the program provided transferable skills that were useful.

Time management, logical thinking, and problem-solving were among the most cited applications. Student Q noted: *"For me, it's the time management."* Similarly, Student T reflected: *"Mathematics sharpened my attention to detail and analytical thinking, which proved valuable in completing my assigned tasks."*

Some students drew direct links between mathematics and data handling. Student S highlighted: *"A mathematics degree provides a powerful foundational toolkit for a DILG internship. It equips you with an analytical mindset, logical rigor, and precision that directly enhances data management, policy analysis, and problem-solving tasks."*

However, a number of students acknowledged limitations. Student U wrote: *"My math background helped me stay organized, think logically, and solve problems efficiently… However, the internship pushed me to grow in areas math doesn't cover, like communication and teamwork."* Similarly, Student F observed that while math helped with discipline and organization, *"I still had to learn new software and office skills that were not covered in my courses."*

Overall, mathematics was found to be indirectly relevant, equipping students with habits of mind and problem-solving strategies that proved useful in real-world contexts, even when the tasks themselves were not computational or theoretical in nature.

Theme 4: Challenges and Coping Mechanisms

Students encountered a variety of challenges during their internships, ranging from personal adjustment to practical constraints. Coping strategies were equally varied, often involving adaptability, resourcefulness, and social support.

A recurring difficulty was financial. Student Q candidly admitted: *"The most challenging part of my experience was financial stability, but thank God I somehow managed to surpass it."* Similarly, Student J reflected:

"Transportation and daily allowance were difficult, but I learned to budget and adjust."

Others highlighted challenges related to workplace adjustment. Student S explained: *"Every office has its own unspoken rules, social dynamics, and communication styles. An intern is an outsider who must quickly learn whom to approach, how to make requests, and how to fit into the established workflow without being disruptive."*

Technical challenges were also common, particularly with office tools. Student T shared: *"I faced challenges with Excel, which I wasn't very skilled at, but I learned a lot from my supervisor."* Student H echoed this sentiment, admitting difficulty in learning scanning and filing systems initially.

Coping strategies ranged from self-directed learning to relying on mentors. Student S described adopting *"a humble learner's attitude"* by being polite and respectful, while Student U overcame communication anxiety by *"observing others, asking questions, and staying organized with checklists."*

These accounts demonstrate that while challenges were inevitable, students found constructive ways to cope, often transforming obstacles into opportunities for growth.

Theme 5: Skills and Growth

Students consistently reported growth in both technical and soft skills. Many emphasized newfound competencies in professional communication, office technology, and personal discipline.

Technical learning was often linked to office operations. Student Q remarked: *"I already knew how to use a printing machine and bookbinding."* Student T reported significant growth in document processing and digital tools: *"I also understood the need to be careful with data entry, as everything I encode is reviewed before approval."*

Soft skills, however, emerged as the most significant area of growth. Student U wrote: *"During my OJT at DAR, I improved my communication, time management, and teamwork skills. I learned how government offices operate and became more confident, adaptable, and professional in handling tasks."* Similarly, Student S emphasized stakeholder engagement and adaptability: *"This experience developed my technical skills in government databases and advanced Excel, while also honing soft skills like stakeholder engagement and professional discretion."*

Another recurring theme was patience and professionalism. Student Q acknowledged developing *"more patience,"* while Student T cited learning *"the importance of professionalism, including punctuality, adaptability, and responsibility."*

Taken together, the internship proved transformative in cultivating professional dispositions alongside technical competence.

Theme 6: Professional Insights and Career Paths

For many students, the OJT reshaped their perspectives on career possibilities for mathematics graduates. Exposure to government and institutional work broadened their horizons beyond traditional academic paths.

Student S captured this shift vividly: *"My OJT at the City DILG fundamentally reshaped my perception of career paths for a BS Mathematics graduate. It moved my focus from purely theoretical or academic roles to the vast potential in applied public service and data-driven governance."*

Others similarly expressed openness to government work. Student Q shared: *"It has influenced me in ways that make me dream of working at a government office someday."* Student U reflected: *"My OJT at DAR showed me that BS Mathematics graduates have diverse career options beyond teaching or research. I saw how analytical and problem-solving skills can be applied in government work, data handling, and operations."*

Some even expressed inspiration to pursue specific agencies. Student K noted: *"I can see myself applying at PSA or similar institutions in the future because of the work exposure I gained."*

Overall, the OJT broadened students' career imagination, reinforcing that mathematics graduates are not confined to classrooms but have meaningful roles to play in government, administration, and data-oriented services.

Theme 7: Recommendations for Program Improvement

Students provided constructive feedback for improving the OJT program, ranging from structural to mentoring-related suggestions.

One recurring recommendation was extending OJT hours. Student Q suggested: *"Extend the number of hours hehe thank you."*

Others emphasized structured orientation and mentorship. Student S proposed: *"Implement a structured onboarding process with a clear OJT plan provided on the first day… assign a dedicated mentor, a field officer or senior staff member to each intern."*

Task relevance was also raised. Student U recommended: *"It would also help to match tasks with our academic background—for example, giving math majors data-related work."*

Professionalism and soft skills were likewise emphasized. Student T listed: *"Punctuality, Professionalism, Adaptability, Diligence (not lazy), Willingness to accept tasks."*

Finally, students suggested activities that promote reflection and accountability. Student U noted: *"Ending the program with a reflection activity would allow interns to share insights and consolidate their learning."*

These recommendations demonstrate students' awareness not only of their own learning but also of the program's potential for enhancement, underscoring their active role in shaping future iterations of the OJT.

CONCLUSION

The thematic analysis of reflections and journals of Students A–U revealed that their inaugural OJT experience was characterized by growth, challenges, and a broadened sense of career possibilities. Overall experiences were described as transformative, with tasks ranging from clerical encoding to community-facing work. While mathematics was indirectly relevant, students credited their degree for developing transferable skills such as logical thinking, organization, and problem-solving.

Challenges (financial, technical, and social) were common, but students coped through adaptability, mentorship, and self-discipline. Growth was evident in both technical and soft skills, particularly in communication, professionalism, and patience. Importantly, many students emerged from the experience with expanded career aspirations, particularly in government service.

Finally, students offered concrete recommendations to improve the OJT program, including structured onboarding, mentoring, relevance of tasks to academic background, extended hours, and reflective activities.

The implementation of the first-ever on-the-job training (OJT) for Bachelor of Science in Mathematics (BS Mathematics) students at the university offered valuable insights into the academic, professional, and personal growth of the participants. The findings reveal that while students encountered a variety of challenges (financial constraints, technical unfamiliarity, and the need to adapt to professional environments) the OJT also became a powerful site for growth. Students consistently highlighted the development of transferable skills such as time management, attention to detail, logical reasoning, professionalism, and teamwork. Importantly, the internship expanded their perspectives on possible career trajectories for mathematics graduates, particularly in government, administration, and data-driven services.

A significant insight is that while the Commission on Higher Education (CHED), through its CMO for BS Mathematics, does not currently require OJT, this pilot implementation demonstrated clear benefits in preparing students for nontraditional and applied career paths. The results show that mathematics, though not always applied in its formal or theoretical sense, provided students with habits of mind—analytical rigor, logical reasoning, and problem-solving—that were directly useful in professional contexts. The OJT thus bridged the gap between academic training and workplace realities, providing students with an experiential platform for holistic formation.

Equally significant are the reflections that point to areas for improvement in program design. Students recommended clearer orientation, the assignment of mentors, better alignment of tasks with their academic background, and structured reflection activities. These insights underscore the importance of intentional program design if OJT is to become a sustained feature of the BS Mathematics curriculum.

RECOMMENDATIONS

Based on the above finding and conclusions, the following recommendations are hereby offered:

1. Universities should formally integrate OJT as an elective or capstone course, accompanied by clear guidelines, orientation sessions, and structured supervision. This ensures alignment of expectations between students, faculty, and host agencies.
2. To maximize the relevance of OJT, placements should match mathematics students with roles involving data analysis, statistics, and research support, while still exposing them to general workplace practices that build adaptability and professionalism.
3. Financial and logistical support, coupled with regular feedback and reflection activities, will make OJT more inclusive and effective. Reflection also consolidates learning and generates continuous improvements for the program.

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