

A Scaffolded Apprenticeship Model of Undergraduate Research Education in Allied Health: The University of the Philippines Experience

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ABSTRACT

This feature article describes the history, key characteristics, and perceived benefits and challenges of the undergraduate research program of the College of Allied Medical Professions of the University of the Philippines Manila (UP CAMP). It also offers some critical reflections on the program after two decades of implementation.

UP CAMP previously subscribed to a consultant model of research supervision (i.e., student-led project ending with a thesis defense). However, the limitations of this model led to a shift to an apprenticeship model (i.e., faculty-led project ending with an oral research presentation). Research courses were also redesigned so that research training starts as early as Year 1 or 2 and becomes progressively more complex every year until the final-year thesis.

After implementing this scaffolded apprenticeship model for 20 years, there have been four main benefits or positive outcomes based on anecdotal evidence and our collective observations: students learning better by doing, students being shielded from more time-consuming administrative requirements, a growing interest in research-focused roles among graduates, and increased research productivity among the faculty. There have also been challenges in the adoption of this model: projects needing to be developed by the time students start their participation, projects needing to be divided into reasonably manageable and substantial sub-projects, students' teamwork issues, and authorship or other research integrity issues. A systematic evaluation of this model is needed to demonstrate its benefits and inform its ongoing development. In the meantime, we drew upon our experiences to identify possible facilitators and barriers and suggest future directions.

Keywords: research, professional education, mentoring, health occupations students, allied health occupations, occupational therapy, physical therapy specialty, speech-language pathology

RESEARCH IN ALLIED HEALTH EDUCATION

Research competence development is a core part of pre-professional allied health education. Research skills are recognized as one of the pillars of clinical practice, as research-informed or evidence-based practice (EBP) is known to improve patient safety, service quality, and resource use efficiency.^{1,2} To enable clinicians to generate and use evidence in practice, research competencies must be developed as early as their undergraduate years.^{3,4}

Research-based education (RBE) can be implemented to develop research competence among undergraduate allied health students. RBE is a pedagogical approach that urges faculty and students to "teach and learn through enquiry and research."⁵ RBE may be implemented in different ways



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depending on the discipline.⁶ Some common inquiry-based activities include literature reviews, data collection, data analysis, and oral research presentations.⁶ For allied health disciplines, RBE develops not only research methods skills but potentially also discipline-specific knowledge.⁴

The benefits of RBE extend beyond enhancing research and subject matter knowledge and include other advantages for students, faculty, and the university. Undergraduate research experiences help students develop critical thinking, information literacy, written communication skills, and problem-solving abilities.^{7,8} They also help the faculty initiate or advance their research agenda while teaching.⁹ Consequently, the university benefits from this student-faculty collaboration as it gains more publications and other research outputs.⁹

Recognizing the value of RBE, universities offering allied health programs have created various undergraduate research experiences. Arguably, the most common of which is the undergraduate thesis or capstone project.^{10,11} As the packed curricula of health science courses may leave little room for research experiences prior to the undergraduate thesis, universities have implemented additional strategies to supplement it.^{12,13} The heterogeneity of such strategies mirrors the variability of undergraduate research experiences.¹⁴ Some allied health programs (e.g., Boston University) create opportunities for individual students to voluntarily assist in a faculty member's research lab, typically for 10 to 15 hours a week.^{14,15} Others offer similarly optional research assistantship programs compressed into the summer or winter term (e.g., The Hong Kong Polytechnic University, The University of Queensland), an intensive full-time engagement that may last for 2-3 months.^{14,16,17} Another strategy is organizing course-based research activities wherein students help conduct studies addressing the needs of a community partner.¹⁸

In this paper, we describe how the the College of Allied Medical Professions of the University of the Philippines Manila (UP CAMP) implements RBE and attempts to maximize undergraduate students' research experiences through a scaffolded apprenticeship model. CAMP is one of the academic units of the Manila campus of UP, the Philippines' national university. UP CAMP offers undergraduate programs in occupational therapy (OT), physical therapy (PT), and speech-language pathology (SLP), as well as master's programs in SLP, clinical audiology, and rehabilitation sciences. We discuss UP CAMP's undergraduate research program in terms of its origins, key characteristics, perceived benefits and challenges, and future directions.

Undergraduate Research Education in UP CAMP before the Early 2000s

Before 2006, UP CAMP's undergraduate research program consisted of a course on research methods with proposal writing and an undergraduate thesis course, both of which were completed within 12 months.¹⁹ The research

proposal and thesis courses operated under a consultant model, wherein students developed and implemented their own projects under the supervision of a faculty member.²⁰ As a model of research supervision, the consultant model is valued for how it allows students to gain a sense of ownership of their work.²⁰ However, it comes with the challenge of students having to plan and implement their own activities, solve problems, modify their research topics or plans as needed, and deal with their own failures.²¹ At UP CAMP, research consultancy was carried out in small groups of around two to six, with some instances of individual projects.²² Because the departments of OT, PT, and SLP had fewer faculty members at the time, one faculty member (usually an instructor with a bachelor's degree; occasionally, an assistant professor with a master's degree) might supervise two or more student research groups working on unrelated topics that might or might not be aligned with the faculty's expertise and/or research interests. For example, in 2000, one PT faculty member supervised an undergraduate research project on the "effects of proprioceptive training on balance and risks of falls" in older adults and a project on the "signs and symptoms of vertebrobasilar insufficiency in individuals complaining of neck pain."^{23,24}

In the early 2000's, the UP CAMP faculty started to consider revising the college's approach to teaching research. At around this time, EBP was being pushed to become standard practice in OT, PT, and SLP.²⁵⁻²⁷ The faculty realized the importance of developing undergraduate students' competencies as research consumers as well as contributors in research production. Additionally, students found it difficult to design, set up, implement, and write up their research project because they did so in parallel with their clinical internship. More importantly, the research projects under this consultant method were rarely disseminated to and utilized by the public.

UP CAMP's Current Model of Undergraduate Research Education

To foster a culture of scientific inquiry for research consumption and production among CAMP's faculty and students, UP CAMP shifted from a consultant model to an apprenticeship model.²⁰ Table 1 presents all the key changes from the consultant to the apprenticeship model and the corresponding factors that drove these changes.

In the apprenticeship model, the research education program of the college pivoted from student-initiated projects to faculty-led research projects (Table 1, row 2).^{19,28} Simpler research designs and studies with more manageable datasets were prioritized (Table 1, row 3). This model is what the college is offering to this day.

In this modified approach, students are now guided in making research decisions at different stages of a faculty's research project, unlike in the previous approach where students would need to "defend" their decisions and actions for their self-initiated research projects. This change

Table 1. Summary of Key Changes to UP CAMP's Previous Model of Undergraduate Education (consultant model) and the Corresponding Drivers of its Current Model (apprenticeship model)

#	Aspect(s) of change	Driver(s)	Previous consultant model	Current apprenticeship model
1	Exposure to a community with a culture of research	There is a need to engender a culture of scientific inquiry to enable research consumption and production.	Little exposure - doing research themselves, possibly without seeing the faculty doing research too	Substantial exposure – learning to do research by observing and assisting the faculty
2	Person(s) leading the project	Students have yet to be immersed in their own profession for them to determine knowledge gaps and develop their own questions. The faculty might not have the expertise in the area/topic selected by the students.	Student-led	Faculty-led
3	Size and complexity of research projects	Most research projects cannot be completed in one or two semesters. The goal for students is to graduate and finish.	Bigger research projects with potentially more complex designs	Mostly simpler and manageable research designs and manageable datasets
4	Final research requirement	Graduates seem to be discouraged from pursuing research after graduation because of having less than ideal research experiences.	Thesis defense	Oral research presentation similar to one done in conferences
5	Teaching-learning strategies and duration of research training	Abstract research concepts may not be easily understood in the classroom.	Learning from the methods of research course (isolated exercises) in Year 4 and then applying it immediately to their thesis in the same year	Scaffolded research courses from Years 1-4, which include opportunities to read sample journal articles written by the faculty Learning by doing in Years 3-4 as they assist the faculty in selected segments of their project



Figure 1. An OT student research group posing for a photo after the assigned teammate delivered their oral presentation.

additionally encourages the students to focus more on developing competencies for research dissemination (Table 1, row 4), such as writing manuscripts in journal article formats, and preparing and delivering conference-style poster and/or oral presentations at the college's annual research symposium (Figure 1).²⁸ These teaching and learning activities provide students with an opportunity to appreciate the value of and develop self-efficacy in sharing research findings with the community.

Supervision remains to be conducted in groups (Figure 2), a practice that is in line with what is now referred to as a team-based learning approach.²⁹ Working in teams brings its own challenges (e.g., balancing group versus individual work, different quality across sections of an output), so a learning module on teamwork is provided. Working in teams prompts students to engage in active and collaborative learning and problem solving, and it allows the faculty to teach several students at the same time.²⁹



Figure 2. One OT student group doing data analysis with their faculty mentor.

In 2018, during the undergraduate programs' curricular revisions, the apprenticeship model was further enhanced by expanding and extending the research courses prior to the thesis (Table 1, row 5). In this revised "research series", students receive continuous scaffolding as they gradually gain research competencies from year 1 until they do their thesis in year 4.³⁰ The choice to stretch out the learning period is a nod

to other undergraduate research programs with scaffolded research experiences.^{21,31} Repetitively and progressively exposing students to research methods and statistical concepts leads to better appreciation and understanding over time.¹³

Figure 3 shows UP CAMP's scaffolded apprenticeship model, highlighting the students' gradual mastery of research program outcomes through deepening knowledge (Figure 3A) and increasing independence (Figure 3B).

The research courses were sequenced so that theoretical concepts in research and evidence-based practice (Figure 3 green segments) provided a foundation for learning more practical skills, such as writing proposals, collecting and analyzing data, and disseminating findings (Figure 3 red segments). In years 1 and 2, students are expected to demonstrate understanding of research concepts introduced to them through a blended learning approach.³² The faculty facilitate in-person and online didactic activities (e.g., lectures, practice quizzes, exercises involving practice datasets). Assessment of learning is done through submission of worksheets and written examinations.

In year 3, students are expected to develop a research proposal under the guidance of faculty supervisors. Before the actual research apprenticeship commences, the students attend lectures, complete self-directed modules on research proposal writing (e.g., referencing, using reference management software, scientific writing), do self-reflection

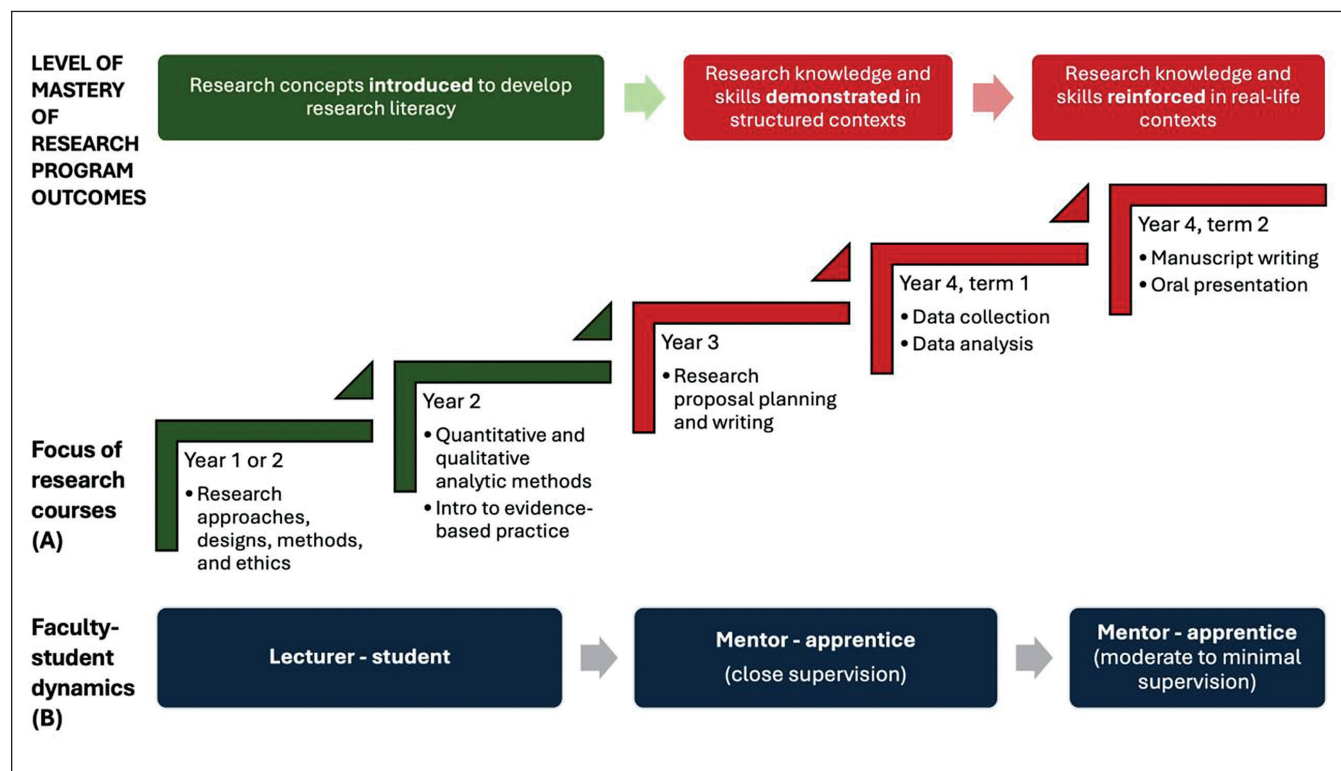


Figure 3. UP CAMP's scaffolded apprenticeship model highlighting the students' gradual mastery of research program outcomes through deepening knowledge (A) and increasing independence (B).

exercises, and participate in workshops on group writing. During the apprenticeship proper, the supervisors' primary function is to teach the process of research proposal writing using their own project as a platform. Some supervisors may also choose to facilitate team-building exercises at the start. While drafting their research proposals, students review and apply concepts learned in prior courses and the course at hand. The faculty supervisors give the students feedback on their drafts and guide them in their revisions. At the end of the course, students are graded for both process (e.g., research competencies, soft skills) and output (i.e., the final proposal).

In year 4, students are expected to implement a reasonable portion of the faculty's research project, analyze the data collected, and disseminate their findings. Students continue to work with their supervisor to learn about data collection, data analysis, and research writing. Initial meetings focus on orientation to the project, application of concepts learned in previous semesters, and setting expectations, goals, and tasks for the semester. In succeeding weeks, supervisors make the students practice the data collection protocols prior to meeting actual participants. During or after the data collection phase, some supervisors may also conduct workshops on specific analytic procedures, including the use of relevant software (e.g., statistical analysis software, qualitative data analysis software, language sample analysis software). Students meet weekly to work on their assigned tasks; depending on the meeting agenda, their supervisor may or may not be present. When supervisors are present at a meeting (e.g., Figure 2), the task at hand typically requires their guidance or supervision (e.g., analyzing data) or live feedback (e.g., brainstorming discussion points). Similar to year 3, students are assessed for both process and output (i.e., the research manuscript). The college's apprenticeship model culminates with research dissemination activities. Students prepare for and present at a college-organized research symposium. To reinforce the value of research in allied health, the college presents a "best research presentation" award to one group per discipline at the college's recognition ceremonies.

Perceived Benefits and Challenges of Implementing UP CAMP's Model of Undergraduate Research Education

Perceived Benefits and Positive Outcomes

Ahead of a formal evaluation of UP CAMP's 20-year undergraduate research education model, anecdotal accounts and our collective observations suggest several key benefits. From our perspective, the most fundamental overarching benefit is that the apprenticeship model makes it easier to teach and learn research concepts. Concepts learned in their introductory research courses (e.g., research designs, statistical procedures) are concretized and solidified through hands-on research work. Additionally, students are able to experience real issues and successes. These experiences allow them to better understand the nuances of conducting

research. For example, even if the faculty is responsible for applying for ethics clearance and grants, students still gain vicarious experiences in these steps. They may also gain hands-on experiences in selected ethical or financial aspects of the project (e.g., discussing informed consent forms with participants, processing, or logging research participants' compensation). Depending on the timing of national conferences, a few students may also get additional research dissemination opportunities beyond their undergraduate requirements. Aside from learning better by doing, students are also shielded from more tedious and time-consuming processes, such as applying for technical and ethical clearance.

In terms of positive outcomes, we have observed a growing number of our graduates pursuing research-focused career pathways. These include research assistantships at various institutions (e.g., UP CAMP, National Institutes of Health, Department of Health) and research-based post-graduate studies both locally and internationally. Pending a robust assessment to link UP CAMP's model to this outcome, this observation may be considered unsurprising, as studies have shown that undergraduate research experiences are associated with increased interest in research, research self-efficacy, and likelihood of pursuing PhD programs.³³⁻³⁵ Furthermore, research self-efficacy has been found to predict undergraduates' plans to pursue research careers.³⁶ Based on our students' evaluation of the research courses in academic year 2024-2025, the students agree (rating of 4) or strongly agree (rating of 5) that their research courses helped them "gain confidence for future semesters". The average ratings given to this item were 4.74 for OPST 195 (research literacy I), 4.37 for OPST 196 (research literacy II), 4.44 for OPST 197 (research proposal writing), and 4.62 for OT/PT/SP 200 (undergraduate thesis). Few students left qualitative feedback on the hands-on courses (research proposal writing, undergraduate thesis), but those who did seemed to appreciate the research immersion and their advisers' degree of support and input (Table 2). Although obtained from more recent batches of students, these data suggest that earlier cohorts may have had similarly positive and confidence-boosting undergraduate research experiences.

Anecdotally, there has also been an increase in faculty research productivity with the implementation of CAMP's apprenticeship model. Knowing that they would likely supervise undergraduate students, the faculty became more proactive in developing and setting up their research projects. Our collective observation is that better alignment of the faculty's research and teaching duties may have also facilitated research planning and implementation and contributed to productivity. This outcome might come as a surprise to those who are more familiar with the consultant model of research supervision, as teaching student research assistants is a time-consuming add-on duty, which often does not count towards the faculty's teaching load.^{21,37} However, in our experience, the apprenticeship model has promoted more efficient use of the faculty's time since there is more intersection between

Table 2. Students' Positive Comments on the Research Proposal Writing and Undergraduate Thesis Courses

Aspect appreciated	Verbatim comments
<i>Advisers' degree of support and input</i>	"What I liked most about this course was the multiple reporting of work and consultations with our advisor, as these helped us structure our line of thinking properly and write our paper with more confidence." (OT student)
	"Learning experience from our thesis advisers" (PT student)
	"I liked how the research advisers were helpful throughout the proposal writing stage." (SP student)
	"How we were guided by our adviser throughout the process" (OT student)
<i>Immersion</i>	"I liked that the course was straight to the point—we were grouped and assigned to studies that will be the focus of the thesis." (SP student)
	"I appreciated the opportunity to be immersed in evidence-based learning and explore research in the future." (OT student)

their research and teaching. Instead of supervising and advising students working on another project, especially one that is not aligned with their subject matter and research expertise, they are able to focus on supervising students while working on their own projects. It has been suggested that the apprenticeship model is more appropriate for junior faculty working towards tenure, probably because it will allow them to focus on establishing their research track record.²⁰

Challenges

UP CAMP's group apprenticeship model also poses some challenges. Table 3 presents these challenges along with the strategies we have found useful. Challenges 1 (risk of projects not being ready yet) and 2 (making projects manageable) are logistical in nature and can therefore be easily addressed by planning well. When choosing among the suggested strategies (Table 3, strategy 1.1 - 2.4), our faculty's main guiding principle is to ensure that students meet the course outcomes regardless of the setup. Even in cases where delayed ethical reviews prompt students to be regrouped or reassigned, the students could still meet the thesis course's outcomes with the new project. While challenges 3 (students' teamwork issues) and 4 (risk of research integrity issues) may not be straightforward to resolve because of their social and ethical nature, our college's experience has shown that these can be overcome through a range of strategies. The faculty just has to do early preparatory work to promote positive group dynamics and set expectations (Table 3, strategies 3.1 - 3.3). Although it may be time-consuming to develop guidelines and forms (e.g., for strategy 3.3), once the college agrees on a template, these documents can apply across different research projects.

Aside from guidelines and forms, additional mechanisms can be adopted to mitigate research integrity issues (Table 3, challenge 4), particularly those related to authorship and intellectual property ownership. At UP Manila, all students and faculty are required to take the Office of Research Integrity's asynchronous research integrity course (Table 3, strategy 4.1) and are offered access to the accompanying authorship manual.^{40,41} With regard to intellectual property, the college implements a practice analogous to the aforementioned manual's guideline on "clear communication

Table 3. Challenges Posed by UP CAMP's Group Apprenticeship Model vis-à-vis Potential Mitigation Strategies or Solutions

#	Challenges	Mitigation strategies or solutions
1	Risk of research projects not being ready by the time students need to take their research proposal writing course and/or undergraduate thesis course	<p>1.1 Processing technical and ethical review applications well in advance</p> <p>1.2 Reassigning students to other projects that are already ready</p>
2	Difficulty in making larger or more complex research projects manageable for undergraduate students	<p>2.1 Giving students only a portion of the dataset to analyze and letting them write a manuscript based on that portion</p> <p>2.2 Assigning only one research objective to them</p> <p>2.3 Limiting student participation to one phase of a multi-phase study</p> <p>2.4 Making them do an evidence synthesis that would help the faculty develop more complex projects of their own³⁸</p>
3	Students' teamwork issues that require the faculty to intervene (e.g., non-performing member, unhealthy team dynamics)	<p>3.1 Deliberately creating groups with students having complementary strengths</p> <p>3.2 Helping students facilitate their first few meetings, especially those involving role assignment</p> <p>3.3 Implementing a "minimum contributions" policy (list each person's contributions and exclude non-contributing members from the group's attestation sheet)</p>
4	Risk of research integrity issues, such as professors taking credit for students' work and students getting authorship credit that they have not rightfully earned ³⁹	<p>4.1 Requiring students and faculty to take modules on research integrity</p> <p>4.2 Discussing authorship and intellectual property issues early and having students and faculty document the agreed terms in writing⁴⁰</p> <p>4.3 Comprehensively listing the roles and responsibilities of students and faculty²⁸</p>

and documentation about authorship” (Table 3, strategy 4.2). Students doing their thesis are asked to sign a “statement of intellectual property” to acknowledge that their research involvement is an academic requirement and that the university and the faculty investigators own the rights to their manuscript. This point is emphasized during the students’ orientation, along with an offer for motivated students to co-author the version of the manuscript for publication after they graduate. The students are aware that the manuscript will need to be rewritten by the faculty adviser and all co-authors, because the students’ thesis covers only a portion of the entire study. Aside from discussing authorship and intellectual property matters at the outset, the students’ and faculty’s roles are also listed in the students’ course packet (Table 3, strategy 4.3). In our experience, all these communication-focused strategies appear to have been helpful in minimizing the so-called “power differentials” between students and faculty.⁴² They probably guide the faculty in ensuring that students’ contributions are ethically recognized.⁴³ They may also help the faculty be more mindful of mentoring the students all throughout and not using them for “free labor.”⁴⁴

Despite the presence of these challenges, the scaffolded apprenticeship model has served our students well, with some of them even gaining early research track records from their undergraduate thesis. Students who met all four criteria of the International Committee of Medical Journal Editors (ICMJE) became co-authors of the paper that would eventually be published after they had graduated, while those who did not were at least mentioned in the paper’s acknowledgments section.⁴⁵⁻⁴⁷

Critical Reflections on UP CAMP’s Model of Undergraduate Education

Lessons Learned after 20 Years of Implementation

After reflecting on our experiences in implementing UP CAMP’s model, we identified contextual factors that may have facilitated the previously discussed perceived benefits and positive outcomes. These factors cover institutional, faculty, and student characteristics.

For institutional factors, because UP CAMP’s model operates on having enough faculty-led studies to involve the students in, it likely helped that UP Manila values research enough for it to have set up a working infrastructure for researchers (e.g., policies and guidelines, research workload units, a research ethics board). In 2008, Republic Act 9500 mandated UP to become a research university.⁴⁸ Based on our observations, this mandate appears to have led to an increase in research resources and support over the years: in-house research grants, a program for visiting professors, some research software, and a growing roster of subscriptions to electronic databases. Research performance has also become an increasingly prominent criterion for tenure, promotion, and awards in the university. As of this writing, research makes up 20-50% of the evaluation criteria for academic

promotions from assistant to full professor.⁴⁹ The university’s incentivization of research may have helped drive faculty engagement in research production and publication. At the college level, the faculty may have also benefitted from the support of our university research associate and the relatively quick turnaround time (two weeks per round) of technical reviews facilitated by our research committee.

Another possible institutional factor is the university’s and the college’s quality assurance culture. At the end of each semester, the departments systematically consider students’ evaluations of courses and faculty teaching capacity. The college’s committee on curriculum and instruction also plays a part in constantly improving our teaching-learning and assessment strategies. These two practices have likely improved the implementation of our research courses and, consequently, our students’ undergraduate research experiences.

For faculty-related factors, research capacity likely played a significant role. If the faculty had not been equipped to design and implement their own research protocols, it would have been difficult to implement UP CAMP’s model, let alone boost the faculty’s research productivity. In the last two decades, UP CAMP has been prioritizing faculty development through post-graduate studies. In 2005, around 50% of the faculty had master’s degrees, and none had PhD degrees.⁵⁰ In contrast, in 2026, 62% of the faculty have master’s degrees (44%) or PhD degrees (18%).⁵¹ Their post-graduate research training likely supported greater scholarly productivity. Studies have shown that having a PhD is a key factor for increasing research productivity, together with higher time spent on research and salary.⁵² The value of post-graduate degrees has also been found in a more recent review of faculty research productivity in developing countries, including the Philippines.^{53,54}

For student factors, our experiences as research advisers suggest that onboarding and training student researchers is easier when they are relatively quick to learn, critical, and self-directed. UP is the country’s national university with admission rates of around 12% (2026 data); getting into the university is competitive due to the high demand.^{55,56} As such, it may be reasonable to infer that the students we get are academically inclined to begin with and therefore easier to train.

Aside from facilitators, we also reflected on contextual factors that may hinder the successful implementation of UP CAMP’s model in other institutions. Some of these are already implied in the section on challenges, but they are explicitly stated here for other colleges or institutions to consider. One possible barrier is the faculty’s lack of time to write research proposals and facilitate all the succeeding administrative requirements (e.g., technical clearance, ethical clearance, research registration). Before our faculty got used to research being a core part of their work, their teaching-focused workload made it difficult for them to carve out time for research. Another possible barrier is the faculty’s research capacity. Before we had enough faculty with post-graduate

degrees, we had to learn how to do research on the job, mostly without a mentor. Related to this is the faculty's research supervision skills. From our conversations with new faculty, being able to do research does not automatically mean being able to teach it to undergraduates. Yet another possible barrier is delays in securing research funding or ethical clearance. These may limit the number or kinds of studies offered to students. Before our faculty became more adept at plotting research timelines against semestral timelines, we sometimes had to quickly shift and resort to studies that were low-cost and exempt from research ethics reviews (e.g., internal program evaluation, scoping reviews, systematic reviews).

UP CAMP's Future Directions for Undergraduate Research Education

Twenty years into UP CAMP's apprenticeship model of undergraduate research education, now would be a suitable time to formally evaluate the past and set intentions and aspirations for the next 5-10 years. One possible project for the UP CAMP administration is to systematically evaluate the college's undergraduate research program. A low-resource way to do that is to ask recent graduates (2024-2026) to complete an online questionnaire covering potential gains, as well as drawbacks, gaps, or negative experiences.^{33,57,58} The latter can be based on commonly reported negative undergraduate research experiences.^{42,59} The graduates can also be asked to complete an outcomes-focused questionnaire, such the University of Colorado Boulder's Undergraduate Research Student Self-Assessment (URSSA). The URSSA covers research skills, field-specific knowledge, understanding of science, research-related confidence and identity, and career plans.⁶⁰ The results of both questionnaires will help the college improve its undergraduate and graduate research programs.

Since the teaching-learning activities in Year 1 and 2 are mostly classroom-based (e.g., lectures, exercises involving practice datasets), another potential endeavor is to explore diverse ways of offering more hands-on research experiences for our Year 1-2 students. One popular strategy is the creation of course-based/classroom undergraduate research experiences (CUREs), which involve students doing actual research as part of their course requirements.⁶¹ An example from the natural sciences is to make students experiment with microorganisms and write about their findings in one semester.⁶¹ In the allied health professions, CUREs might be harder to implement because of potentially more ethical issues at play. A scoping review of studies on research-based courses in health professions education found that these courses were mostly related to community or public health.⁶² The authors hypothesized that the predominance of research experiences in public health courses over clinical courses might be because the former is "less sensitive and ethically demanding" than investigating vulnerable groups.⁶² At UP CAMP, we offer an undergraduate course on health promotion for OTs, PTs, and SLPs. It might be possible

to create CUREs for that in the far future with adequate planning and guidance from the UP-Manila Research Ethics Board.

An ethically and logistically simpler alternative to CUREs is to make Year 1 or 2 students (taking research literacy I) participate in the research meetings of Year 3 students (taking research proposal writing), and to make Year 2 students (taking research literacy II) observe Year 4 students (doing their theses) collecting or analyzing research data in real life. This setup is similar to the tiered mentoring program of the Westminster College, wherein seniors and lowerclassmen are assigned to the same research group, and mentoring (i.e., faculty-seniors; seniors-lowerclassmen) happens during weekly research meetings.⁶³ This setup maximizes research engagement opportunities and offers improved scaffolding for students enrolled in low-resource institutions.⁶³ Since UP CAMP has a considerable number of Year 1 and 2 students, they can just take turns throughout the semester so that they do not cram meeting spaces.

Aside from tiered mentoring, more summer term research assistantships can also be made available for Year 1, 2, and 3 students with great potential for or interest in research. The college's funded projects often already have research assistants who work full-time or for at least 20 hours a week, so the opportunity lies more in smaller-scale projects that would benefit from some help in the short term (e.g., doing literature reviews; collecting or analyzing data; designing research posters, presentation slides, or graphical abstracts). Such projects are often self-funded, so the college's administration can consider looking for ways to offer small undergraduate research mentoring grants. The grant should at least support the student research assistant's travel and meal expenses for the period of the assistantship (likely 4-5 weeks).

In addition to offering additional research experiences to students, there can also be more capacity-building opportunities for the faculty. Since UP CAMP's model relies on the quantity, variety, and quality of faculty-led projects, the college administration can advocate for more support for the faculty to pursue their masters or PhD. The college can also organize in-house seminars or workshops on research methods based on the faculty's needs. According to the college research committee's recent analysis of the faculty's development plans, the following topics are of interest to the majority: project management (especially the financial aspect), writing for publication, disseminating research findings visually, research productivity in general, and research collaboration. Faculty upskilling in these areas will likely trickle down to the students' undergraduate research experiences. As implied by the section on lessons learned, research supervision and mentoring can also be a capacity-building priority, especially for new faculty. Additional insights for faculty capacity building can also be gained when the college's undergraduate research program is finally evaluated. Current students and recent graduates can be asked to identify their research supervisors' strengths and areas for improvement.

CONCLUSION

As a unit of the country's national university, UP CAMP aims to "deliver and advance transformative, collaborative, and innovative *education integrated with research* and public service."⁶⁴ In this paper, we described why and how UP CAMP uses a scaffolded apprenticeship model to provide undergraduate students with early research training. In this model, students take progressively more advanced research courses throughout their program and do their thesis in groups through a faculty-led research project. We also discussed the model's benefits and actionable challenges from our perspective and ended by sharing lessons learned and suggesting formal evaluation and some potential improvements. UP CAMP stands with the global academic community in constantly improving undergraduate research education toward this vision: "through the transformative power of research, all undergraduates will be empowered to tackle complex challenges for better lives and a better future."⁶⁵

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Declaration of Artificial Intelligence (AI) Use

We used Google Gemini (gemini.google.com) to check for grammatical errors and cohesion issues in selected paragraphs of the "UP CAMP's current model of undergraduate education" section. The final version of those paragraphs was still written by the authors.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

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