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Students' Experiences of Learning Research Methods in an Interdisciplinary Project-Based Multi-Stakeholder Collaboration

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ABSTRACT

Teaching research methods is a challenging endeavor in any discipline. Approaches that offer beneficial and rewarding learning opportunities to students can improve their experiences of methods courses. This article describes research psychology students' and urban planning students' experiences of an approach that combines experiential and interdisciplinary scholarship in a university-science council research collaboration. Qualitative data from a focus group discussion and in-depth interviews generated three themes: learning about research in the real world, experiences of multidisciplinary teamwork, and professional and personal development of emerging researchers. These themes underline the importance of offering opportunities for learning about research in real-world settings, particularly when it is possible to involve external partners. We present implications of and recommendations for the implementation of the interdisciplinary project-based learning (IPjBL) strategy for teaching research methods.

Keywords: *project-based learning (PjBL), research methods, interdisciplinary collaboration*

Competence in research methods is an important skill that university students should acquire. The ability to think critically, produce valuable knowledge, and address practical issues is essential to solve the increasingly complex problems facing humanity (Stan et al., 2023; Warr & West, 2020),

especially problems relating to climate change, lack of resources and inequality (Polk, 2015). Teaching strategies have been developed to foster this ability, particularly interdisciplinary collaboration (Rooij & Frank, 2016) and project-based learning (PjBL) (Lewthwaite & Nind, 2016). In this article, we explore the role of these strategies in developing the ability to understand and conduct research. Partnerships with communities, organizations, and external research agencies are also constructive sites of learning as they provide real-world contexts to apply acquired research knowledge (Balleisen et al., 2023; Pan et al., 2019; Suiter et al., 2023). Although there is consensus in the literature about the importance of competence in research methods, such courses at the university level may be challenging for both lecturers and students (Lewthwaite & Nind, 2016). Students possibly may experience research concepts as abstract and not yet know, or are not interested in knowing, how the subject can be applied in the real world. Their lack of enthusiasm or understanding can frustrate their lecturers who are passionate researchers (Stoa et al., 2022).

Our study involved a group of research psychology students (referred to as psychology students in this article) taking an environmental psychology course and a group of urban planning students (referred to as planning students in this article) taking a course in research methods. Research methods and statistics courses in psychology are often compulsory, and students tend to feel negative and anxious about them in contrast with the practical courses they enjoy, such as clinical psychology (Stoa et al., 2022). Methods courses in planning programs are likely unpopular because the effort required to learn empirical research skills is often not justified by their infrequent serious applications in practice (Goodman et al., 2022; Rooij & Frank, 2016). Exposing students to an authentic project that involves an empirical study in the real world (also referred to as experiential learning) is a popular teaching strategy among experts in the pedagogy of methods (Lewthwaite & Nind, 2016). This strategy has been found to change students' attitudes (Korobar & Siljanoska, 2016) and enhance their perception of their competence (Stoa et al., 2022).

In this article, we describe the approach we used to provide a positive space for applying theoretical knowledge about research methods. The opportunity for this experiment arose with the establishment of a partnership between the university and a national science council tasked with conducting government-funded research on urban household water use. We relate experiences of psychology and planning students who conducted research in an interdisciplinary project-based learning (IPjBL) collaboration. We use the term interdisciplinary to refer to researchers from several disciplines (i.e., anthropology, environmental studies, political sciences, psychology, urban planning) who combined their knowledge to conduct the research project. Although a rich body of literature explores the benefits of IPjBL identified through investigating student perceptions (Balleisen et al., 2023), our article focuses on the broader experiences of two different groups of students in an interdisciplinary setting who participated in a research project to consider solutions to an authentic problem.

Literature Review

Interdisciplinary Collaboration in PjBL

PjBL is an inquiry-led learning methodology in which students work on a project that presents a problem or challenge related to the real world that may require interdisciplinary approaches. Students engage in activities over an extended period of time, using their existing knowledge to create new solutions to problems and effect deeper learning about a topic. One example may entail a research project outside the classroom or with an external partner in which students collect and analyze data and compile the results in a report (Pan et al., 2019). This method is a core feature of PjBL referred to as a concrete artifact (Warr & West, 2020) and is the method we used in our teaching approach. This methodology is in contrast to problem-based learning (PBL) in which the emphasis is on the process

of learning by solving a realistic problem that generates a conceptual artifact (Vogler et al., 2018; Warr & West, 2020). Although PBL and PjBL share many characteristics, the latter requires students to develop a specific solution or product that addresses a problem, while the former requires less structure and several results are possible (Vogler et al., 2018). Studies have found that exposure of students to real societal problems requiring solutions improves their engagement with the subject, their perception of learning (Matzembacher et al., 2019), their ability to co-operate and work in groups, their creativity and critical thinking (Trisdiono et al., 2019), and their development of career-related skills (Balleisen et al., 2023).

Training across disciplines has shown promise in enabling students to cross disciplinary barriers, particularly in the STEM fields (see Foley, 2016) and when students collaborate on a study project (see Koch et al., 2017). IPjBL bridges the gap between research and practice and develops the interdisciplinary capacity of students and researchers alike (Lyll & Meagher, 2012). Interdisciplinary cooperation is essential for planners to find effective solutions to spatial issues in an increasingly complex environmental system (Chen et al., 2022; Korobar & Siljanoska, 2016; Rooij & Frank, 2016). Similarly, the Standards of Accreditation for Health Service Psychology (American Psychological Association, 2017) requires competence in interdisciplinary skills. The emerging trend to incorporate environmental psychology into urban studies provides insights into the relationship between human well-being, behavior, and built environments (Salama & Patil, 2024). IPjBL does, however, present difficulties. Even though collaboration between disciplines is becoming increasingly prevalent, particularly when the social and natural sciences are bridged, IPjBL faces obstacles, such as lack of recognition and funding (Lyll & Meagher, 2012). In addition, this approach may be initially challenging for students and their lecturers as it requires more input and time and may lack structure (Korobar & Siljanoska, 2016). A large-scale impact study (Balleisen et al., 2023) indicated important factors that ensure the efficacy of IPjBL: planning thoroughly in regard to team set-up and logistics; building relationships and facilitating mentoring between various academic levels; and conducting authentic research.

A scoping review by Stan et al. (2023) found similarities between competencies required for research and research teaching across social sciences and engineering. They argue that research proficiency is essentially interdisciplinary in nature and that “knowledge transfer and teaching experiences across various disciplines might generate innovative further competence-oriented higher education programs” (p. 14). Our psychology and planning courses were ideal to be combined in an IPjBL program as both subjects focus on issues of sustainability and research, albeit from different viewpoints. Furthermore, our IPjBL program formed part of a university-external stakeholder partnership.

University-External Stakeholder Partnerships

The planning profession recognizes the importance of input from external stakeholders (Oonk et al., 2019), especially for students' final-year projects that address real-world problems through research (Baldwin & Rosier, 2017). In psychology, the focus tends to be on community-based research partnerships, as opposed to traditional courses, which create more authentic learning contexts for students about the complexity and management of relationships (see Racine et al., 2022). Although the literature contains examples of collaboration on research projects between students from different disciplines, few studies report an IPjBL scenario involving an external stakeholder (see e.g., Balleisen et al., 2023; Pan et al., 2019; Suiter et al., 2023). One such study is that of Kueffer et al. (2012) on sustainability research that includes (a) interdisciplinary collaboration, (b) partnerships with stakeholders outside academia, and (c) development of problem-oriented research that provides a solution that society needs. They argue that “new ways of teaching are important in building capacity for problem-oriented research” (p. 7). Our project, which focused on sustainability research, followed Kueffer et al.'s research strategy and, in addition, built the interdisciplinary capacity of psychology

and planning students by using specialized courses. This strategy is recognized as one approach to optimize education.

Students' Experiences of IPjBL

Although the benefits and barriers of PjBL are widely discussed in the literature (see Baldwin & Rosier, 2017), research on university students' experiences of IPjBL is more limited, perhaps because this teaching approach is relatively novel and fluid (Rooij & Frank, 2016). One such study reports on the collaboration between planning students and landscape architecture, ecology, and marine affairs students to learn to overcome mutual misunderstandings and address real problems while managing stakeholder relationships (Chen et al., 2022). Pan et al.'s (2019) in-depth case study of various IPjBL courses at a tertiary institution revealed that students had transformed their learning. Students felt it was important to clarify expectations before commencing a project to avoid later disparities, and they expected lecturers to intervene and provide support. At times, they faced anxiety brought on by perceptions of failure and had to find meaning in their project achievements. They also experienced challenges working in an interdisciplinary team that related to allocating roles clearly, being open to opposing ideas, and communicating effectively with stakeholders.

Similar assessments of sustainability-related research involving collaborations between psychology and planning students generally reported positive experiences. Assessment results also highlighted the role this teaching approach can play in developing the soft skills and competencies their professions required (Wagner & Du Toit, 2019, 2020, 2024). Students taking a course on evaluation in a community development program appreciated being able to put theory into practice, share multiple viewpoints, and build external partnerships. Difficulties they experienced included deviance from established structure, a fast-paced environment, more experienced students taking on the challenging tasks to the detriment of the learning of those less experienced, lack of the external partner's readiness for program evaluation, and the inability to share experiences across groups (Suiter et al., 2023). Vogler et al.'s (2018) study of a two-year IPjBL program spanning hotel or restaurant administration, computer science, and graphic design indicated students' positive experiences of preparing for the real world and learning from team members in other disciplines. Nevertheless, students were frustrated by the project's short timeline, the lack of structure, and the varied expectations from the discipline's course instructors. They also experienced anxiety about the assessment process. According to Warr and West (2020), their institution-wide IPjBL design studio gave students personally meaningful work, autonomy, and space to experience their discipline's mode of thinking. Their study highlighted issues with support from within their discipline, problems with time management and workload, and communication across disciplines. Furthermore, students in undergraduate geography and earth and environmental sciences enjoyed an IPjBL program but wanted more structure with regard to their topics and group membership (Harmer & Stokes, 2016).

The above studies recommended promoting a better understanding of interdisciplinary collaboration among students early in the IPjBL program; "a friendly and open participatory environment" (Chen et al., 2022, p. 481) to overcome misconceptions (Chen et al., 2022; Pan et al., 2019); more structure and support from lecturers (Harmer & Stokes, 2016; Vogler et al., 2018; Warr & West, 2020); and preparation of students to deal with the expected anxiety when engaging with uncertainty and the real world (Suiter et al., 2023). This paper aims to contribute to the literature on students' experiences in learning research methods in an IPjBL collaboration.

Description of the IPjBL Program

In 2019, two university lecturers, respectively from the Department of Psychology and the Department of Town and Regional Planning, began collaborating with a unit at a science council on a

two-year project aimed at understanding urban household water use in six major South African metropolitan areas. The problem we studied was the increasing municipal water supply shortages in South Africa, especially in light of the 2018 Day Zero crisis in Cape Town, in which municipal water supply nearly reached a point of complete shutdown (Taing et al., 2019). The science council subsequently received parliamentary grant funding for a study on urban household water use, with the aim of developing more effective water demand management instruments. Effecting large-scale behavioral change at household level is particularly difficult in a socio-economically stressed country with low levels of environmental awareness and engagement. For the psychology students, the problem was to develop a better understanding of household water use behavior and demand management instruments that would be more suited to behavioral change in the South African context. For the planning students, the problem was how urban planning and design may play a role in reducing demand for municipal water, considering that different land uses affect water demand differently. The planning students consequently focused on the perceived efficacy of Water Sensitive Urban Design measures, such as rainwater harvesting, relative to more traditional demand management instruments, such as water restrictions.

Preparations commenced once an agreement had been signed and ethical approval for the household water use project had been granted by both institutions. Data for the household water use project were collected through a survey and focus group discussions (FGDs). The present article is based on the experiences of students involved in the second year of the project. All eight master's students in the research psychology program taking a course in environmental psychology and six of the fourth-year planning students in the research report module who chose to work on the household water use project were informed about the project's activities, timeline, and assessment criteria and given the opportunity to participate. This arrangement provided students with a space for learning about research in the real world and a chance to network with a science council. The project took place during the second semester once the psychology students had completed the theoretical component of their environmental psychology module and the planning students had completed a module on research methods.

We held a workshop at the science council's premises to introduce the students to the research team and to give the students an opportunity to contribute to the research project's design and development of the data collection instruments. This workshop also served as a fieldwork induction session to train the students in logistics and procedure. One subgroup of the project team consisted of staff from the science council with the following roles:

- project leader: managing the urban household water use project conceptualization, institutional and funding arrangements, and overall implementation
- co-investigators: contributing to the conceptualization of the project and design of the instruments as senior staff members from the relevant science council cluster
- fieldworkers: sampling households and administering the survey questionnaires with the planning students
- drivers: transporting research teams to survey sites and FGD venues
- interns: taking primary responsibility for the research project's practical arrangements (with some assistance from the students) to gain work experience under the guidance of the science council's unit

The other subgroup of the project team consisted of the students from the university planning and psychology departments and their lecturers. The lecturers were responsible for contributing to the finalization of the research design and development of the data collection instruments. They also guided the students through the research process by attending some of the fieldwork sessions and

discussing issues that arose on site. To remain within the allocated notional hours for each module, the planning students were involved with the household surveys and the psychology students handled the FGDs, both groups working in the three metropolitan areas closest to the university. The psychology group and the planning group each created three subsets of their teams that were assigned to one of the three metropolitan areas to collect data. This arrangement resulted in six research groups that joined the science council team members who were allocated to the respective areas. The science council funded the project, arranged the logistics, and gave the students equipment to carry out their tasks.

The psychology students made suggestions to the science council interns for suitable venues for the FGDs and assisted with recruiting participants where necessary, setting up equipment, and recording the sessions. The discussions were facilitated by an experienced member of the science council research team. Together with the science council fieldworkers, the planning students administered survey questionnaires to heads or members of households. The planning students also captured the data in a spreadsheet and submitted a consolidated dataset for verification to their lecturer. Lecturers monitored both groups of students throughout the fieldwork process – they met with the students if necessary and communicated through group emails and instant messaging. On completion of the fieldwork, the lecturers convened a post-project debriefing session. The students also received fieldwork certificates from the science council. The assessment of the psychology students comprised an individual mark for their engagement in the workshop and training presented at the science council and in the fieldwork. The psychology students also received a group mark for a report that summarized the research process and general findings from the FGDs. Each planning student had to submit a research report on a particular aspect of the household survey data, including a literature review, statistical analysis, and write-up of the results.

In summary, the educational design of the IPjBL program comprised the following aspects:

- an authentic research project about the role of household behavior in the problem of increasing municipal water shortages in South Africa that entailed collecting and analyzing data and producing a research report (i.e., the IPjBL artifact);
- students working in multidisciplinary teams and learning about research methods;
- collaboration between students and an external partner about the content of the project and conducting fieldwork; and
- lecturers coaching students through the learning-about-research process and in collaborating with the external partner.

The research skills we wanted the students to learn included planning and executing a project in the real world, learning to work in multidisciplinary groups that involved industry partners, and producing high-quality reports that used the data to expand knowledge about urban water use. This approach is consistent with the main justifications for PjBL cited by Balleisen et al. (2023), which include exposing students to projects that simulate the teamwork required by their future work environment, have relevance to society, cultivate an enquiring mindset, and develop their understanding of subject content. The phases of the project with the respective activities and involvement by the science council and university teams are outlined in Table 1.

	Phases				
	1	2	3	4	5
Activities	Conceptualization of project, ethics approval & funding	Project planning: workshop, instrument design, fieldwork training	Logistics: household sampling, venues, recruitment, equipment	Data collection: household survey, focus groups	Data analysis & reporting
Science council team	Project manager Co-investigators	Project manager Co-investigators Fieldworkers Drivers Interns	Project manager Interns	Project manager, fieldworkers, drivers, interns	Project manager, co-investigators
University team	Planning lecturer, psychology lecturer	Planning students & lecturer, psychology students & lecturer	Planning students, psychology students	Planning students, psychology students	Planning students research report, psychology students project report

Table 1. Project phases, activities and team involvement

Method

As we were interested in understanding the students' experiences of IPjBL we wanted to know what it was like to participate in the project and what meanings the students attached to their experiences. To this end, we followed a qualitative approach "to encourage research participants to reflect on their interdisciplinary experiences as a way of bringing research insights most effectively into practice" (Lyll & Meagher, 2012, p. 609) and to "shed light on students' experiences and the challenges of interdisciplinary teamwork" (Brassler & Dettmers, 2017, p. 12). Accessing students' experiential knowledge had the potential to bring about mutual learning and co-production of knowledge with the science council as a key stakeholder. This tactic aligns with Braun and Clarke's (2022) description of small q qualitative research that is informed by a post-positivist paradigm as we wanted to accurately summarize the students' experiences while recognizing that our descriptions are our interpretations of their reality.

To understand the students' experiences of participating in this IPjBL program, we asked the overall research question: How did the students experience participating in IPjBL with a science council research partner? Particularly, we wanted to know whether the psychology students felt they had benefitted from the partnership in terms of their personal and professional development as researchers (i.e., being able to plan, execute and report on a project with a multidisciplinary team) and whether the fourth-year planning students felt they had benefitted with regard to their research skills. The objectives of this inquiry, therefore, were the following:

- to gain an in-depth understanding of the students' experiences of the collaboration with a science council research partner and
- to gather empirical evidence for making recommendations about using IPjBL opportunities.

Ethics clearance was obtained for either conducting FGDs or in-depth interviews with the planning students (EBIT/231/2019) and psychology students (HUM/039/0519). Information letters were sent to all participating students explaining that their involvement in the study was voluntary, that they may withdraw at any time during data collection without being penalized, that no course credits were linked to participation, and that responses would be anonymized to ensure confidentiality. Informed consent was obtained from those who agreed to participate.

Participants

As it was important for the students to feel comfortable about relating their experiences (which might include feedback about the lecturers), two independent consultants (one with a background in psychology and the other in urban planning) were appointed to collect and analyze the data for purposes of contextualization and alignment with disciplinary-specific nuances. Figure 1 depicts the role played by the consultants within the IPjBL program.

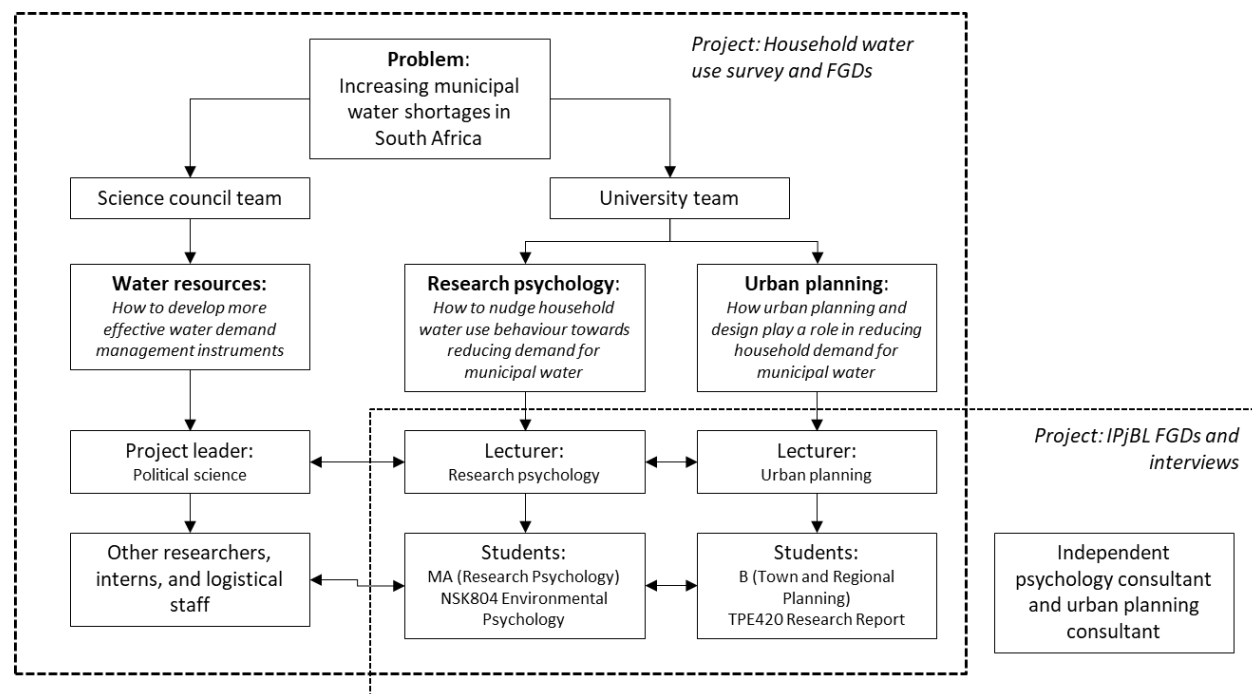


Figure 1. IPjBL Project Team Structure with Independent Consultants Investigating Students' Experiences

The lecturers and independent consultants co-developed guides for the FGD and in-depth interviews based on the research question and existing literature about students' experiences of IPjBL. The following questions were formulated for the data collection phase of the program:

- What are the most important experiences you had?
- Describe your interactions with the science council research team.
- What did you learn about research from your activities?
- What was it like working in a multidisciplinary team?
- Which aspects of the IPjBL did you find challenging?
- What would you suggest for improving future IPjBL for students?

Participants completed a short questionnaire on demographic information (e.g., age, gender, home language, study field). Both independent consultants recruited the participants for the FGD and invited them to a suitable venue on campus where they co-facilitated the discussion that lasted approximately an hour and a half. The consultants also recruited the participants for the interviews and invited them to choose a medium suitable for conducting and recording each interview that lasted approximately one hour. The interviews were conducted by one of the consultants, each in accordance

with their schedule and the participants' availability. Data were collected in English in keeping with the medium of instruction at the tertiary institution, except for one in-depth interview conducted in Afrikaans.

Data Analysis

A transcription company was used to provide anonymized verbatim transcriptions of the FGD and in-depth interview recordings to protect the students' identities. Within Braun and Clarke's (2022) typology of thematic analysis, the coding reliability method best suited our approach to analyze the FGD and interview data together as we wanted to summarize categories in related themes, using the topics reflected in the FGD and interview guides. This approach enabled us to present an outline of the participants' experiences of the IPjBL that focused on particular topics of interest, for example, learning about research in a real-world project. The psychology consultant performed the initial analysis based on Braun and Clarke's description of this method to generate themes. The verbatim transcripts were studied and notes were made of preliminary impressions related to the questions asked in the data collection phase. Meaning units in the transcripts related to these questions were identified and coded, codes were assigned to possible themes, themes were reviewed and refined, and these themes were named and defined for the purposes of writing this article. The themes summarized the responses to the main data collection questions. Our coding frame was constructed in a spreadsheet that captured a theme's name, description, meaning, and relation to other themes, including direct quotations from the transcripts that illustrated the theme and indicated the source of the response (FGD or in-depth interview).

Trustworthiness

We depended on consensus among the research team members to determine the trustworthiness of the data analysis (Braun & Clarke, 2022). The planning consultant validated the initial themes that the psychology consultant generated and recorded in the spreadsheet codebook. Both lecturers reviewed the themes, discussed the findings, and sent the revised themes to the consultants for final verification. This step ensured that we did not select only positive experiences when analyzing the IPjBL collaboration. Although the authors may have been biased, we gained "deep contextual understanding" (Vogler et al., 2018, p. 483) of the IPjBL process and how it can afford learning opportunities regarding research. As the participants had graduated and left campus by the time the themes were finalized, we could not perform member checks.

Results

Having studied the students' experiences of the IPjBL program, we generated three themes: learning about conducting research in theory versus in the real world; being part of an interdisciplinary project and how involvement assists with learning to do research; and how IPjBL may contribute to the professional and personal development of emerging researchers. Despite communication and functional challenges within a complex team of collaborators, the students generally appreciated learning about the practice of research.

Theme 1: Learning about Research in the Real World

The students learned about the theoretical and practical aspects of the research process in the field. Two sub-themes describe (a) how learning about research in the real world facilitated their understanding of the application of theoretical knowledge, and (b) the practical skills they gained

from the project. The latter included fieldwork planning (e.g., instrument design); good project management (e.g., recruitment of participants); ethical procedures; and the logistics of collecting, managing, capturing, and analyzing data using statistical software.

Theoretical vs. Practical Research Knowledge

Conducting research in the real world afforded students the opportunity to apply their theoretical knowledge, i.e., the academic content from the module on research methods completed by the planning students in the first semester and a unit on research methods presented in the environmental psychology course for the psychology students. They discovered what research is like in practice during the IPjBL, when they realized that what is portrayed in textbooks about conducting research (theoretical knowledge) may differ from what actually occurs in the field (practical knowledge). For example, the students noticed that changing certain characteristics of a research project for logistical reasons could have a fundamental impact on the research design, specifically on data quality, response rate, and practicalities. The planning students learned the importance of building systems into a research design to prevent some issues (e.g., being under less pressure to achieve a large sample size in favor of quality data and designing questions for the local context). One planning student commented, "The questionnaire ... needed to be more customized to South Africa. Even the water saving techniques were way too advanced." The psychology students gained an appreciation of standard research practice (e.g., doing focus groups is impractical without enough participants). Both groups gained an understanding of how to choose effective research designs and make an effort to conduct successful fieldwork.

In regard to the drafting of the household survey questionnaire and FGD guide by the science council stakeholders and psychology and planning lecturers and students, reference may be made to the students' experience. They found that combining too many objectives from different stakeholders can decrease the effectiveness of research instruments and that accepting other people's objectives can be more difficult than creating one's own. A participant from planning said, "It ... would have been more effective for me to just design my own survey."

The IPjBL program taught students that research objectives give direction and significance to a study. A planning student remarked, "I had to link my objectives with the literature review ... read articles and make sense of what I have read in those articles." Students also learned that research instruments should be aligned to the objectives, as shown in a comment from another participant: "I also remember I changed objectives because what I wanted to find out the respondents didn't answer."

The psychology students appreciated the opportunity to observe a good facilitator (a project manager from the science council) during the household FGDs and to learn how to apply the theoretical knowledge they had been taught. One participant noted, "The facilitator was very skilled in getting information from people ... really exciting to see all of the theoretical skills we have been learning in practice." The opportunity to observe research in practice demonstrates the importance of aligning project activities with program curricula, in this case, how to formulate research ideas and design relevant instruments and the skills needed to facilitate focus groups.

Practical Research Skills

The participants described gaining some skills related to project management, data collection, capturing, and analysis. The psychology students learned the importance of (a) good planning and detailed project management for the smooth implementation of the research plan, (b) understanding the context within which the research takes place (e.g., easy access to electricity for recording devices), (c) acknowledging the risks of fieldwork, and (d) taking ownership of the research process and actively managing it. A psychology participant described a challenging scenario at a project FGD

session and how they dealt with it when the original recruitment plan failed: "There weren't enough people ... we ended up walking around looking for participants. ... We did eventually get a focus group going and we got useful information." They reflected on the limitations of this type of recruitment and what they would do differently next time.

Both groups of students learned about the importance of logistics (e.g. choosing appropriate focus group venues and fieldwork partners, making feasible travel arrangements, printing enough consent forms, having multiple methods of recording and backing them up). Not all the students enjoyed gaining practical research skills through IPjBL. Although putting research into practice may seem exciting at first, one of the psychology students became disillusioned: "At first I was excited ... getting practical experience ... But as it progressed ... I don't really want to take part in this anymore." This attitude might be ascribed to a lack of interest in the topic of water use and not in the experience of IPjBL.

The planning students appreciated the opportunity to learn to use data analysis software and could see how it enabled them to achieve their study's objectives: "As I was analyzing the data it got ... through to my objectives, I was able to make conclusions from the data." Working on a research project gave students insights into what happens in the field and how to respond to challenges. The practical experience also revealed the connection between various parts of the research process.

Theme 2: Experiences of Interdisciplinary Teamwork

The participants experienced being part of an interdisciplinary team as both beneficial and challenging. The beneficial aspects are described in the first sub-theme about what participants gained from IPjBL as a research learning experience. The second sub-theme presents challenges related to learning to manage the relationship with the external stakeholder as a conceivable client and the associated collaborative fieldwork.

IPjBL as Research Learning Experience

The students acknowledged various benefits of interdisciplinary teamwork for learning about research, which helped them meet their module requirements. For example, belonging to a team that worked in a professional environment was a positive experience for the planning participants. Two participants expressed favorable opinions about the physical space at the science council's offices when they were invited to the project meetings: "The first briefing [at the science council] where they have a nice big boardroom, food, it was very professional," and "The campus was amazing as well. The research commons is so cool." A planning student described the advantage of having access to a large dataset (when multiple fieldworkers collected and shared data), compared to having a small dataset (when one works on one's own). They believed that a large amount of data would improve the quality of the work they submitted for assessment. One participant stated, "We had so much data to work with ... it's going to stick out."

They also learned that working in a diverse team in terms of gender, race, and language was beneficial to conducting research in the South African context. As one participant stated, "If someone is comfortable in a community and can speak and get the people to open up more ... you are getting completely different data." According to the participants in the planning FGD, this scenario had the potential to increase the validity of the results.

One of the psychology interviewees commented that interdisciplinary collaboration produced meaningful research: "I ... learned that people from different institutions can actually work together and create more useful information." However, the psychology participants also commented that the composition of the project's household FGDs was skewed towards certain demographic groups when convenience sampling crept into the recruitment process because of the way planning was done by the external partner: "So, I am not sure how valid the results are going to be." Therefore, they learned

that dependence on an external partner can affect the quality of the data collected both positively and negatively.

Belonging to a multidisciplinary team can improve one's performance in specific parts of the research process. One planning participant described how being grouped with an unfamiliar fieldwork partner resulted in more productive work:

I told my friend, obviously I will choose someone that I know to work with. We got comfortable along the way looking for participants ... with a friend you feel like there's no point let's just leave. But if you are with someone who you are not used to, you would be professional about it.

Managing the Relationship with the External Stakeholder as a Client

Learning how to manage relationships with partners on the project team, and especially with the external stakeholder acting as a client (i.e., the party who requested the student researchers to conduct research), was part of the IPjBL experience. The students were largely dependent on the science council's infrastructure and project staff for the success of the data collection. They experienced a number of challenges with the logistical arrangements and the flow of communication between the various groups.

The various components of the team needed to work closely together and communicate project updates as the fieldwork progressed. Both groups of students raised the challenges of poor communication between some components and unclear roles, most notably the function of the students and the interns who were responsible for the logistical arrangements. One psychology participant remarked that the interns were perceived as peers and not as leaders who could delegate work to them, which resulted in some tension between the students and interns: "Having three departments involved ... and then you have interns and ... students who ... didn't really enjoy taking orders from the interns. ... So, it wasn't a great relationship that we had with any of the other departments."

A seemingly trivial issue of branded clothing was described by a planning student as affecting the experience of fieldwork: "We didn't wear any T-shirts ... we should have ... makes people feel that this thing is being taken seriously." Another planning participant felt that a branded cap and vehicles with the external partner's logo were enough to indicate fieldworkers' affiliation to the science council when they arrive at households and to facilitate access to potential participants.

Although the psychology and planning students were part of the team, the two groups perceived a lack of connection with each other because they worked on different components of the project and their study levels also differed. The planning students thought the psychology students had more knowledge of the project. One planning participant said, "I feel like the psychology people were a little more involved, because they seem to know a lot more about the project than we did ... maybe they were doing it at a higher level." In contrast, the psychology students felt isolated from the survey team who seemed to collaborate with one another. A psychology participant noted, "I could see that the survey benefitted from a multidisciplinary team, you know it had a more environmental aspect as well."

The difficulties the students experienced with each other and with the client relationship led to feelings of disappointment and frustration. One psychology participant dealt with the situation by adopting the attitude that sometimes one had to "take one for the team" (i.e., do what is expected). Another participant set clear boundaries when communication from the interns was too late, stating, "No, I can't help you." The planning students were more accepting of circumstances and recognized the benefit of observing and being in agreement even though not everyone may benefit. A participant commented, "I mean, someone somewhere designed this whole study ... There's a plan behind it all, so that's also observational learning potentially."

Theme 3: Professional and Personal Development of (Emerging) Researchers

In addition to the research knowledge and skills acquired described in Theme 1, the students reported that IPjBL promoted their professional development, which is related to soft skills and competence in the workplace (e.g., they learned how to communicate in a professional environment, do sound project administration, collaborate, and relate IPjBL to employment opportunities). The IPjBL also enhanced their personal development by allowing the students to reflect on the individual strengths they needed to cultivate to complete the research project (e.g., they learned about perseverance through adversity, self-reliance, and self-motivation).

Professional Development

The participants described their understanding of how the IPjBL offered them opportunities as emerging researchers to engage with some of the competencies needed in their respective professions. A planning student explained that IPjBL developed communication skills: "About the fieldwork, for me it was enhancing my communication skills, because when you go out there and talk to people when you introduce the study to them, you have to sound professional." The guidance provided to students encouraged them to embrace professional research conduct. A participant observed that "[The planning lecturer] made ... a point that he wants [the fieldwork] to be professional. We must have minutes for every consultation and meeting—one of us writes the minutes every time so that we all learn from doing that."

Learning how to collaborate was another professional skill described by the participants as a part of the IPjBL exercise. A planning participant experienced a lack of commitment from some team members, providing insight into the reality of collaborative relationships. Even though the student may not have felt they had learned from this situation, the experience may make them more resilient to similar experiences in the future. The participant noted, "You do have to deal with people like this or with situations like that. [It] shows you not everyone is always a team player and not everyone puts in the quality of work that you put into it."

The IPjBL was helpful to the psychology participants with regard to undertaking opportunities in the research field and demonstrating what they had learned about project work. One participant stated, "It gave me experience to talk about when I was applying for internships. It was really useful to have that on my CV."

Personal Development

The participants reflected on the personal strengths the IPjBL process required, which included making a conscious effort to ensure that the execution of the research project was successful and learning how to persevere despite adversity by relying on their own abilities. The planning participants described how they felt rewarded by the project, even though they had to work much harder than they expected. This experience taught them about self-motivation and taking ownership of their work, as mentioned by one participant:

I didn't think it would be as tiring and as much work, but it was a lot more rewarding as well. ... This was like you actually did it and you understood it and it was more self-beneficial than just handing in for a lecturer to mark.

Submitting a high-quality individual research report, even though it was the result of teamwork, gave the planning students a sense of achievement and satisfaction. Moreover, they learned that involvement in a project is about more than achieving a mark in a subject—it is about an authentic project that has a purpose and must be done well. A participant observed, "It's exciting and it helps you get through the process; it helps you do a better job ... None of us were aiming for a mark,

we were trying to answer our objective and do the work.”

A psychology participant described the project as “chaotic” and a situation in which one had to accept that things would go wrong. Thus, a real-life research project may not be similar to an organized research process described in a textbook, as observed by the student: “It was a more independent thing than we had expected ... we had to figure it out ourselves and go and research. And also, just the chaotic nature of it was something that we ... had to get used to.” This participant learned how to rely on their own efforts to do what the project required and to persevere if their expectations were not met.

Discussion

Our study explored both research psychology and planning students' experiences of a combined experiential and interdisciplinary approach to learning about research. The three themes we generated from an FGD and in-depth interviews highlighted educational experiences about research in the real world, multidisciplinary teamwork, and professional and personal development. Participation in an authentic project with an external partner exposed students to the application of research in a multidisciplinary context. Overall, the IPjBL program revealed many of the same benefits and barriers of experiential learning described by Baldwin and Rosier (2017), including acquiring new soft skills (e.g., effective communication, problem-solving, collaborating with others), developing professional and personal competence, and dealing with the challenges of a time-intensive program and stress that accompanies a complex team structure

As lecturers, we have found that students struggle to formulate a research aim and objectives that would make a meaningful study possible. With regard to the first theme about using IPjBL to provide learning opportunities about research in the real world, the participants mentioned several experiences that fostered their research skills. Examples include planning a project; designing instruments; recruiting participants; and collecting, managing, capturing, and analyzing data. Interestingly, the students did not request assistance from the lecturers when they experienced challenges with the fieldwork. The reason may be ascribed to their inexperience with practical situations or their lack of knowledge about how to conduct themselves or ask for help (Matzembacher et al., 2019). Project management is a component of research practice that is perhaps not easily taught in theory—a lesson about the impact of poor project management on research quality may be best learned through IPjBL.

The second theme, students' experiences of interdisciplinary teamwork, revealed the benefits and challenges of collaboration between disciplines in working with multiple group members. Brassler and Dettmers' (2017) study, which showed a lack of interdisciplinary competency when using IPjBL, should be considered in our setting. These authors could not attribute their findings to the composition of their teams involving students from divergent disciplines in the social and natural sciences and proposed that the challenges associated with IPjBL could be responsible. Although we did not set out to measure interdisciplinary competence, we obtained limited reflection from the participants on how they viewed research in other disciplines. Therefore, their reported difficulties related to IPjBL may align with Brassler and Dettmers' explanation. Although some collaboration occurred within the larger team, having the psychology and planning students participate in different components of the household water use project may have constrained their ability to integrate various approaches to research and build collaborative partnerships between the disciplines. This problem was also identified by Costantino et al. (2010) in an interdisciplinary design studio in which engineering and art students played different roles.

In our study, we cannot clearly identify how the students' perceptions of having less knowledge (planning participants) and being less involved (psychology participants) arose. Both groups received a similar introduction to the project and participated jointly in its planning (Phase 2)

and related activities, subsequently working in blended teams on the same topic. This outcome suggests a need for regular dialog with students to gauge their understanding of the processes unfolding in a project. Moreover, the assertion that planning students, and potentially psychology students, may be more enthusiastic about learning from an authentic research partner than from their peers (Oonk et al., 2019), may also apply to our study.

Although no evidence surfaced within the focus group and interviews with the students that the IPjBL facilitated boundary-crossing in research methods between the disciplines, some apparent learning emerged from the collaboration between the external stakeholder and the larger project team. For example, utilizing an experienced project manager to model some of the expected behaviors and skills of a scientist was a valuable socialization opportunity that may have enriched students' roles as future researchers.

Our study revealed a conundrum regarding IPjBL in that students are meant to be confronted with uncertainty and problem-solving situations, whereas our participants experienced these issues more as a negative rather than positive learning opportunity. However, difficult situations prompted students to adapt by devising creative solutions to problems in the field, which enabled them to take ownership of the process and to feel competent. A rewarding finding was in the participants' description of how the IPjBL contributed to their professional and personal development, as reflected in Theme 3. This result confirmed the findings in other studies (see e.g., Suiter et al., 2023; Vogler et al., 2018). Although we intended to build the students' awareness of professional behavior as researchers, we hope that some of the unplanned adverse events that occurred during the project developed their abilities to be flexible and self-reliant and to persevere, collaborate, and work hard. Learning to work with external partners in authentic research situations may serve as a foundation for their performance in future careers (Baldwin & Rosier, 2017; Balleisen et al., 2023; Lee et al., 2014) and help them navigate uncertainties in an increasingly complex world (Rooij & Frank, 2016).

Limitations of the Study

As the students participated in different components of the household water use project, they may have encountered different experiences because of the context of the IPjBL program. Although the psychology and planning students participated collectively in project meetings and collaborated on some of the phases that offered lessons about real-world research, they did not conduct the fieldwork together. This lack of interaction during a key phase of the project may have decreased interdisciplinary boundary-crossing in relation to the subject of research methods. Furthermore, the psychology participants were registered for a program aiming to train professional psychology researchers; therefore, they may have had a positive attitude toward research and a different expectation of IPjBL, unlike the challenging pedagogical context described in the introduction. Although the two groups of students had similar experiences of IPjBL, some of their experiences may be difficult to relate to each other.

As the data were generated from a small group of students' self-reported experiences, we cannot make empirical claims about whether their research competence improved. Studies measuring the learning outcomes of larger samples of students from a variety of tertiary institutions would address some of these limitations. Circumstances required the collection of data about the students' experiences via two methods, i.e., FGDs and in-depth interviews, which may have influenced some of the responses. We also did not compare the experiences of planning students who were in the same class as the participants but were not involved in our IPjBL program to understand what they learned about research from their respective projects. Furthermore, as noted by Vogler et al. (2018), "the students' experiences with the project remain closely bound to the context of the project" (p. 483); therefore, teachers who want to implement similar approaches should decide to what extent our circumstances are similar to theirs.

Conclusion and Lessons for Implementation

Our study supports the ability of IPjBL to enrich students' experiences. Although our findings were confined to a particular setting and sample set, they may contribute to the body of knowledge regarding learning about research. This knowledge is limited, especially in the context of sub-Saharan Africa where our study was located. We propose some considerations for the use of IPjBL approaches to teach research methods. Incorporating elements of IPjBL before starting a project may be helpful in developing interdisciplinary competency. One element may be to examine jointly the variances between disciplines and opportunities for integration (Brassler & Dettmers, 2017; Lee et al., 2014). Furthermore, it is essential to establish clear expectations and systems of communication between the various components of IPjBL. We did not foresee the complexity of relationships prior to the project and may have planned for this variable more effectively. Lecturers should be available to guide students through this new learning experience, especially in terms of how to handle the challenges of messy real-world research and the difficulties of teamwork when multiple parties are involved (Chen et al., 2022). Guidance from lecturers enables students to respond better to the inevitable uncertainty and the need to solve problems. Managing an external partner's expectations of students is necessary to avoid overwhelming them with unfamiliar responsibilities and a heavy workload (Baldwin & Rosier, 2017). Students' reflections on what they learned from the IPjBL program about the theory-practice dialectic in research, about research in their discipline, and about collaboration with other disciplines on projects are important. These qualitative details were obtained during the FGD with the students, the individual interviews, and the post-project debriefing session.

We encourage lecturers to implement IPjBL in their methods courses. The program would assist them in gaining more understanding of its benefits and challenges when teaching research outside of traditional classrooms and in higher education where the emphasis is on work-readiness. Future studies on the use of IPjBL in methods courses may explore whether the program improves students' research competence, how external partners can best contribute to learning, and how interdisciplinary boundaries in the subject of research methods can be crossed. We also encourage faculty to write about their own experiences of using IPjBL approaches, especially in teaching research methods, and the kinds of institutional support they require to become successful instructors in this model. More studies on students' experiences of learning about research in diverse IPjBL settings should be conducted to reflect a broader range of socio-economic and educational contexts than those covered in existing literature.

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