

ASCILITE 2023

People, Partnerships and Pedagogies

Embracing reflexivity: Exploring deeper partnerships during an interdisciplinary technology-focused research project

Kerry Bond, Michelle Vanderburg, Ritesh Chugh, Katrina Johnston, Margaret Flanders, Roslyn Clapperton and Colleen Ryan

Central Queensland University

This case study evaluates the interdisciplinary experiences of a research team producing a digital education tool. It proposes important considerations for successful collaboration and group development, which can lead to beneficial and deeper long-term partnerships across faculties within an institution. The study suggests value in using components of collaborative research to reflect on group development and progress. In alignment with the literature, it was found that time is essential for creativity, innovation, and group performance, which are successful products of both interpersonal and task-activity aspects of interdisciplinary collaborations. Challenges and impacts on group morale can be ameliorated by factors such as operational strategies, a sense of shared ownership and personal value to the project. The long-term benefits of fostering deeper interdisciplinary partnerships are briefly explored.

Keywords: Interdisciplinary research, reflexivity, group development, collaboration.

Introduction

It has been argued that the growing field of technology-enhanced learning (TEL) research (Chugh et al., 2023) necessarily involves interdisciplinary problem-solving but that challenges are innate in the dynamic arena of interdisciplinary research (Scanlon & Conole, 2018). The study of success factors related to the coordination of skill and knowledge flows between the fields of education, technology, and the discipline being taught is essential in TEL research. Interdisciplinary collaboration is a promising avenue for generating innovative solutions to complex problems (Scanlon & Conole, 2018), and its researchers have a competitive advantage over monodisciplinary researchers with regard to knowledge brokerage opportunities (Sun et al., 2021). However, it introduces unique challenges stemming from the inherent diversity of disciplinary backgrounds and practices (Timmis & Williams, 2017), and it can take time for researchers to adjust to each other's alternative discourses (Braßler & Schultze, 2021), which can impact group development and research-impact timelines compared to monodisciplinary teams (Sun et al., 2021). Unsurprisingly, Moirano et al. (2020) have noted a rise in interdisciplinary groups and creativity in recent years, with the demand for skill development in collaborative problem-solving and innovation being internationally prioritised (von Davier et al., 2017). Recognising the significance of these dynamics, researchers are increasingly focusing on reflexivity, which involves critically examining and reflecting upon their own biases, assumptions, and interactions within the group context (Mortari, 2015). This qualitative case study provides insight into the long-term experiences of interdisciplinary researchers who conceptualised, designed and implemented a novel digital education tool for undergraduate nursing students. It examines the interdisciplinary team's reflections, utilising Wine et al.'s (2022) eight essential components of the collaborative research process as a framework, with consideration of the relevance to Tuckman's (1965) model of group development.

Literature review

Group development and interdisciplinary research

Tuckman's widely embraced model of group development integrates group structure observations with task-activity processes, summarised as Forming, Storming, Norming, and Performing (Tuckman, 1965), with a final stage, Adjourning, added later (Tuckman & Jensen, 1977). In comparison, Wine et al. (2022) focused on collaborative research processes, proposing eight essential components for successful outcomes (see Table 1, in the Findings section), which are also applicable to interdisciplinary research teams, and which we propose can underpin successful transition through Tuckman's stages. Group tasks and social dynamics are understood to significantly impact project outcomes (Collins & Guetzkow, 1964), and while team outputs are a natural focus of group research, interpersonal relationships can underpin team success and the construction of collective intelligence (Love et al., 2021). Interpersonal relationships take time to develop, and people are likely to

develop positive affect towards one another over time (Moreland & Beach, 1992), positively impacting project outcomes (Thye et al., 2019). The negotiation of challenges depends on a management style that is communicative, inclusive, and attentive; this supports alignment processes while increasing transparency, trust, and individual growth (Wine et al., 2022).

When diverse knowledge types synergise, it can culminate in innovation, performance, problem-solving, and impact (DeHart, 2017). Creativity has a presence throughout the entire process of implementing innovative ideas, and innovation is generally defined as encompassing both the generation of creative ideas and their implementation (Moirano et al., 2020). TEL is a domain where diverse knowledge and skillsets are synergised to produce pedagogical impact (Scanlon & Conole, 2018). However, obstacles to successful group development and task-activity outcomes in interdisciplinary teams may arise in response to different philosophical and epistemological positioning (Timmis & Williams, 2017), plus barriers around conceptual language and identifying roles and responsibilities (Tebes & Thai, 2018).

Reflexivity in interdisciplinary research teams

Reflexivity, as a concept rooted in social science research, has gained significant attention in recent years, particularly within the realm of interdisciplinary research (e.g., Leibowitz et al., 2016). By adopting a reflexive stance, researchers are more actively engaged in self-reflection, acknowledging their positionality and the potential impact it may have on data collection, analysis and interpretation (Day, 2012). In an interdisciplinary research group model, reflexive researchers also acknowledge their impact on group dynamics. Reflexivity promotes open dialogue and shared understanding among the researchers. Reflexivity facilitates integrating diverse perspectives in an interdisciplinary research group where diverse epistemological and methodological approaches exist (Leibowitz et al., 2016).

Research design

The project reflected in this case study combined theory, knowledge, experience, and skills from across the disciplines of adult education, language learning, learning sciences (including psychology and neuroscience), nursing, biosciences, and digital media. We aimed to enhance nursing students' fluency and comprehension of bioscience terminology by developing a mobile language-learning app prototype. The project utilised both quantitative and qualitative research methodologies, incorporating a diverse range of skills. Our group consisted of experts from five different schools within the university, with backgrounds covering all of these domains; so after working together for 2.5 years, we reflected on our unique, interdisciplinary working group thus far. Employing a qualitative case study approach, we explored how the personal experiences of interdisciplinary researchers in this successful, long-term collaboration reflect actual and potential partnerships.

Using Wine et al.'s (2022) framework, we developed a semi-structured, qualitative reflection tool encompassing personal, interpersonal, and task-related aspects to gather insights from each group member. The reflections were de-identified, merged into a single document, and underwent thematic analysis utilising the first four stages of Tuckman's (1965) group development model and Wine et al.'s (2022) essential components of collaborative research. The de-identified responses were independently coded, and through discussions, unanimous decisions were reached on themes related to group development and essential components of interdisciplinary collaborative research.

Findings

Table 1 includes reflective comments from the research team and a summary of the reflections related to Wine et al.'s (2022) eight essential components of collaborative research. Each reflective comment was chosen to be a representation of the overall reflections from the team. The seven team members were labelled A-G.

Table 1: Sample of reflective comments representing Wine et al.'s (2022) eight components.

Essential Component	Representative Reflective Comment(s)	Summary
Building Relationships	<p>I have learned more about what my colleagues are working on other than this project. (B)</p> <p>Engaging in this project has also fostered a sense of camaraderie and shared purpose. (A)</p> <p>The most enjoyable part of the process has been the level of interaction between our team members. Our team is cohesive, and members are dependable. (F)</p> <p>We may end up doing other projects together at some point in the future. (E)</p>	<p>Over time, team members learned more about each other, not just in this project, but also about the other projects individuals are involved in, and we celebrate each other's achievements. There is a sense of camaraderie during meetings. Members know each other's strengths and how each person works and look forward to working with each other on future projects.</p>
Advancing Individual Growth	<p>I think I've learned a little bit more about digital tools in education. (E)</p> <p>These experiences contribute to my effectiveness as a member of research teams in diverse domains. (A)</p> <p>I think I've really built my confidence. (E)</p> <p>It has exposed me to different ideas and ways to approach a problem... and helping me to develop my own understanding and language around education. (C)</p>	<p>Individuals have gained new skills and knowledge from others in areas they would not have in monodisciplinary research. Participants' self-efficacy as a researcher, practitioner, and valuable team member has increased over the course of the project.</p>
Building Team Capacity for Co-Production and Knowledge Translation	<p>Initially, there was a sense of cautiousness as team members got acquainted with each other's backgrounds and expertise. This project has highlighted the significance of leveraging diverse expertise and perspectives. (A)</p> <p>Different professionals have different strengths that you can utilise to get the best outcome. (C)</p>	<p>After initial cautiousness, members appreciated the integration of diverse expertise and perspectives, including research experience, to optimise outcomes. Our interactions led our thinking beyond what we would normally achieve, staying within our disciplines.</p>
Maintaining Alignment of progress, knowledge, and expectations	<p>I have enjoyed the process of working in a team with enthusiastic members, who were learning alongside of me and who have a real desire to help students, not just to research to get more papers out there. (G)</p> <p>Through open communication, feedback and active listening, we were able to navigate a sense of cohesion and collaboration began to emerge (A)</p>	<p>We came together as a group with the main goal of improving university students' bioscience terminology. Although we had the same goal, we also reflected that it was still necessary for us to have a clear consensus on everyone's role throughout the project.</p>
Establishing Trust in each other, procedures, and outcomes	<p>I really enjoyed being able to entrust certain jobs to someone with skills that I don't have. (E)</p> <p>Their specialised knowledge, skills, and roles have significantly influenced the project's direction and outcomes. (A)</p> <p>Each person has different strengths, and we have all relied on each other at different times. (B)</p> <p>That was really reassuring to know that I had an expert in the content. To know that you're not trying to achieve something where you're out of your depth because you have team members that <u>do</u> know. (E)</p>	<p>Team members enjoyed being able to entrust roles outside of their expertise area to others to achieve outcomes they wouldn't be able to achieve alone.</p>
Developing Shared Ownership	<p>My specific role or contribution to the group has been along the technological side in helping to create the prototype and with the testing once the app was created and just helping the other team members test the app. I believe that the writing side is going to be where I am not as strong, but I'm willing to make an effort and learn as I go. (G)</p> <p>We all fit together to bring about this outcome which we hope will ultimately be valuable. (E)</p>	<p>Each participant understood their role/s and the roles of others in bringing about a shared outcome. It is noted that in the reflections, the use of "we" and "our project" demonstrated team ownership of the project.</p>
Operative Elements	<p>I've also learned about the importance of organisation within a somewhat large team of researchers and because we are all in different geographical locations. (E)</p>	<p>Organisation from the start was important. The team members expressed appreciation for the regular meetings as essential for staying</p>

Essential Component	Representative Reflective Comment(s)	Summary
	I have learned that it is important to have one leader of a large group and to have regular meetings even though sometimes those meetings are just to touch base. The regular meetings have kept this project moving even during times when we are waiting for the app to be developed or waiting for some policy hurdle to be approved. The regular meetings help us stay connected. (B)	connected and for members to keep updated on the project's progress. Reflections also noted the team's seamless connectivity through Microsoft Teams, where all communications, notes, and documents were organised and easily accessible.
Individual Attitudes	I do feel of value to the group and to make myself more useful I decided to lead one of the literature reviews and to progress a team publication. (D) During the app development, I felt I couldn't contribute as much, so I tried to find things to do, (Qualtrics survey), so I could feel I was still contributing. (B)	Several members reflected on initiating a way to contribute to the team. Members initiated task activities, utilising individual strengths to keep the project progressing.

Discussion

With the understanding that interdisciplinary teams need more time in the formation stages (Braßler & Schultze, 2021), this study presents data to answer the call from current research to continually re-examine the notion of creative interdisciplinary collaborations (Moirano et al., 2020). The team had been together for 2.5 years at the time of the study, with a project timeline extension resulting in a further projected year of collaboration. The extra time has allowed us to have a longer Forming to Performing period (Tuckman, 1965), and researchers seem to be overcoming any insecurities and difficulties in role identification often seen in members of interdisciplinary teams (Braßler & Schultze, 2021), which can enable more efficient task activities. It became apparent that Wine et al.'s (2022) components impacted the group development stages described by Tuckman, often in interdependent ways. The participant remarks clearly demonstrated individual development and relationship building across multiple elements, which may underpin deeper partnerships. Participant E noted that future collaborations were possible, indicating the potential for deepening research partnerships over time. Comments suggested that interdisciplinary and interpersonal barriers had been traversed and thus are unlikely to require the same timeframe to overcome in future projects undertaken by the same group.

Team reflections acknowledge both positive aspects and frustrations, as project delays caused moments of feeling insignificant and uncertainty among team members with limited technological expertise. Despite these frustrations, organised leadership and operational strategies, including the use of an accessible shared platform and regular meetings, have fostered group cohesiveness. Our journey aligns with Moirano et al.'s (2020) findings, emphasising the importance of time, management, and three key elements—individual, collective, and organisational—in fostering creativity in interdisciplinary collaborations. Our reflexivity study aligns with their main elements as collectively, we considered how we are as individuals, how we work as a team, and how the organisation of our team has created a cohesive unit, ready to analyse the project data and disseminate findings.

Conclusion

Limitations of our reflexivity study included that the single reflective process was done two and a half years into the project. Ideally, interdisciplinary teams should periodically self-reflect throughout the project timeline to better understand shifts in perspectives, experiences and productivity over a long period (Wine et al., 2022). We also recognise our own biases, as team members analysing our reflections may influence the analysis, potentially leading to subjective interpretations.

We recommend that interdisciplinary research teams engage in regular reflective processes, individually and/or as a group, or that researchers keep an ongoing reflective project journal from the outset to support more accurate records of team experiences. We recommend that time should be spent offering task allocations (e.g., literature reviews, design of data collection tools) for those with no roles at early points in the timeline, which may help to ameliorate feelings of low team value for some individuals. Planning for strong operational organisation and a realistic timeline to optimise success is ideal, e.g., having regularly scheduled meetings which keep team members connected, even if there are few project issues to discuss. Team reflections did not indicate that collaborating online, due to the team's diverse geographical locations, posed any barrier to developing successful research partnerships. Nevertheless, the dynamics of an online interdisciplinary research

group require careful attention, and the advantages of long-term, multi-project, interdisciplinary partnerships warrant further investigation.

By bringing together individuals from diverse fields of study, collaborative research groups foster an environment that encourages the creative exchange of ideas, methods, and perspectives. Collectively, our group is well-prepared to take on the next phase of our project. We also welcome our next opportunity for reflection, as it allows us to contribute to the existing knowledge on reflexivity of interdisciplinary collaboration. We are confident that future projects and interdisciplinary teams will emerge from within our current group, with many barriers to success already hurdled, and we hope we can meet in person to foster deeper research collegiality.

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Bond, K., Vanderburg, M., Chugh, R., Johnston, K., Flanders, M., Clapperton, R., & Ryan, C. (2023). Embracing reflexivity: Exploring deeper partnerships during an interdisciplinary technology-focused research project. In T. Cochrane, V. Narayan, C. Brown, K. MacCallum, E. Bone, C. Deneen, R. Vanderburg, & B. Hurren (Eds.), *People, partnerships and pedagogies*. Proceedings ASCILITE 2023. Christchurch (pp. 296–301). DOI: <https://doi.org/10.14742/apubs.2023.591>

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