Uncovering the factors underlying collaboration outcomes in interprofessional education: A preliminary investigation involving healthcare students

Abstract

Background: Interprofessional education (IPE) incorporates healthcare students from various disciplines to learn with, about, and from one another, aiming to foster effective collaboration. However, the factors that promote these collaboration outcomes remain elusive. Recognizing this knowledge gap, this study utilizes self-determination theory applied in a ten-day IPE programme. The study aims are twofold: to clarify the potential influence of personal factors (autonomy, competence, and relatedness) and environmental factors (clear goals and technology support) on collaboration outcomes (team goal achievement and team effectiveness) and to examine the effect of the IPE on these outcomes.

Methodology: The study utilized an IPE programme that integrated asynchronous and synchronous learning methods across two institutions in Hong Kong and the United Kingdom. This involved 147 students from diverse healthcare disciplines who were enrolled in the IPE programme. A pre- and post-test design was employed to examine programme effects. Multiple regression analysis was conducted to explore the factors influencing these outcomes, while paired samples t-tests were used to evaluate the effect of the IPE programme on collaboration outcomes.

Results: Among the personal factors, a sense of relatedness emerged as an important predictor of team effectiveness and goal achievement. Clear goals and technology support positively influenced collaboration outcomes. A paired samples t-test indicated significant improvements in collaboration outcomes after the IPE simulation.

Conclusion: These findings highlight the importance of designing a large IPE programme that meets basic psychological needs (especially the sense of relatedness) and provides clear goals and adequate technology support in the IPE context. This study is helpful to understand how personal and environmental factors promote the collaboration outcomes in medical education and provide insights for future IPE curriculum development.

Keywords: interprofessional education; self-determination theory; environmental factors; personal factors; collaboration outcomes

Introduction

Although interprofessional education (IPE) has been introduced and formalized in healthcare curricula for decades (Barr, 2015), our understanding of the factors that contribute to collaboration outcomes is still limited. It is crucial to have a clear understanding of these underlying factors to advance our knowledge of effective interprofessional training and collaborative practice. By addressing this fundamental knowledge gap in IPE, an area that emphasizes an interprofessional team-based approach to care management, programme implementers can design practical and evidence-based IPE training programmes rather than relying solely on intuition or gut feelings (Ganotice et al., 2021). By undertaking this effort, we can simultaneously make strides in advancing the theory of interprofessional collaborative practice. This is particularly important as IPE has faced criticism for its perceived limitations in terms of theoretical underpinnings and methodological rigor (Paradis & Whitehead, 2015).

Literature has highlighted that collaboration outcomes, which encompass the effects of collective endeavors among groups striving towards a shared objective (Hadyaoui & Cheniti-Belcadhi, 2023), such as achieving team goals and enhancing team effectiveness, are not innate or inborn but can be nurtured through focused interventions (Braithwaite et al., 2012; Buljac-Samardzic et al., 2020). Goal achievement, which pertains to the development of team performance (Alrakaf et al., 2014), and team effectiveness, which refers to the perception of teamwork accomplishments (Fransen et al., 2011), are malleable outcomes that can be improved through IPE interventions.

Prior studies explored personal psychological factors like intrinsic motivation, self-efficacy, and emotion management in relation to goal achievement (Kusurkar & Croiset, 2015). Furthermore, earlier studies established the role of basic psychological factors in predicting team effectiveness and goal achievement (Ganotice et al., 2021). However, the significance of environmental factors has been largely overlooked, which could have offered a more comprehensive understanding of the factors influencing collaboration outcomes.

Environmental factors encompass clear goals and technology support, which influence the learning environment from structural, social, and technical perspectives (Chen et al., 2010; Lei et al., 2018; Shogren et al., 2024). Clear goals focus individuals' attention, stimulate their efforts, and promote suitable methods and strategies for tasks (Locke & Latham, 1990), leading to successful task completion (Jung et al., 2010). Redelius et al. (2015) also found that specifying learning goals properly can improve students' learning and participation. Similarly, technology support is crucial as it mitigates challenges related to resource search and collaboration, and the improvement of student learning outcomes (Wekerle et al., 2022). Although the prior studies have identified the relationship between environmental factors and learning outcomes, to the best of our knowledge, their application to IPE has not been examined. Additionally, the combined influence of personal and environmental factors on predicting collaborative outcomes remains undetermined.

A theoretical framework for explaining how personal and environmental factors influence collaboration outcomes is self-determination theory (SDT, Ryan & Deci, 2000). SDT assumes that engagement and achievement outcomes are largely dependent on the satisfaction of basic psychological needs: autonomy (sense of self-endorsement of behaviors and volition), competence (sense of mastery and effectiveness), and relatedness (sense of belongingness and connection with others). The satisfaction of these needs fosters intrinsic motivation, defined as engaging in activities for their inherent satisfaction, enjoyment, or interest (Deci & Ryan, 1985). In application to the current study, the satisfaction of the basic psychological needs fosters collaboration outcomes (see Figure 1 for the IPE activities). Additionally, we hypothesized that environmental factors also play a significant role in achieving collaboration outcomes, which we investigated further in this study.

The context of the study

This study conducted an IPE programme with both asynchronous and synchronous components involving two learning institutions, one in Hong Kong and the other in the United Kingdom, in line with the internationalization of IPE. As the students at these institutions were from different locations, online tools were used to facilitate team interaction. Specifically, these tools included various digital enhancements and collaborative features to optimize interactions within the learning management system, screen sharing, main room and breakout room functionality for team meetings and presentations in Zoom, interprofessional management of care planning in Miro (https://miro.com/), and gamified learning in Kahoot (https://kahoot.com/) and Mentimeter (https://www.mentimeter.com/). Figure 1 depicts the IPE model for the course in which this study was conducted.

*** Figure 1 here ***

The present study

The purpose of this quantitative study is to model the relationship between personal factors (autonomy, competence, relatedness), environmental factors (clear goals and technology support), and collaboration outcomes (team goal achievement and team effectiveness) involving students from diverse disciplines. By examining the relationships among these variables, the study aims to develop a comprehensive model that explains the influence of personal and environmental factors on collaboration outcomes. The findings provide valuable insights into the factors contributing to successful interprofessional collaboration and inform the development of interventions and strategies to enhance collaboration outcomes in diverse healthcare teams (see Figure 2).

*** Figure 2 here ***

The study tested the following particular hypotheses:

H_1: Personal factors (autonomy, competence, and relatedness) predict team effectiveness and team goal achievement.

H_2: Environmental factors (clear goals and technology support) predict team effectiveness and team goal achievement.

An ancillary aim of this study is to examine the potential pre- and post-test behavioral changes in terms of team goal achievement and team effectiveness as an effect of IPE intervention (Figure 1) implemented in this study.

H_3: There will be significant changes in team goal achievement and team effectiveness after the intervention.

This study has the potential to make valuable contributions to the ongoing discourse on IPE in medical education. *Firstly*, by focusing on both personal and environmental factors of collaboration outcomes, we aim to enhance the understanding of factors that explain collaboration outcomes in IPE, which is a relatively new research area. *Secondly*, this inclusion of a diverse population of majority Asian students from Hong Kong, who may be underrepresented in existing IPE studies, will broaden the scope of knowledge in the field. *Lastly*, our study seeks to contribute to the discussion of best practices in running cross-institutional IPE, which is increasingly recognized as a global trend. By examining the experiences and outcomes of collaboration across different institutions, we can provide insights and recommendations that can inform the development of effective strategies and policies in this area. Therefore, this study holds critical implications for teaching, encompassing both theoretical understanding, practical implementation, and policy development.

Methodology

Participants and procedures

This study recruited a total of 147 university students (female: 105; male: 42) with a mean age of 22.81 years (*SD* = 2.56). Participants were drawn from various disciplines including Medicine (MBBS, *n*=27), Nursing (*n*=61), Pharmacy (*n*=5), Speech and Hearing Sciences (n=25), and Social Work (n=29). Students were randomly assigned to interprofessional groups, each comprising approximately ten members, as part of a cross-institution ten-day IPE programme. Consent forms were signed voluntarily by participants after the Human Research Ethics Committee approved the project (Reference number: EA220544). Participants completed online surveys before and after the programme.

Instruments

In this study, personal and environmental factors are independent variables, and collaborative outcomes are dependent variables. We employed Cronbach's alpha, a widely used statistical tool for assessing internal consistency to ensure the reliability of our measures. A scale or subscale with a Cronbach's alpha greater than .70 is deemed reliable (Cortina, 1993; Taber, 2018). The specific questionnaires that measure each variable are provided below.

Basic Psychological Need Satisfaction in General (BPNS). This 16-item scale (Johnston & Finney, 2010) was used to measure the basic psychological needs of the participants. The scale has three subscales that measure the basic psychological needs of autonomy (3 items; e.g., "*I generally feel free to express my ideas and opinions*"; α=.80), competence (6 items; e.g., "*I have* *been able to learn interesting new skills recently*"; α=.70), and relatedness (7 items; e.g., "*I really like the people I interact with*"; α=.77), and with a response scale from 1 (not at all true) to 7 (very true). This scale has been adapted to IPE previously (Ganotice et al., 2023).

Course Experience Questionnaire (CEQ). The four-item 'clear goals' subscale of the CEQ (Wilson et al., 1997) was used to assess students' perceptions of clear goals in IPE (e.g., "*The staff made it clear right from the start what they expected from students*"; α =.70), with five-point Likert scale (1 = strongly disagree to 5 = strongly agree).

Technology support. The scale of technology support pertains to the notion of technology support for IPE learning (Davis, 1989), including six items (e.g., "*Using technology enables me to accomplish tasks more quickly*"; α =.97), with a response scale of 1 (strongly disagree) to 7 (strongly agree).

Team goal achievement. This outcome relates to how team members felt the IPE programme helped them develop interprofessional competencies (Ganotice et al., 2021). It is composed of seven items (e.g., "*Collaborate with students in other professions to identify and solve the clinical problems*"; α=.96) with a response scale ranging from 1 (to the least extent/not at all) to 5 (to the highest extent).

Team effectiveness. This scale (Fransen et al., 2011) measures how students perceive their teamwork accomplishments in IPE composed of three items (e.g., "*We have completed the tasks in a way we all agreed upon.*"; α=.92). It has a response scale of 1 (strongly disagree) to 5 (strongly agree).

Data analysis

To understand the factors that underlie positive collaboration outcomes, a multiple linear regression was performed with the predictors of personal factors and environmental factors. To examine whether the IPE programme was effective for the collaboration outcomes, a paired-samples t-test was performed on the pre-and post-test scores of team goal achievement and team effectiveness. All the data analyses were done using IBM SPSS Statistics version 27.

Results

We followed guidelines from Finney and DiStefano (2006) for skewness and kurtosis, where values greater than 2 and 7, respectively, indicate a violation of univariate normality. Our data showed normality, with skewness ranging from -1.13 to .30 and kurtosis ranging from -.87 to 1.50 for all items.

Personal factors predicted team effectiveness and team goal achievement significantly and positively. Specifically, relatedness predicted team effectiveness ($F(3,143)=10.178$, $p<.001$, $R^2=.159$) and goal achievement $F(3,143)=8.488$, $p<.001$, $R^2=.133$). The most significant predictor of all the IPE outcomes was sense of relatedness, a variable we highlighted in IPE. Similar to personal factors, clear goals and technology support from environmental factors predicted team effectiveness ($F(3,143)=32.471$, $p<.001$, $R^2=.301$) and team goal achievement ($F(3,143)=31.997$, $p<.001$, $R^2=.298$) significantly (Table 1).

*** Table 1 here ***

To assess the impact of IPE training on collaboration outcomes, a paired-samples t-test was conducted (Table 2). The results revealed a significant difference ($t(146)=-14.743$, $p<0.001$) in team goal achievement between the pretest ($M=3.41$, $SD=.49$) and the posttest ($M=4.15$; $SD=.65$). Similarly, there was a significant difference ($t(146)=-8.146$, $p<0.001$) in team effectiveness scores between the pretest ($M=3.68$; $SD=.61$) and posttest ($M=4.22$; $SD=.72$).

*** Table 2 here ***

Discussion

Amidst growing emphasis on team-based care management, it becomes imperative to understand the factors influencing team collaboration outcomes. This study sought to advance the IPE literature by investigating both personal and environmental factors that might explain these outcomes. Our findings reveal that, within the IPE context, personal and environmental factors significantly predict both team goal achievement and team effectiveness.

Our data reveals an interesting finding that supports Hypothesis 1, emphasizing the sense of relatedness as a consistent and strong predictor of positive collaboration outcomes, such as team goal achievement and overall team effectiveness. This finding is in line with prior research in various contexts, including primary (Furrer & Skinner, 2003) and secondary schools (King, 2015). In IPE, students are encouraged to work together as a team to achieve common goals in patient management. By engaging in interprofessional activities like care planning and case studies, learners can directly experience the advantages of teamwork and cultivate a sense of relatedness (Corbacho et al., 2021; Vogl, 2009).

Surprisingly, autonomy and competence did not significantly explain the variance in collaboration outcomes, a finding that prompted us to reevaluate our IPE design. Initially, we thought learning activities such as team goal setting, team naming, and MCQ writing would foster autonomy. However, it may be possible that the predominance of predefined team-based activities like care planning and team readiness assurance tests might have limited the development of students' sense of autonomy by requiring conformity rather than individual decision-making (Dworkin, 2015). Similarly, competence did not predict collaboration outcomes in IPE, which yielded support to previous studies in IPE (Ganotice et al., 2021)

Another major finding of our research is related to environmental factors, which confirms our second hypothesis. In the face-to-face briefings, we clearly pointed out that the ultimate goal of IPE is to provide patient-centered care. Our research results are consistent with the study of Moeller et al. (2012), which proves that clear goals have a beneficial impact on learning outcomes. Technology support (such as a learning management system and collaboration tools) in large-scale IPE programme enables students from different geographical locations to learn together.

To test the effect of the IPE programme, we made a comparison of collaboration outcomes (team goal achievement and team effectiveness) before and after the programme to measure the changes in collaboration outcomes. Our results revealed that students' collaboration outcomes increased after participating in the programme, supporting our third hypothesis. Our results are consistent with previous study findings that through IPE intervention, interprofessional collaboration can be realized, and the roles of various professionals can be more clearly understood (Wang et al., 2019). These previous and current findings further reinforce the importance of integrating IPE within the healthcare curriculum. Such an integration may lead to more effective healthcare services and the ability to manage the needs of complex patients (O'Leary et al., 2020).

Several limitations were identified in this study. Firstly, the reliance on quantitative data may introduce certain biases, and future research should consider employing more precise research methods to enhance scientific validity (Ivankova & Wingo, 2018). Secondly, the relatively small sample size may limit the generalizability of the findings to a broader population. Lastly, the study did not investigate teacher support and peer help as environmental factors, which have been shown to influence IPE collaboration outcomes (Nguyen et al., 2024).

These limitations notwithstanding, we are convinced that our contributions have enhanced the understanding of factors crucial to the effective delivery of IPE. Our data involving students from Hong Kong and the United Kingdom demonstrated that sense of relatedness, clear goals, and technology support promoted the achievement of team goal achievement and team effectiveness. To reiterate, gaining this understanding is essential for IPE program implementers, as it allows them to tailor and adjust the IPE design with consideration for personal and environmental factors that are known to enhance collaboration outcomes. We hope our work encourages further research to uncover additional factors that contribute to successful collaboration outcomes.

Declaration of interest

The authors report no conflict of interest.

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Data availability statement

The authors confirm that the data supporting the findings of this study are available from the corresponding author, FAG or GLT, upon reasonable request.

References

Alrakaf, S., Sainsbury, E., Rose, G., & Smith, L. (2014). Identifying achievement goals and their relationship to academic achievement in undergraduate pharmacy students. *American Journal of Pharmaceutical Education, 78*(7), 133. https://doi.org/10.5688/ajpe787133

Barr, H. (2015). Interprofessional education: The genesis of global movement. *Centre for the Advancement of Interprofessional Education (CAIPE)*. Retrieved from https://www.caipe.org/resources/publications/barr-h-2015-interprofessional-education-genesis-global-movement

Braithwaite, J., Westbrook, M., Nugus, P., Greenfield, D., Travaglia, J., Runciman, W., Foxwell, A. R., Boyce, R. A., Devinney, T., & Westbrook, J. (2012). A four-year, systems-wide intervention promoting interprofessional collaboration. *BMC Health Services Research, 12*(1), 99. https://doi.org/10.1186/1472-6963-12-99

Buljac-Samardzic, M., Doekhie, K. D., & van Wijngaarden, J. D. H. (2020). Interventions to improve team effectiveness within health care: a systematic review of the past decade. *Human Resources for Health, 18*(1), 1–42. https://doi.org/10.1186/s12960-019-0411-3

Chen, P.-S. D., Lambert, A. D., & Guidry, K. R. (2010). Engaging online learners: The impact of Web-based learning technology on college student engagement. *Computers and Education, 54*(4), 1222–1232. https://doi.org/10.1016/j.compedu.2009.11.008

Corbacho, A. M., Minini, L., Pereyra, M., González-Fernández, A. E., Echániz, R., Repetto, L., Cruz, P., Fernández-Damonte, V., Lorieto, A., & Basile, M. (2021). Interdisciplinary higher education with a focus on academic motivation and teamwork diversity. *International Journal of Educational Research Open, 2*, 100062. https://doi.org/10.1016/j.ijedro.2021.100062

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology*, *78*(1), 98–104. https://doi.org/10.1037/0021-9010.78.1.98

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality, 19*(2), 109-134. https://doi.org/10.1016/0092-6566(85)90023-6

Dworkin, G. (2015). The nature of autonomy. *Nordic Journal of Studies in Educational Policy, 2015*(2), 28479. https://doi.org/10.3402/nstep.v1.28479

Finney, S. J., & DiStefano, C. (2006). Nonnormal and categorical data in structural equation models. In G. R. Hancock & R. O. Mueller (Eds.), *A second course in structural equation modeling* (pp. 269–314). Information Age.

Furrer, C., & Skinner, E. (2003). Sense of relatedness as a factor in children's academic engagement and performance. *Journal of Educational Psychology, 95*(1), 148–162. https://doi.org/10.1037/0022-0663.95.1.148

Fransen, J., Kirschner, P. A., & Erkens, G. (2011). Mediating team effectiveness in the context of collaborative learning: The importance of team and task awareness. *Computers in human Behavior, 27*(3), 1103-1113. https://doi.org/10.1016/j.chb.2010.05.017

Ganotice Jr, F. A., Chan, K. M., Chan, S. L., Chan, S. S. C., Fan, K. K. H., Lam, M. P., ... & Tipoe, G. L. (2023). Applying motivational framework in medical education: a self-determination theory perspectives. *Medical Education Online, 28*(1), 2178873. https://doi.org/10.1080/10872981.2023.2178873

Ganotice Jr, F. A., Gill, H., Fung, J. T. C., Wong, J. K., & Tipoe, G. L. (2021). Autonomous motivation explains interprofessional education outcomes. *Medical education, 55*(6), 701-712. https://doi.org/10.1111/medu.14423

Hadyaoui, A., & Cheniti-Belcadhi, L. (2023). Ontology-based group assessment analytics framework for performances prediction in project-based collaborative learning. *Smart Learning Environments, 10*(1), 1–27. https://doi.org/10.1186/s40561-023-00262-w

Ivankova, N., & Wingo, N. (2018). Applying mixed methods in action research: Methodological potentials and advantages. *American Behavioral Scientist, 62*(7), 978-997. https://doi.org/10.1177/0002764218772673

Johnston, M. M., & Finney, S. J. (2010). Measuring basic needs satisfaction: Evaluating previous research and conducting new psychometric evaluations of the Basic Needs Satisfaction in General Scale. *Contemporary educational psychology, 35*(4), 280-296. https://doi.org/10.1016/j.cedpsych.2010.04.003

Jung, J. H., Schneider, C., & Valacich, J. (2010). Enhancing the motivational affordance of information systems: The effects of real-time performance feedback and goal setting in group collaboration environments. *Management Science, 56*(4), 724-742. https://doi.org/10.1287/mnsc.1090.1129

King, R. B. (2015). Sense of relatedness boosts engagement, achievement, and well-being: A latent growth model study. *Contemporary Educational Psychology, 42*, 26–38. https://doi.org/10.1016/j.cedpsych.2015.04.002

Kusurkar, R. A., & Croiset, G. (2015). Autonomy support for autonomous motivation in medical education. *Medical education online, 20*(1), 27951. https://doi.org/10.3402/meo.v20.27951

Lei, H., Cui, Y., & Chiu, M. M. (2018). The relationship between teacher support and students' academic emotions: A meta-analysis. *Frontiers in Psychology, 8*, 2288. https://doi.org/10.3389/fpsyg.2017.02288

Locke, E. A., & Latham, G. P. (1990). *A theory of goal setting and task performance*. Prentice-Hall.

Moeller, A. J., Theiler, J. M., & Wu, C. (2012). Goal setting and student achievement: A longitudinal study. *The Modern Language Journal, 96*(2), 153-169. https://doi.org/10.1111/j.1540-4781.2011.01231.x

Nguyen, H. T. T., Wens, J., Tsakitzidis, G., Valcke, M., Nguyen, H. T., Duong, T. Q., ... & Nguyen, T. M. (2024). A study of the impact of an interprofessional education module in Vietnam on students' readiness and competencies. *Plos One, 19*(2), e0296759. https://doi.org/10.1371/journal.pone.0296759

O'Leary, N., Salmon, N., & Clifford, A. M. (2020). 'It benefits patient care': the value of practice-based IPE in healthcare curriculums. *BMC Medical Education, 20*(1).424. https://doi.org/10.1186/s12909-020-02356-2

Paradis, E., & Whitehead, C. R. (2015). Louder than words: power and conflict in interprofessional education articles, 1954–2013. *Medical education, 49*(4), 399-407. https://doi.org/10.1111/medu.12668

Redelius, K., Quennerstedt, M., & Öhman, M. (2015). Communicating aims and learning goals in physical education: Part of a subject for learning?. *Sport, Education and Society, 20*(5), 641-655. https://doi.org/10.1080/13573322.2014.987745

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25*(1), 54-67. https://doi.org/10.1006/ceps.1999.1020

Shogren, K. A., Mazzotti, V. L., Hicks, T. A., Raley, S. K., Gerasimova, D., Pace, J. R., Kwiatek, S. M., Fredrick, D., Stewart-Ginsburg, J. H., Chapman, R., & Wysenski, D. (2024). The Goal Setting Challenge App: Impact on Transition Goal Attainment Outcomes of Students With Disabilities. *Career Development and Transition for Exceptional Individuals, 47*(1), 4–18. https://doi.org/10.1177/21651434221146470

Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science, 48(*6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Vogl, G. (2009). Work as community: narratives of solidarity and teamwork in the contemporary workplace, who owns them?. *Sociological Research Online, 14*(4), 27-36. https://doi.org/10.5153/sro.1933

Wang, Z., Feng, F., Gao, S., & Yang, J. (2019). A Systematic Meta-Analysis of the Effect of Interprofessional Education on Health Professions Students' Attitudes. *Journal of Dental Education, 83*(12), 1361–1369. https://doi.org/10.21815/JDE.019.147

Wekerle, C., Daumiller, M., & Kollar, I. (2022). Using digital technology to promote higher education learning: The importance of different learning activities and their relations to learning outcomes. *Journal of Research on Technology in Education, 54*(1), 1-17. https://doi.org/10.1080/15391523.2020.1799455

Wilson, K. L., Lizzio, A., & Ramsden, P. (1997). The development, validation and application of the Course Experience Questionnaire. *Studies in Higher Education (Dorchester-on-Thames), 22*(1), 33–53. https://doi.org/10.1080/03075079712331381121