Appendix. Summary of Data Extraction

*Resources, facilities, and organizational factors that support the educational intervention.
Abbreviations: ID (interdisciplinary), IDE (interdisciplinary education), IP (interprofessional), IPE (interprofessional education), UG (undergraduate).
Note the terminology used in the table (e.g., IDE vs. IPE.) reflects the terms used by the original study authors.

Study Characteristics		Context	Structure	Process		Outcomes	
Author, Year	**Study Aim**	**Country**	**Organization factors***	**Disciplines**	**Intervention**	**Outcomes**	**Recommendations**
Review							
Rodrigues da Silva Noll Gonçalves et al., 2021	To explore the potentialities and limitations of IPE, from the perspective of UG students, through a synthesis of quantitative studies and mixed methods.	N/A	N/A	Eleven studies included in the review. There was a wide range of health science disciplines represented across studies. ID grouping: not applicable	Studies included a workshop, online course, small group discussion, clinical education, reflective assignment, patient care simulations; writing a brochure on a health-related topic for public use; IP care planning; didactic lecture; skills competition for healthcare students; unplanned interaction with other healthcare students during their internships; multidisciplinary educa-tional sessions during internship; sequential discover/ explore/apply/reflect; symposium; simulated patient interviews Variable information is provided in the review on duration and format of the included interventions.	Measured by a variety of sources across studies included in their review. Students perceived that: IPE offered a more detailed view of roles and responsibilities, and about each other's practice scopes; peer learning enables development of greater confidence in professional identity; IPE improved relationships, teamwork, understanding of roles and responsibilities, and patient care. Students had readiness for teamwork and shared learning, although readiness may vary between professions, between years, and is dependent on recency of IPE. Some characteristics (e.g., gender) were statistically significant for greater or lesser readiness. Readiness increased after IPE. However, negative attitudes towards IPE also existed; some of these correlated with one's own weakened professional identity.	Start IPE early on upon higher education entry. Insert other professional areas, in addition to the 'traditional' health professions (e.g., nursing), with the objective of favoring collaborative work. To assess IPE, develop instruments with appropriate psychometric properties; combine quantitative instruments (validated and with psychometric properties) and qualitative.
Commentary							

Clark & Hoffman, 2019	To 1) discuss and describe challenges in a high-tech complex healthcare environment that necessitate teaching systems thinking to future healthcare students, and 2) describe use of IPE, IP practice, Team STEPPS® (an approach to collaborative teamwork involving all healthcare disciplines in healthcare settings), curricular content, and other teaching methods as strategies for teaching systems thinking.	USA	In general, approaches to integrate IPE have included creating IPE departments or centres to promote, engage, and grow the IPE principles for healthcare students, and providing certificates of completion for curricular activities or required extracurricular activities. An example with earned credit during UG studies is required observations in clinical environments as part of an IP practice team.	Nursing ID grouping: Not applicable	Using IPE to teach systems thinking: Getting to know one's team and how the healthcare system works, getting to know terms that other teams use, and understanding the role that technology plays in the healthcare system. Duration: Not applicable Format: Not applicable	N/A	Merging disciplines early in healthcare education (e.g., an IP course on professionalism and professions). Infusing informatics in the healthcare environment (e.g., an IP course on healthcare systems and informatics). Using peer to peer learning with groups of mixed disciplines. Teaching students about the high-tech environment and how technology works within the healthcare system. Using a systems approach to teaching instead of a reductionist approach. Using learning theories such as peer to peer learning and heutagogy.

Pumar Mendez et al., 2008	To examine literature on IPE to analyze feasibility, advantages, and disadvantages of introducing an IPE approach within healthcare curricula in Spain.	Spain	Paper refers to legislative demands on Spanish higher education following the Bologna Agreement on European Higher Education which has caused large curricular change. For example, expansions to UG nursing, physiotherapy, and social work; changes to length and content of courses; and requirement to include IP communication skills.	N/A ID grouping: Not applicable	N/A Duration: Not applicable Format: Not applicable	Paper describes advantages of IPE including greater collaboration; increased understanding of professions; broadened knowledge; effective at targeting competencies and increasing workforce flexibility. Paper also outlines some disadvantages such as blurring the focus of disciplines; implications on length of training; lack of resources and buy-in between disciplines; and debate over when it should be introduced. The paper provides a list of questions for educationalists to reflect on when considering IDE/IPE in their program.	Authors suggest more rigorous evaluation methods beyond learner satisfaction; introducing IPE/IDE on a continuum across learners' academic careers; and tailoring the design of the educational intervention to the audiences' needs.
Rango, 1981	To discuss the current structure of UG (premedical/health) education and need for reform.	USA	Paper identifies two types of ID science programs that already exist on many campuses: those that increase "scientific literacy" of arts students; and those that enrich "social consciousness" of science students.	N/A ID grouping: Not applicable	N/A Duration: Not applicable Format: Not applicable	Paper suggests that liberal arts courses introducing students to science and science courses introducing students to arts/literacy have historically been superficial. Paper also discusses inherent conflicts and complexities between medicine/science and arts (or making subjective decisions and objective data/information) on complex issues that intersect with morals and politics. Illustrative cases are presented in the paper to highlight the authors points and recommendations.	Authors suggest premedical reform involving IDE frameworks that target complex issues around the intersection of art/science or the objective/subjective is needed. For example, focusing on the limits of science/medicine, intersection with values, morals and judgment, and relationship to politics. Authors also suggest that IDE should "help students think about familiar problems in unfamiliar ways", employ causal thinking, and reflective skepticism.
Methods/Design Study							

Karsten et al., 2015	To promote IP collaboration among healthcare students via the use of an IP electronic portfolio (ePortfolio), a shared electronic record.	USA	N/A	Food and nutrition, human services, nursing, occupational therapy assistant, physiotherapy assistant ID grouping: not described by authors	To promote IP collaboration, the faculty of the health sciences department developed an IP ePortfolio that was used by students to serve as an electronic medical record. Students and faculty from each program met one time in-person at an orientation meeting to conduct case studies. Work was collected for analysis. Duration: One-time intervention Format: In-person	No data collected. Authors provide comments on their observations. Authors state the simulated nurses' station allowed for informal discussions and joint planning within the group, facilitating coordination of intervention and comprehensive patient care. Using ePortfolio as an electronic medical record among students facilitated IP collaboration (data not collected; results are stated from the authors).	Address institutional barriers to IPE in higher education, including workload and classroom capacity.
Snyder et al., 2017	To discuss the creation of a first-year, IP healthcare course that integrates IP practice/competencies and competency-based education.	USA	The College of Health and Human Sciences at Western Carolina University aimed to implement IP competencies in each one of their majors.	Athletic training, communication sciences and disorders, emergency medical care, environmental health, nursing, nutrition and dietetics, recreational therapy, social work ID grouping: not described by authors	Every student from the College of Health and Human Sciences took a first-year IP competency-based seminar course aligning with WHO frameworks based on the 2015 Health Educator Academy. Duration: Semestered course Format: In-person	No formal data was collected. Authors have one statement on student comments on the course evaluations which suggested the course helped them adjust to college life well, opened their eyes to different options for work within healthcare, and provided a safe space for reflection on the initial challenges of life at college/university. The authors also comment on the following: educator strategies included institutional support and creating a collegial, collaborative culture. Curricular strategies emphasized engagement and competency outcomes. Curricular challenges like oversimplification of	Authors recommended to continue to implement such courses for first-years following a competency-based curriculum teaching students to think collaboratively.

						competencies (in relation to competence-based education) and logistical issues associated with competency-based education were addressed.	
Sponselee & Van Hoof, 2017	To demonstrate how transitions in healthcare and technology sectors can result in IDE by means of higher education, demonstrated by project examples.	The Netherlands	The Centre for Healthcare and Technology is a new approach compared to existing educational structures. It educates future professionals in the domains of care and technology. It prepares them for a future that requires flexibility and reflectivity, and provides them with the skills to incorporate innovations and research into daily professional practice. The ID centre combines knowledge and expertise of 8 institutes within the university.	School for Applied Health Professions (among others, speech therapy, podiatry, orthotics, medical imaging & radiation oncology, and physiotherapy), School of Engineering, School of Human Resource Management & Psychology, School of Information and Communication Technology, School of Natural Sciences, School of Nursing, School of Sports, School of Technology and Logistics ID grouping: not described by authors	A program which offers a multidisciplinary minor in Care & Technology at the School for Applied Health. The program includes various classes taught by lecturers from 8 participating institutes) and an ID research project in which students work on a real-life problem of a social/healthcare organization. Duration: In-person Format: Program minor	Teaching students the intersection of technology and healthcare, involving faculty from various disciplines, cultivates ID professionals. Collaborating with students from diverse backgrounds allows for a deeper understanding of multiple work environments, enhancing innovation. Multidisciplinary cooperation among students and faculty improves the quality and feasibility of technological interventions in care. Principles of user-centered design and co-creation are essential for success in developing care-related solutions. Successful Projects strengthen the position of the centre, leading to long-term partnerships with healthcare organizations and tech-based companies. These partnerships facilitate low-risk, low-cost multidisciplinary innovation, contributing to a sustainable society.	Authors suggest that as a first step to making developments in care technology, students must be educated on the crossroads of healthcare and technology.
Waggie & Laattoe, 2014	To share an IDE curriculum design with other higher education institutions.	South Africa	Commitment from university administration and faculty leadership is required to champion the effort it takes for development of IP curriculum. Resistance of academic staff to participate in IPE can be due to their lack of knowledge of trends within	Dietetics, national medicine, nursing, occupational therapy, physiotherapy, recreation, social work, sport medicine ID grouping: not described by authors	Three online ID core modules with mandatory completion for each of the three years of UG education. Duration: Not specified Format: Not specified	No data collected. Authors comment on their experience. Specifically, that institutional support is critical. Also that students were not able to fully understand IP complexities initially. Integrating modules into the mainstream curriculum resulted in reduced	Authors recommended: IP programs should be 4-7 weeks long for optimal effectiveness in fostering collaboration. IPE needs to be institutionalized and it is important to form structures to

			health professions education, where curricular transformation is needed if we want to graduate relevant health professionals.			stress and increased acceptance for students and staff, compared to adding-on the modules. Establishing a common care framework early on is crucial.	facilitate and support IPE. Establishing an IPE committee, represented by all departments and units in a faculty to address issues of staff development, curriculum planning and timetabling will aid in operationalizing IP education. IP programmes should be integrated into the mainstream curriculum including the students' service-learning or fieldwork experiences and not seen as an add-on.
Exploratory Study							
Avrech Bar et al., 2018	To examine the attitudes of health professions students towards IP collaboration in correlation with their personal resilience and personality traits.	Israel	In Israel, IPE among health professions students is rare. Problem-based learning (PBL) is used in other teaching and learning contexts but still needs to be embedded as a means for IPE in Israel.	Nursing, occupational therapy, physiotherapy ID grouping: not applicable	Attitudes were assessed with a questionnaire consisting of the Interdisciplinary Education Perception Scale, the Connor-Davidson Resilience Scale, the Big Five Inventory of personality dimensions, and a question evaluating students' experience with the problem-based learning method. Duration: One-time assessment Format: Not specified	Overall, attitudes were positive toward PBL and collaborative approaches, as it is associated with agreeableness, openness, and cooperative perceptions (as in positive correlations were found between students' perception of actual cooperation and the above mentioned personality traits). Regarding their perception of IDE (measured with a scale), OT students outperformed nursing and PT counterparts in Competency & Autonomy and Perception of Actual Cooperation (they are the only students who were familiar with and had experienced the PBL method). Despite generally positive attitudes, nursing students perceived slightly lower cooperation and competency compared to OT and PT peers.	Future studies should address the discrepancy in attitudes among health professionals, such as incorporating resilience-building strategies to explore resilient role models. The impact of personality traits on one's career choice and attitudes towards teamwork should be explored.

Kerry et al., 2021	To examine students' and facilitators' perceptions of the valued competencies of IPE facilitators.	Switzerland	N/A	Midwifery, nursing, occupational therapy, physiotherapy ID grouping: not described by authors	*Details about the course are not provided.* A pre- and post-course assessment was conducted through an online survey. Analyses were done by exploratory and confirmatory factor analyses to determine dimensionality of 25 teacher abilities extracted from the literature, then compared the 10 characteristics matched across uni- and IP contexts. Finally, variance of the 12 teacher profiles were compared to a normal distribution. Duration: Not specified Format: one-time assessment	After completing a semester-long IPE course, students completed a survey rating the importance of IP facilitator competency with regard to 25 abilities, 12 teacher profiles, and 10 characteristics. There is preferred ordering and higher variability when it comes to valued IPE teacher roles. Professional Bias (as in not having it) emerged as a primary factor of the 25 abilities. Variance analysis indicated prioritized preferences for specific IP facilitator profiles, with a Clear Lecturer (defined as understandably explains educational content and shares their knowledge) profile being rated most important, and Curriculum Planner as the lowest preferred role. Regarding characteristics, Technical Competence was less important than Organizational Preparation.	Authors suggested that the findings on what students considered important in IP facilitators can be used to design IP facilitators or train-the trainer programs.
Roberts & Forman, 2015	To examine perceptions of IPE in relation to intended career directions among psychology students, including whether attitudes vary depending on career direction, and whether	Australia	Despite the increased focus on the importance of IP care in the field of psychology, psychology students have been absent from the IPE literature, yet as indicated by the IP Curriculum Renewal Consortium, Australia (2013) they are the tenth most common group to be included in IPE. Psychology training is unique in the paper's Australian context. In summary, the structure of psychology education in Australia does not align with most health	Commerce, psychology, science ID grouping: not described by authors	Students were recruited through a second-year psychology participant pool, then randomly assigned to two versions of an online questionnaire to be taken one time. Duration: one-time assessment Format: online	There were positive correlations between orientation (i.e., intended career direction) and perceived relevance/attitudes toward IPE, with medium effect sizes. IPE was perceived as relevant to working as a psychologist, providing exposure to different professions, contributing to an understanding of the workplace and developing necessary interpersonal skills.	Authors suggested that the proposed mediated model of the relationship between intended career direction (i.e., professional identification and practitioner orientation) and attitudes toward IPE (e.g., IPE learning attitudes and IPE negative attitudes) can be applied to students from ranging professions (especially disciplines that offer various possible career paths outside the direct healthcare setting) and include longitudinal data to track

	perceived relevance of IPE mediates the relationship between IPE attitudes and career direction.		professional degrees. In contrast to many other health professions, UG psychology students do not engage in client care skill training or work placements until they start a graduate level qualification, limiting the opportunity for IPE. This creates difficulties for the curricular timing of IPE. If it is put in postgraduate training, psychology students may be placed with UG students from other professions. If instead, IPE is within the UG psychology degree, it may not be seen as relevant to students pursuing careers outside of direct client care in health contexts.				changes in key variables over time.
Williams et al., 2008	To ascertain UG health science student views on IPE and educational technology during their first year of UG.	Australia	N/A	Health science/social work, midwifery nursing, occupational therapy, paramedics, physiotherapy ID grouping: not described by authors	An online survey was taken one time among first year health science students at Monash University, where the results were analyzed on the 5-point Likert Scale. Duration: one-time assessment Format: online	Almost 90% of students either agreed or strongly agreed that IPE should be part of the course education and training. Fifty-five percent of the first-year students either agreed or strongly agreed that they have a good understanding of the roles and responsibilities of other healthcare professionals. Similarly, students also felt strongly that IPE would be advantageous to their education and training with (95%) either agreeing or strongly agreeing.	N/A
Evaluation Study							
Cino et al., 2018	To determine if self-efficacy levels improved in students that attended an IPE seminar.	USA	Educators of dental hygiene, nursing, and medical laboratory technology at Farmingdale State College, in New York, collaborated on a project designed to introduce lower level UG students to various	Dental hygiene, medical laboratory technology, nursing ID grouping: described by authors	A one-time 75-minute session all participants were given IPE and ethics introduction. Small groups had one participant from each discipline. The codes of	Authors used the Self-Efficacy for Interprofessional Learning (SEIL) scale. Students rated their self-efficacy and reported significant improvement in working with students from other professions to: (1) form	N/A

			health professions through participation in a collaborative exercise on ethics. Ethics education is a shared requirement among the program curricula. The session was on campus in a meeting room with three circular tables for each small group.		ethics of each profession were compared and discussed. Case studies were reviewed through this ethical lens within small groups and followed by a whole group discussion. Duration: one-time intervention Format: in-person	a team; (2) learn roles of each other in an IP team; (3) understand the benefit to the patient as team-based care. As well, (4) understanding/discussing IP learning objectives; (5) evaluating work quality as an IP team; (6) evaluating the degree to which the IP team has achieved goals.	
Cleak & Williamson, 2007	To prepare health science students for professional practice.	Australia	The Faculty of Health Sciences at La Trobe University in Victoria is the second largest provider of allied health education in Australia, with each course containing a third- or fourth-year subject around professional practice issues. This causes content duplication, with each school developing content independently, resulting in little ID contact between students and teaching staff. There was impetus for change, including academic staff recognizing the need to ensure that graduates were equipped to work in healthcare.	Health information management, health sciences, nursing, nursing and midwifery, occupational therapy, orthoptics and ophthalmic science, physiotherapy, podiatry, prosthetics and orthotics, social work, speech pathology ID grouping: described by authors	Lecturers designed an ID professional practice subject for final year UG health science students. In the course, students were assigned into different departments consisting of 6-7 members, making up at least 3 different disciplines. As a group over a 13-week semester, students worked collaboratively to complete tasks and assignments assigned in each online module. Duration: In-person & Online Format: Semestered Course	Generally positive feedback from students about the course effectiveness in career skill development and course relevance. However, students noted that there were a lot of assignments, readings, and some conflicts within groups. Positive feedback from students about the course's effectiveness in career skill development and course relevance, although there were lots of assessments, readings, and conflicts within groups. Therefore, the number of modules and student workload were reduced; individualized assessments and more problem-solving strategies within groups were increased. Students were required to develop a group contract and reflect on its effectiveness in individual assignments.	Useful adaptations mentioned in discussion section of paper: Group contract to help with group dynamics. Using theoretical content about group dynamics and problem-solving strategies at the orientation day to help with feedback about conflict.
Gilbert et al., 2000	To expand students' knowledge of other disciplines and to develop skills that enable optimal	Canada	An analysis of coursework in the health and human service disciplines at the University of British Columbia indicated that IP courses were few. Existing teamwork courses did not explicitly address IP issues.	Audiology, family and nutritional sciences, nursing, occupational therapy, pharmaceutical sciences, physiotherapy, speech language pathology,	The Office of the Coordinator of Health Sciences at the university developed and piloted a 2-day workshop. 1. Lego building activity designed to provide	Participants were unanimous in their praise and support for the IP educational experience, and commented on how much they had learned and how applicable this material was to their clinical practice	Authors recommended that module format allows for easier implementation in IP experiences, facilitating the development of students' IP knowledge and skills. Authors highlighted the need

	performance within a team			social work ID grouping: described by authors	students with a common experience base for discussing and making sense of teamwork concepts and tools. 2. Practicing basic team processes in interactive hospital-based case analyses to provide opportunity to apply team theory and to demonstrate the effectiveness of IP teamwork. Duration: one-time intervention Format: In-person		for university structure that foster collaboration across faculties and through mechanisms that acknowledge and reward IP activities.
Hawley, 2021	To assess an adaptive leadership course to provide an educational framework for implementing adaptive leadership instruction for UG students.	USA	The adaptive leadership course was required for health management and psychology majors through a state university.	Business education, health, nursing, social science, business ID grouping: not described by authors	Online semester-long asynchronous course in adaptive leadership. Duration: Semestered course Format: online	Participants completed post-learning assessments, with items evaluating course engagement (Kirkpatrick Level 1, Reaction), competency/confidence/commitment (Kirkpatrick Level 2, Learning) and behavior change (Kirkpatrick Level 3, Behavior) Level 1: Students reported they were interested in adaptive leadership due to taking the course. Level 2: Students reported that understanding and the ability to actively engage in active leadership after taking the course increased. Students planned to apply active leadership in their life and future careers. Level 3: Students reported that they used information learned in the course in their life.	Future research should use objective measures for determining the impact of (multidisciplinary) education/training. One framework to use is the Kirkpatrick model which describes four levels of training assessment, with each tier building upon the previous ones.

						Six major qualitative themes: commitment to learning, broader definition of leadership, managing self, increased confidence, experiments beyond comfort zone, applying challenge.	
Hendrick et al., 2014	To share the reflections of an ID team of educators working with health science students to prepare them for working with Aboriginal and Torres Strait Islander peoples. The educators share their observations of what works and why, to consider further how they can build on this evidence in an informed way.	Australia	The Indigenous Cultures and Health Unit is one of the designated first-year IP educational units that offer an innovative approach in its management of large student cohorts and excellence in teaching. The unit (i.e, course) is one of six units for first-year students that focuses on IPE, with up to 2,000 students enrolled in the unit in any one semester.	Health and safety, nursing, medical imaging, midwifery, physiotherapy, psychology, occupational therapy, social work ID grouping: not described by authors	First-year course addressing issues related to the disproportionate over-representation of aboriginal peoples in the health system. Duration: semestered course Format: not specified	Authors reported their observation that at the beginning of each semester, either by way of body language and/or expressed in early journal entries, some students were reluctant to engage with the course. Authors reported an evident shift for most of the students. Based on authors' reflections, the reason for the attitudinal change is the new knowledge that enhanced their understanding of the challenges that some Indigenous peoples face, coupled with a teaching and learning space that promoted discussions and diverse perspectives.	N/A
Hinderer & Joyner, 2014	To describe development and implementation of an UG IP critical care elective course offered to nursing and respiratory care students.	USA	Challenges in the structure (impetus for change): The institution's location in a remote rural area without the benefit of an academic medical centre nearby, created challenges related to access to resources and modeling of IP practice teams in healthcare settings. Local clinical placements lacked collaborative practice models. In clinical rotations, nursing and	Nursing, respiratory care ID grouping: not described by authors	2.5-hour in-person sessions once a week for 15 weeks. Included: shadowing opposite profession, case studies, simulations, attending a nursing association meeting. Duration: semestered course Format: in-person	Students reported that the course increased ability to interact with students and faculty from other disciplines. Students reported an increased understanding of the importance of IP collaboration and viewed the course content as useful for critical care practice. Students felt more prepared to be placed in critical care settings.	Creative teaching approaches are needed to deliver complex material in a way that is meaningful to students from differing clinical backgrounds. Expanding IPE to several professions/ institutions would provide diversity from which students can draw knowledge to apply to clinical practice. Future research should focus on the relationship and

			respiratory students learned next to each other without working together to care for patients. Development of the critical care course began to address the IPE and IP practice disconnect. Challenges with IPE: It was difficult to find where the courses would best fit in the program curricula. There were student recruitment challenges as the course was going to be an elective for one program with other electives competing for the same students. Offering a cross-listed nursing and respiratory course created logistic challenges related to registration, learning support technology, drafting course proposal documents, and curriculum approval. Challenges with faculty members: Departmental buy-in was needed as many faculty did not value offering an IPE course. The need for IPE was justified by informing faculty about the benefits of IPE. Faculty created a partnership for course development.			Students reported challenges grasping content outside of their respective roles. These challenges encouraged students to seek guidance from one another and faculty. The authors identified challenges that included perception about complexity of course content, student enrollment and interest, competition from other elective courses, lack of resources to support intervention, initial lack of faculty buyin. Offering a cross-listed nursing and respiratory course created logistic challenges related to registration, learning support technology, drafting course proposal documents, and obtaining curriculum approval.	implications of UG IPE on IP collaboration, IP practice, and patient-care outcomes in healthcare.
Hoffman & Cowdery, 2022	To evaluate the effects of an IPE intervention on UG health professions students' current IP awareness and understanding, and intent for	USA	All students had the opportunity to sign up for learning beyond the classroom (LBC) credit, of which a certain amount is required of all UG students at the university. Also, all students had the opportunity to sign up for IPE Passport which provides a certificate of attendance for IPE events and after a certain	Community health nursing, health education ID grouping: described by authors	A one-time IPE intervention consisting of videos, case studies, and discussion on student IP awareness and understanding, and intent to interprofessionally collaborate. Duration: one-time	Videos and case studies were found helpful by the majority of students. The majority of students indicated that as a result of the event their IP awareness and understanding increased. Students stated that they learned about IP collaboration and how to effectively	This type of intervention can be used to address the lack of representation of public health in IPE initiatives.

	IP collaboration.		number are attended, students receive a letter of acknowledgement from the Dean (passport and letter can be included in a health professions student's portfolio and shared with potential employers during interviews).		intervention Format: in-person	collaborate; about health professional roles. In terms of misconceptions students had that were clarified, the theme of individual health professional roles was noted. Students found the case studies and the application of collaboration as most helpful.	
Karuguti et al., 2017	To assess cognitive rigor of IPE curriculum using Depth of Knowledge (DOK) framework.	South Africa	IPE curriculum has been created at this university since the late 1990s. Many departments participate in initiatives for community based education and IPE.	Natural medicine and exercise, nursing, occupational therapy, physiotherapy psychology, sports science ID grouping: not described by authors	Three module courses: introduction to philosophy of care, primary healthcare, and health promotion. Each course had 4-5 outcomes (14 total) which were assessed using DOK. Duration: three semestered courses Format: not specified	Half of the course outcomes required extended thinking (DOK level 4, where DOK is about cognitive rigor, i.e., the complexity of content, cognitive engagement with that content, and scope of planned learning activities). One quarter required planning and using evidence (level 3). One quarter required engagement beyond just recall (level 2). In general, assessment criteria was not aligned with the q4 course outcomes. Five course outcomes had 0% alignment with assessment criteria. Four course outcomes had between 20-33% alignment with assessment criteria. Three course outcomes had between 50-60% alignment with assessment criteria. Only two course outcomes had 100% alignment with assessment criteria.	Curriculum could be revised with the DOK perspective of cognitive complexity to achieve higher cognitive levels for instruction. The DOK framework can support educators in aligning the quality of the specific outcomes and that of the assessment criteria. Future research should look into different assessments for cognitive rigor and improving curriculum based on these assessments.
Kenaszchuk et al., 2012	To teach students about their own and other professions' responsibilities during a patient care incident; to	Canada	New federal and provincial policies indicate that government planning authorities expect pre-licensure IPE and post-licensure IP collaboration to be key in future health professionals' education and practice.	Early childhood education, funeral services, nursing, occupational therapy, pharmacy technician, personal support worker, physiotherapy ID grouping:	Case-based workshop: health care trajectory of an elderly woman who had a traumatic, injurious fall in her home. Duration: one-time intervention	Approximately 80% reported medium or high enthusiasm for IPE. The workshop students had higher scores on attitudes toward IP learning.	IPE training developed to anticipate participation by students earlier in their training and students with low enthusiasm may be more effective than one-size-fits-all IPE.

	require students to practice effective IP communication, and to improve student attitudes toward IP collaboration.			described by authors	Format: not specified		
LaDuca et al., 2019	To prepare students for the increasing complexities of the interconnected world by developing and testing a transdisciplinary model for education which links multiple classes from different disciplines via a common theme (local addiction crisis) and within a common space.	USA	The University of Dayton's Institute of Applied Creativity for Transformation (IACT) has developed a transdisciplinary educational framework. IACT's collaboration approach integrates all disciplines together around a social problem in the local community. More than 50 faculty and staff from all sectors of campus serve as IACT Collective members and 17 IACT Fellows, who participated in more intensive training, contribute to the design and teaching of the IACT curriculum. They also commit to using their IACT experience for the education they deliver to students within their own discipline. An IACT UG Certificate in Applied Creativity and Transformation exists in the School of Engineering. IACT course experiences have been tested over 4 years, including summer pilot programs bringing together a group of transdisciplinary student interns to work on	Applied creativity, education, engineering, health and sport science, religious studies, theater ID grouping: not described by authors	Themed experiences centered on the addiction crisis in Dayton. Students were required to post reflections on immersion experiences, develop solutions to the prompt, and present their products to their peers (in a physical space). Duration: semestered course Format: in-person	Students recognized that the experience expanded their perspectives of the other disciplines. Most suggested that i improved their ability to collaborate in a transdisciplinary environment	When ID experiences are in a large space, although conducive to collaboration, ensure that there are also undistracted spaces (visually and sound-wise) so teams of students can isolate themselves. When students are working on an ID project, their individual vocations should be related to the research, work, problem-solving, and creativity they are involved in.

			applied creativity projects for external sponsors. The sponsors have been positive about the processes, solutions, and learning impact on them and the students. IACT leadership convinced upper level leadership to provide a large caged storage space for use and a budget was allocated for renovation.				
Macdonald et al., 2022	To use ID co-design workshops to create opportunities for bringing scientists and designers to work together, exposing them to the challenges of developing accessible immunology materials and to using empathy and reflective practice to resolve challenges.	UK	In UK higher education institutions there is a growing realization and appreciation for academic disciplines to seek research partners beyond their own subject.	Biological sciences, product design ID grouping: described by authors	A project in which students co-created designs and prototype displays of immunology concepts. Duration: multi-week project Format: in-person	Student participants were excited and inspired by each other's different knowledge and skills, but were also rewarded by overcoming different cultures of learning and communication (as in the different cultures between disciplines). Students reported their use of soft skills to engage with each other and move the projects forward.	If researchers can support each other to look beyond the safety of their silos and borders, then new ways of thinking and working can be stimulated and celebrated.
Malachowski, 1990	To assess the strengths and weaknesses of a cluster approach to teaching ID science courses.	USA	Faculty members in arts and sciences believed that it is critical in the educational process to show the overlap of thought between many disciplines. The course developed in the paper is team-taught by 5 faculty members.	A class of first-year UG students (non-science or undeclared) majors. ID grouping: not described by authors	A course on the impact of science on society (with specific health-related topics). taught by faculty of chemistry, biology, political science, psychology, and philosophy. Taught twice per week by 5 faculty members, each	Students often reported having to think about topics in a different way, or think about topics they haven't thought about previously. Certain frustrations occurred due to the difficulty of questions posed and the difficulty to resolve them due to conflicting viewpoints of a pluralistic society, teaching	In implementing writing-across-the curriculum, students should keep a journal to describe their thoughts on class topics, leading to their discussion.

					with their class of 18 students, alternating between large group lectures and small group discussions. Duration: Semestered course Format: In-person	them the lack of definitive answers in science.	
Marx et al., 2021	To describe a creative model for an ID approach to service-learning and provide a framework for future development and application.	USA	During the Fall 2016 and 2017 semesters, a 200-level genetics course collaborated with a 300-level graphic design course on a project for the Education and Community Involvement Branch (ECIB) of the National Human Genome Research Institute. ECIB's mission is to develop education, community engagement programs, and resources that enhance the public's understanding of genomics and related ethical, legal, and social issues. By collaborating with ECIB to create games about a current genomic technique, students were addressing the need of the community partner.	Biological sciences, graphic design ID grouping: described by authors	A service learning project (situated within a genetics 1-semester course and a graphic design 1-semester course) for a community partner in which students created interactive games about the genome editing technique, CRISPR, for middle school students. Duration: semestered course Format: in-person	Students reported that the project provided real-life experience. Students reported that being exposed to another discipline was eye-opening.	A generalisable model is recommended for successful integration of ID service-learning. (1) Finding a community partner. Once a community partner is identified and presents their tangible needs, it can be determined which courses and student learning objectives may be the best to address those needs. Faculty of those courses can start to collaborate and determine how to integrate service-learning via an ID approach. (2) Overlapping class time and shared meeting space. A time and place to meet (virtual or face to face), conducive to both classes, instructors, and client, is important for collaboration and communication. (3) Organized partnerships. Think about how to pair students, and set process and outcomes for the project. (4) Joint ownership of the project. Have content experts address both classes simultaneously and have a shared budget to foster a sense of joint ownership between the students, especially if the weight of the project is different in each

							class. (5) Assessment strategies such as course-specific assignments and rubrics (assignments differ for each class because the learning outcomes differ); critical reflections; common learning objectives so that the effectiveness of the project can be assessed with regard to student learning.
Misra et al., 2009	To (1) design an ID health promotion training curriculum for UG research fellows; (2) develop measures for evaluating and assessing program-related educational processes and products; and (3) compare these educational process and product measures between groups of students who did or did not receive the training; all within The University of California at Irvine Interdisciplinary Summer	USA	The ID-SURE program combines ID coursework with an intensive summer research fellowship experience. ID-SURE aims to foster a new generation of scientists and practitioners equipped with the integrative conceptual and methodologic skills to solve the future's health challenges. With the ID scope of the public health field, health promotion, and disease prevention, the ID-SURE program was created to give students with collaborative opportunities, exposure to disciplines other than their own, mentorship from faculty representing diverse fields, and training in ID theories and methods.	Learner disciplines not described ID grouping: mentor grouping described by authors	The University of California at Irvine Interdisciplinary 10-week Summer UG Research Experience (ID-SURE) program. Each week students had 3 hour lectures. Students had 2-3 hours of teamwork experiences and were required to complete 320 hours of research. Duration: semestered course Format: in-person	This paper uses indexes/scales to assess transdisciplinary attitudes and behaviors. Exposing UG research fellows to the ID curriculum led to increased participation in, and positive attitudes about, ID classroom and laboratory activities. Products, such as the integrative and ID quality of student research projects, showed no differences when compared to those of UG who were not exposed to the ID curriculum. However, UGs exposed to the training engaged in more ID behaviors at the end of the program than students who were not trained in ID research techniques. A theme that emerged was that working in a multidisciplinary team is enjoyable. Students valued ID work, and appreciated ID research collaboration.	The findings suggest that ID training programs should incorporate team projects as a required curricular component, at least for those programs geared toward UG students.

	UG Research Experience (ID-SURE) program.						
Mulligan et al., 2011	To explore student experiences regarding cross-disciplinary thermoregulation and sweat analysis laboratory sessions and to identify key themes for consideration in further implementation	Canada	Previously, laboratory sessions in the Analytical Chemistry and Exercise physiology courses were mutually exclusive and conducted independently with no form of interaction. Chemistry students analyzed a nonhuman biological sample provided to them for the determination of the concentration of a given ion. Exercise physiology students studied thermoregulation by observing, recording, and analyzing the physiological response to continuous exercise.	Chemistry, kinesiology ID grouping: not described by authors	A 2-week lab experience to study exercise and thermoregulation and sweat analysis. Duration: condensed course Format: in-person	Student perceptions were that the laboratory 1) stimulated interest in this area of physiology, 2) provided insight into practical applications of the laboratory techniques they had learned previously within their respective discipline, 3) offered an opportunity to understand their course curriculum from another perspective, 4) allowed for valuable interactions with students from, and another discipline, but also 5) presented with challenges such as amount of work, lack of information to prepare for lab, lack of discussion.	N/A
Noy et al., 2017	To provide insights and new knowledge about how pedagogy supports ID sustainability learning that will inform future teaching.	Australia	Although some Australian universities were signatories to the international Talloires Declaration (University Leaders for a Sustainable Future, 2000) or other higher education sustainability covenants with ID pathways, the fragmented character of university approaches to sustainability has not allowed institution-wide ID learning for sustainability. This is despite the impetus of Australia's National Action Plan on Education for Sustainability which identified higher education as a key player in promoting this agenda and articulated principles that highlight the need for ID	Arts/education, business and law, health, science ID grouping: not described by authors	12-week long semester course: participate in creative, collaborative ID action on sustainability. Students had 3 hour lectures, group assignments, and individual assignments. Duration: semestered course Format: in-person	Vast majority of students felt they gained ID and other skills for sustainability. Students, regardless of discipline background, valued the processes and pedagogy used to promote ID collaboration and awareness.	The authors put together an interpretive framework/template that provides educators with a guide for developing deliberative curriculum and pedagogy that promote ID knowledge, skills and confidence in education for sustainability. The framework includes group work (e.g., space for disruptions, conflict resolution, and collaboration to generate ID products; sense of belonging and shared identity; being able to share fears of unknown), challenging existing worldviews (e.g., students exposed to unexpected connections), peer

			learning.				learning/exchange, and personal engagement (e.g., developing new skills for working toward ID solutions; linking class experiences to real life).
Parker et al., 2022	To evaluate the incorporation of IPE in a wound management elective unit from students of different disciplines.	Australia	Academic teaching staff promoted the course. The course was designed and delivered based on IPE best practices. Educators had 1 hour of pre-briefing on IPE principles.	Exercise and nutrition science, nursing, pharmacy, podiatry ID grouping: not described by authors	6-hour in-person sessions per day over 3 days with the purpose to develop an evidence-based care plan. Duration: one-time intervention Format: in-person	Increase in understanding of the role in the IP healthcare team and roles of other health professionals. Students agreed that HCPs should be educated to have collaborative relationships with other HCPs and curriculum should involve teamwork with other HCP students. Based on the SPICE-R scale, students improved their knowledge and evaluation of IPE. After participation, students had more detailed knowledge of IPE and value of this approach in clinical care. The facilitators wrote answers to open-ended questions where two themes emerged: developing awareness of different roles and care dimensions, working together for a common purpose. Challenges with limited attendance from other health disciplines due to promotion opportunities lacking and timetabling difficulties.	IPE should be standardized within wound care teaching. Organization is necessary to incorporate IPE into a curriculum (financial, time allocations, admin support). IPE must be mapped to course curricula and its importance emphasized to students (because of professional standards and accreditation). The assumption that educators understand how to implement IPE should not be made.
Reitsma et al., 2019	To determine the IP dynamics between the different health professions by exploring and	South Africa	This was outside of the formal curriculum. An IPE pilot project was planned and executed in a Faculty of Health Sciences at a university. Lecturers from 6 health professions were invited to participate in the project	Dietetics, human movement sciences, nursing, pharmacy, psychology, social work ID grouping: described by authors	In-person course for 1 hour per week for 4-6 weeks. Split into groups of about 5 with representatives from each discipline in each group, where possible.	Students felt that they further developed IPE competencies (leadership, communication, professional identity, collaboration, conflict management, working as part of a team) as a result of the intervention.	The inclusion of different health professions in an IP team should be guided by a specific and suitable case study, the availability of the students, and their scopes of practice at third-year level.

	describing the students' experiences of the IPE process.		planning, implementation, assessment, and evaluation.		Duration: condensed course Format: in-person	Students learned more about other professions and IPE roles within their own profession. Leadership within groups seemed to naturally shift over the weeks. Challenges included: Some students reported that the provided case studies did not have adequate information; they did not understand how their profession was relevant to the case study. Authors and students reported that the case study content influenced the interaction between disciplines, e.g., if students from one discipline have a hard time identifying their roles and scope of practice, or seeing the relevance of their profession in the IP team. Students reported that facilitators directed discussions towards their own profession and valued perspectives from their own disciplines over others. Authors reported variation between facilitators, i.e., how a session is conducted and opportunities for IP collaboration.	IPE should be part of every curriculum.
Robeva, 2009	To assess the effectiveness of an ID course and textbook in mathematical biology to bridge the gap	USA	The National Science Foundation (NSF), the National Institutes of Health (NIH), and the Howard Hughes Medical Institute have provided funding for innovative ways to establish ID ties between mathematics and biology. The Mathematical	Biology, mathematics ID grouping: not described by authors	Three 50-minute lectures and one 3-hour lab session per week, teaching sophomore to senior biology and math majors over the course of a semester.	Based on student course evaluations, the course structure, topic selection, and teaching pedagogy received positive feedback from students. Students reported their	Authors recommended that there is a need for an ID approach in educating future mathematical biologists, especially at an UG level, with the aim to inspire meaningful inquiry and prepare students more effectively for advanced

	between mathematical and biological sciences at the lower UG level.		Association of America and National Science Foundation funded faculty development workshops for mathematicians and biologists to develop and teach mathematical biology courses. In 2007, the Mathematical Biosciences Institute at Ohio State University had its first educational workshop in mathematical biology, resulting in an increase of UG and graduate programs in mathematical and computational biology. The intervention in the paper was created jointly by faculty from Sweet Briar College and the University of Virginia School of Medicine, and offered for the first time at Sweet Briar College in spring 2002.		Duration: Semestered course Format: In-person	increased understanding of the importance of ID collaboration. *For the below outcomes, no data was collected/reported on the effectiveness of IDE. The statements are provided by the authors Robeva, 2009.* The authors stated that the introduction of a textbook in a subsequent iteration of the intervention was crucial for course completion, as many students had to rely on various resources when the intervention was initially implemented. The authors believe that the integration of a textbook also makes the course more accessible and adoptable. The authors stated that having used an ID team teaching approach was crucial in modeling interdisciplinarity. The authors stated that when exposed to ID problems, students with a minimal mathematics background were able to grasp concepts of math and biology much more efficiently compared to students taught in the traditional environment of disciplinary separation. The authors stated that the learning environment was enhanced with “student mentoring”, which benefited students.	studies or careers. There must be exposure to classical and contemporary research in biomathematics, hands-on laboratory experiences, and more collaboration between mathematicians and biologists.

Satterwhite et al., 2020	To examine potential environmental contamination with a transdisciplinary collaboration through designing the environmental research study as part of a community-based ID research class.	USA	The role of the university-community partnership in shaping the research class was crucial in the positive transition to transdisciplinarity. Two local county Boards of Supervisors agreed to serve as formal partners, in part due to Army staff endorsement of the project. Local residents also participated. The research emerged from community advocacy focused on environmental health concerns; openness to research collaborations on the part of leadership at Radford Army Ammunition Plant; university funding; university structural encouragement of transdisciplinary work (e.g., co-teaching small, ID classes); and faculty members' willingness to engage with other disciplines and adopt research agendas shaped by local demands.	Biochemistry, environmental policy and planning, environmental science, human development, political science, sociology ID grouping: not described by authors	UG research course. Research was inspired by local concerns on environmental health and relied on community collaboration. Duration: not specified Format: in-person	Students' final reflection papers asserted the value of transdisciplinary collaboration.	Institutional structures and initiatives which support co-instruction of small, research-based courses, as well as funding for IDE, may help growth of transdisciplinary research capable of addressing complex problems.

Scrooby et al., 2019	To determine the appropriateness of a practice model embedded in the theory of constructivism for IPE implementation with first year students in health professions.	South Africa	South Africa has 21 universities of which 6 have medical schools or faculties. The remaining 15 universities teach anatomy within non-medical schools or within health sciences faculties. The context of this research is a university where anatomy teaching is the responsibility of the School of Nursing Science (Faculty of Health Sciences). Anatomy is taught to UG students in pharmacy, nursing, nutrition and dietetics, and human and movement sciences.	Dietetics, nursing, pharmacy and human movement sciences ID grouping: described by authors	Integrated anatomy session for those currently enrolled in anatomy. Learners reviewed 5 case studies as an IP group (2 learners from each discipline). The case studies included scenarios of a patient with hypertension, a patient with an orthopedic condition, and a patient with rheumatoid arthritis. Frequency, duration, and format of intervention not described. Duration: not specified Format: not specified	Students reported increases in communication and professional identity competencies, followed by collaboration and leadership. Most feedback was positive, however students wanted more hands-on real-life exposure rather than theoretical cases; 3/23 students reported issues working in an IP group; and 2 students did not find it an effective experience.	Authors suggest using IPE models that include a constructive perspective (where students discover and adapt complex information to internalize new knowledge) is effective.
Valaitis et al., 2016	To develop, implement, and evaluate an ID UG course embedded within a campus–community partnership initiative involving McMaster University School of Nursing, and 3 urban priority neighborhoods in Hamilton, Ontario, Canada.	Canada	The School of Nursing was interested in increasing its community engagement efforts. A municipal community developer was recruited to work with the School of Nursing for a small stipend. In the neighborhoods, resident-led local planning teams supported partnerships between residents and community organizations (such as the School of Nursing).	Nursing (2 students), biochemistry (2), arts and sciences (2), social work (1), psychology (2), health sciences (1), life sciences (1), and biology (1); 4 students were assigned to each neighborhood or "hub" ID grouping: not described by authors	ID full-time, in-person UG course embedded within a campus–community partnership initiative involving McMaster University School of Nursing, and 3 urban priority neighborhoods in Hamilton, Canada. Students worked together with community residents and faculty to address selected priority community issues identified by neighborhood members. Class time was dedicated to faculty,	PERCEIVED IMPACTS on students: -Learned what they could do as individuals, with other students from different faculties and community members. -Learned about the complexities of working with, and in, communities, the need for time, relationship building, different agendas, and the struggle to find a unified vision. -Noted the importance and reward of knowing that they were offering added value and that their learning could be applied. SWOT analysis (SWOT	Recommendations are for changing the specific intervention: 1. Orient and engage community consultants earlier prior to the beginning of the course. 2. Provide insight/instruction on how community consultants can work with students. 3. Clarify course objectives with students and prepare them about how to work with community members. 4. Invite members of the neighborhood planning team to academic presentations at the university. 5. Provide students with more exposure to the community,

					student, and resident interactions; Students and residents worked to refine a researchable question based on the priority neighborhood issue. Duration: semestered course Format: in-person	themes were related to factors that may have influenced outcomes): STRENGTHS: -Opportunities to engage with, and in, the community influenced students' career directions -Valuing and commitment of all players -Authentic learning approaches used -Quality of the research and dissemination strategies -Positive qualities of students -Expertise and teaching strengths of faculty and community members -Multifaceted problem solving that moves to shared goals and solutions -Partnerships with the community -Bringing in new residents through university affiliation -Support from the School of Nursing WEAKNESSES -Scheduling/timing challenges influence ability to build strong student–community relationships -Communication challenges between students and community -Decision-making difficulties in the neighborhoods -Lack of sustainability and follow through with neighborhoods -Students' difficulties connecting and balancing course objectives and communities' expectations	that is, beyond the classroom setting, to include more visits to community meetings. 6. Engage the broader community more with special events in the neighborhood using planning teams to work through logistics during early evening hours to allow families with young children to come. 7. Offer consistent communication regarding the course/project through websites, blogs, emails, and regular reports at community meetings. 8. Involve more community partners such as the city partners through broader, strategic communication. 9. Address research recommendations earlier to promote expedited community action. 10. Consider strategies to obtain resources to move actions forward; e.g., grants leveraging community assets, and more local government involvement.

						-Orientation lacking -Lack of human and financial resources to move solutions forward OPPORTUNITIES -Opened up future possibilities for continued involvement of students in communities toward community betterment THREATS -Potential lack of consistency in approaches to working with neighborhoods across faculties -Potential threat for personal safety	
Wingert et al., 2011	To critically evaluate a pedagogical strategy used by faculty members across different disciplines to enhance integrative learning through the theme of food.	USA	In 2004, the University of North Carolina Asheville introduced a revised general education curriculum called the Integrative Liberal Studies program: students take their general education distribution in natural science, social science, and humanities or arts in topical clusters around a common theme. Students participate in the cluster by completing 3 courses from 3 different disciplines, of which there is at least one science and at least one social science. In 2011, there were 15 topical clusters available. Faculty teaching in the cluster developed a set of shared learning outcomes that inform individual courses in the cluster and also inform shared learning opportunities among the courses, including cross-course cluster projects or activities.	Health sciences, natural sciences, social sciences and humanities ID grouping: not described by authors	Cross-course projects/activities. Students collaborated on joint endeavors (e.g. seminars to local farms or food production facilities). Duration: semestered course Format: in-person	No significant changes in academic attitudes about student interest in ID activities.	N/A