

# Developing Sustainability Competencies of University Students Through Problem-Oriented Project in a Social Practice Course

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## Abstract

This study examines the effects of scaffolding instruction and situated learning on students' sustainability competencies through a problem-oriented project in a social practice course. Both qualitative and quantitative methods were conducted to examine the change in sustainability competencies and the process's underlying mechanism. Students enrolled in the course "The Behavior Modification Strategies" that incorporated social practice activities were recruited in 2022 and 2023. The quantitative aspect of the study, known as Competency assessment, consisted of both a pretest and a posttest that was administered immediately after the course. The qualitative elements entailed 23 semi-structured interviews conducted in September 2022, involving 10 students, and in September 2023, involving 13 students. After completing the course, the competency examination demonstrated a notable augmentation in the domains of communication, continuous learning, problem-solving, creativity, and technology application. The remaining parts, interpersonal skills, teamwork, and discipline were deemed statistically non-significant. An analysis of the thematic content revealed four fundamental themes that surfaced during the process of learning: (1)

situated learning, (2) scaffolding instruction, (3) problem-oriented project, and (4) deep-level cognitive processing. The findings indicated that the students' essential competencies were enhanced by implementing situated learning within the context of the social practice course, facilitated by scaffolding instruction in problem-oriented projects.

*Keywords:* deep-level cognitive processing, problem-oriented project, scaffolding instruction, situated learning, sustainability competency

## **Developing Sustainability Competencies of University Students Through Problem-Oriented Project in a Social Practice Course**

Recently, universities have placed increased emphasis on the third mission, known as societal contribution. Higher educational institutions are encouraged to operate with a sense of responsibility in promoting economic growth through their academic resources (Abreu et al., 2016). Universities undertake a variety of activities aimed at transferring knowledge for the purposes of fostering economic growth, advancing social welfare, and cultivating students' skills and competencies. The relationship between higher education and organizations is established through communication, engagement, and connection. That is mutually beneficial, contributing to the intellectual capital of both parties (Di Berardino & Corsi, 2018). This shift in focus moves away from the traditional missions of teaching and research towards the goal of utilizing knowledge to benefit society and promote its growth (Compagnucci & Spigarelli, 2020). In the context of the university's third mission, the aim is not only to address societal issues and provide solutions but also to foster students' awareness of public welfare through engagement with communities (Coelho & Menezes, 2021). Education is not solely aimed at personal fulfillment but also at enabling individuals to actively participate in the social sphere and contribute to solving problems in their chosen profession. Developing core competencies that align with students' interests and meet the needs of future employers and the nation is a genuine concern that universities must address (Brauer, 2021). The development of competencies requires the provision of institutional support, the

design of curriculum, and the implementation of teaching pedagogy. Additionally, it relies on the conceptualization of competencies, the training of teachers, and the comprehension of students' interests (Chan et al., 2017). The 2030 Agenda for Sustainable Development places great importance on the essential role of quality education at all levels. It is implemented in an interdisciplinary and integral capacity, enabling individuals to engage in action, reflection, and participation in future ecosystems. It enables individuals to navigate complex challenges in a sustainable manner, thereby propelling society towards sustainable development from both local and global perspectives (Cebrián & Junyent, 2015).

Taiwan has embarked on a mission to advance the concept of university social responsibility (USR), which has subsequently led to the initiation of 652 programs since 2018. This endeavor endeavors to foster the active involvement of universities in their local communities, with the aim of contributing towards sustainable development (MOE, 2019). The key areas of concern encompassed within this initiative encompass the nurturing of the immediate environs, fostering collaboration with industry, fostering environmental sustainability, ensuring food safety and long-term care, and fulfilling various other social obligations, all of which are in consonance with the principles underlying the UN Sustainable Development Goals. Students are oriented to be active learners in the classroom and in practical contexts in executive projects. It offers a chance to engage with wider communities and apply the theoretical concepts acquired from textbooks to intricate situations. Students greatly benefit from both cognitive and non-cognitive learning attained throughout this profound educational learning journey (Sousa et al., 2019). The USR program, which encompasses hundreds of initiatives, was initiated in Taiwan. Both universities and project principal investigators are dedicated to disseminating the program's impact within the local community and fostering student learning.

Numerous instances of sustainable projects were incorporated within the educational institution; however, typically, the endeavors tended to be fragmented (Lozano et al., 2015). The perception among students regarding the developed sustainability competencies varied across different learning activities (Molderez & Fonseca, 2018). It is a challenge in an instructional setting. Situated learning encounters transdisciplinary and resolving tangible sustainability issues with practical engagements to support sustainable development (BürGENER & Barth, 2018; Bielefeldt, 2013). The teaching method for building sustainability competencies through the creation of interdisciplinary experience in socio-ecological systems was reported as effective (Elder et al., 2023). These practical engagements appear to cultivate normative and critical competencies that have scarcely been developed (Remington-Doucette et al., 2013). The implementation of pedagogies that prioritize community engagement and constructive learning leads to enhanced learning outcomes (Tejedor et al., 2019).

The curriculum, through projects designed to address socio-environmental issues, serves to cultivate sustainability competencies (Fuertes-Camacho et al., 2019). A problem-driven approach was developed toward directing the teaching strategy in educational institutions for sustainability activities (Lang et al., 2012; Wiek et al., 2012). Moreover, active learning strategies such as service learning, problem-based learning, and project-oriented learning have been recognized as pertinent for the development of sustainability competencies (Tejedor et al., 2019). Additionally, a systematic approach known as project-oriented learning has demonstrated its effectiveness in fostering competencies in sustainability (Albareda-Tiana et al., 2018). Sustainability initiatives experienced advantages through the incorporation of problem-based and project-based learning in their educational programs and motivated students to develop sustainable competencies (Bertel et al., 2022;

Brundiens et al., 2014).

However, students may lack fundamental knowledge and comprehension of sustainability principles, thereby impeding the learning outcome. Moreover, without guidance, the incorporation of this learning strategy proves intricate given the course (Molderez & Fonseca, 2018). Engaging in practical scenarios without a structured framework can impose excessive demands on students and entail potential hazards and ethical dilemmas. The utilization of scaffolding has been found to yield favorable outcomes in the process of learning. Individuals with substantial pre-existing knowledge tend to derive greater advantages from this instructional approach, whereas those with limited prior knowledge exhibit enhanced learning outcomes when provided with examples (Chernikova et al., 2020). Project-based learning offers student teams the opportunity to engage with intricate real-world issues and often integrates the advanced problem-solving skills that stem from interdisciplinary collaboration. The utilization of regular group supervision, commonly referred to as scaffolding, plays a pivotal role in facilitating the attainment of learning goals within this multifaceted context (MacLeod & van der Veen, 2020).

The cultivation of essential competencies is founded upon both cognitive and noncognitive predispositions, necessitating engagement in various settings. Competencies are characterized as being capable of being learned but not capable of being taught. The progression of elevated levels of awareness can be observed as a sign of heightened cognitive intricacy, and consequently, augmented cognitive constituents can be discerned (Barth et al., 2007). The achievement of educational objectives is significantly influenced by the techniques utilized in instruction and the strategies pursued in the process of learning, through which cognitive information is processed (Weinstein & Mayer,

1986). Sustainability competencies encompass a comprehensive range of cognitive capacities and aptitudes, along with associated motivational and social preparedness, with the aim of addressing sustainability-related challenges (Waltner et al., 2019). From the point of view of learning effectiveness, the acquisition of transversal competences, such as cognitive abilities for problem-solving with non-evident solutions, is of utmost importance for educators. Furthermore, the active engagement of students in constructive thinking is equally vital (Mesárošová & Mesároš, 2012; Tsankov, 2018).

Under the intricate circumstances, the educational issue on this specific topic of building sustainability competencies is to provide more paradigms with empirical data to explore the impact of the instructional setting and learning outcomes. Given sustainability competencies gained from particular successful settings, it is more important to investigate the cognitive component of transformation in learning experiences toward sustainability competencies. Hence, the objectives of this research are to investigate the impact of the instructional setting on students' sustainability competencies and explore the influence of the instructional setting and the cognitive factor that facilitates the growth of competencies in a social practice course. Consequently, the present study was to investigate the questions below.

- What kinds of sustainability competencies grew in a social practice course among students under the project of a problem-oriented instructional approach?
- What are the core elements of the instructional setting that contribute to the development of sustainability competencies?
- What is the main cognitive factor in the learning process that led to competency development?

The researcher conducted the quantitative study to examine the growth of sustainability competencies. The qualitative study aims to explain how sustainability competencies developed and provide insight from learning achievement. The qualitative research also explored the core elements of the instructional setting and the main cognitive factors that transfer learning experience to competencies.

### **A Problem-Oriented Project Learning**

Problem-based learning, project-based learning, problem-oriented project, or problem-oriented and project-based learning are observed in diverse educational contexts with distinct aims. These types of pedagogy encompass two pivotal components, namely, problem and project. The concept of "problem-based learning" (PBL) was previously only utilized to depict a technique of medical education that revolved around collaborative efforts centered on patient issues and led by a mentor (Schmidt, 1983). Then, it emerged in the field of engineering education literature and practice. In this method, small teams of students collaborate under the guidance of a mentor to solve real-world problems (Servant-Miklos, 2020). Even though the establishment was known as "the Aalborg Centre for Problem Based Learning in Engineering Science and Sustainability under the Auspices of UNESCO" was introduced in 2014 with the appellation "PBL," it has recently shown a preference for the abbreviation "PPL." This acronym signifies problem-oriented project learning (Andersen et al., 2015). Both PBL and PPL prioritize learner-centric as opposed to teacher-centric pedagogy, are conducted in small group settings, afford students the opportunity to apply knowledge in authentic contexts, and foster heightened student motivation, thereby potentially enhancing lifelong learning. Additionally, both approaches emphasize the cultivation of self-directed learning capabilities and interpersonal proficiencies.



It is worthwhile to note that the problem serves as the catalyst for learning and the facilitation of interdisciplinary connections (Servant-Miklos, 2020). Nonetheless, the cultivation of self-directed learning is more pronounced in PBL owing to the requisite knowledge acquisition inherent in projects. Distinctions between PBL tutors and PPL supervisors are evident in their respective instructional roles. PBL tutors are responsible for intricately framing the problem, whereas in PPL, students assume the responsibility of problem identification (Perrenet et al., 2000; Savery, 2015; Servant-Miklos, 2020). Learning in project-based settings is predicated upon the notion that the acquisition of knowledge takes place within a specific context, where individuals engaged in the learning process consistently interact with one another in order to attain specific objectives via social connections. This social engagement represents the very circumstances in which learning transpires, as students apply their acquired knowledge to address practical challenges encountered in the real world, prompting them to pose inquiries and articulate hypotheses that can subsequently be tested through empirical means (Kokotsaki et al., 2016). In order to involve learners in a practical task, it is necessary for students to engage in productive collaboration, effective communication, inventive thinking, and the discovery of innovative solutions, while also demonstrating critical thinking skills. Furthermore, Project-Based Learning has been identified as a means to enhance the long-term retention of knowledge, enhance problem-solving and collaboration abilities, and foster positive attitudes toward the process of acquiring knowledge (Strobel & Van Barneveld, 2009). Problem- and project-based learning (PPBL) courses have implemented a novel methodology in collaboration with sustainability partners to tackle authentic sustainability challenges (Brundiens & Wiek, 2013).

### **Building the Sustainability Competencies in Higher Education**

The individuals who acquired advanced proficiencies indicated an equivalent degree of perceived employability, and this association was influenced by the level of satisfaction they experienced in their careers (Blokker et al., 2019). Technological advancements have the potential to generate possibilities for modifications in the essence of labor itself. Moreover, with the continuous progress in technology, they have the capacity to modify both the configuration of organizations and the kind of employability, particularly in the complex and challenging future. Scholars express apprehension regarding the dynamism and adaptability within the labor force, as well as the realm of education and vocational instruction (National Academies of Sciences, 2017). The intricacy and uncertainty of the situation have advanced the absence of a straight progression in modern career paths and the variety of potential routes in the development of careers (Lawrence et al., 2015). The concept of sustainable careers is employed to explicate the personal reaction to these contextual metamorphoses. It accentuates the manner in which the mutual reliance and impact of societal environments occur, as well as the necessity for individuals and organizations to exhibit receptiveness and adaptability in the face of alteration while actively pursuing avenues for revitalization (Vinkenburg et al., 2015). In this ever-changing and demanding environment, there is a pressing need to develop the necessary competencies for suitability for the entire younger generation. The inclusion of education for sustainable development (ESD) at all levels of education is emphasized in the 2030 Agenda for Sustainable Development. ESD has the potential and obligation to foster the cultivation of sustainability competencies. The issues titled "Competencies in Education for Sustainable Development" address this

urgency, and the included papers present recent advancements in the realm of ESD competencies (Cebrián et al., 2020; UNESCO, 2023). It is imperative that the creation of interactive and learner-centered teaching and learning settings be pursued. This necessitates the adoption of a transformative pedagogy. The goal of this pedagogy is to facilitate independent learning, encourage active involvement, foster problem-solving skills, promote interdisciplinary and transdisciplinary approaches, and establish a connection between formal and informal learning in order to cultivate essential competencies related to sustainability (Tilbury, 2011; Van Laar et al., 2020). Competencies are not inherently cultivated in educational environments; rather, they necessitate deliberate and continuous endeavors to acquire knowledge about competencies and to engage with the various concepts, methodologies, and proficiencies that accompany each competency (Brundiers et al., 2021).

## **Method**

The present study employs a quasi-experiment mixed method with an explanatory sequential mixed design on a sample of psychology students enrolled in an undergraduate course on Behavior Modification Strategies. The research methodology employs the categorization of quantitative and qualitative in order to underscore the prominence of the quantitative stage and the supplementary function of the qualitative stage within the mixed methods design (Creswell et al., 2006). The rationale for employing a mixed-methods explanatory sequential design lies in the pursuit of achieving a more comprehensive understanding of the research question, as it is grounded in the realization that neither quantitative nor qualitative methodologies alone possess the capacity to adequately encapsulate the intricacies of a given situation (Ivankova et al., 2006). The design of the study provides a descriptive analysis

and paired sample *t*-tests from pre- and post-tests of students' competencies, utilizing a validated metric known as UCAN. Additionally, it delves into the interpretation and exploration of qualitative responses obtained through interviews with students, thereby elaborating on the findings.

## Context

Followed 2 consecutive years the students selected for the study were from an undergraduate psychology course embedded in social practice activities. This course is regularly held at 2<sup>nd</sup> semester at a private university in Psychology department in Taipei Taiwan. The course with the same instructor offered an essential framework to examine the impact of sustainability competencies within a problem-oriented project. The majority of students belong to underrepresented groups in the field of situated learning with a community focus, and these students have minimal or no prior exposure to the course on Behavior Modification Strategy.

## Participants

The investigation incorporated a cumulative sum of 111 students (59 in 2022, and 52 in 2023) who were registered in the undergraduate courses of Psychology. Only those who signed the consent form and completed both pre-course and post-course assessments were included in the analysis. The final analysis involved 85 students (47 in the year 2022 and 38 in the year 2023). Psychology was the chosen major for 95% of the students, while the female gender constituted 71% of the participants. The majority of the students (70%) were in the process of completing their third year, whereas the remaining individuals (30%) were in their fourth year of study at the university. The average age of students in the sample was 22.6 years ( $SD = 2.3$ ).

**Table 1**  
**Characteristics of Students Enrolled in the Undergraduate Course**

<i>Characteristic</i>	<i>Course offerings</i>		<i>Total (N = 111)</i>
	<i>2022 (n = 59)</i>	<i>2023 (n = 52)</i>	
Age, <i>M (SD)</i>	22.38 (2.5)	23 (2.2)	
Gender			
Female	41	38	79
Male	17	14	31
Not identify	1		1
Grade level			
Senior	17	17	34
Junior	42	35	77

*Note:* The enrollments in 2022 and 2023 were recorded at 62 and 54, respectively. Incomplete data was removed

## Course Structure

Ageing is a significant yet disregarded phenomenon in the realm of development, which has a direct impact on 12.2% of the worldwide populace. There were over 901 million individuals aged 60 and above at the end of 2015 (UN DESA, 2015). Despite their significant demographic presence, older individuals have traditionally lacked support. Consequently, countries with low-to-middle incomes have lagged in their efforts to invest in initiatives and enhance their capabilities to cater to the requirements of their aging societies. The vulnerable context places them at a heightened risk of exclusion and displacement, thereby rendering them highly susceptible to acts of violence, abuse, and negligence (UNDP, 2016). Initiatives focused on the elderly population were discussed across a span of 12 distinct Sustainable Development Goals (SDGs) during the period of 2016 to 2020 (Shevelkova et al., 2023). The older individual, given the mounting concerns surrounding sustainability, was the focal demographic within the social initiatives carried out by students within

the local community.

During the initial year, the project objective is tasked with the principal endeavor of creating a podcast aimed at disseminating a successful instance of behavior modification and the incorporation of behavior modification principles entailed in said process to the audience. Students independently form their own teams for collaborative group projects. They were required to select a client from a provided list and direct their attention to a specific topic for their group project. Each group works with one 55- to 70-year-old client from the local community where the faculty cohort was engaged for the purpose of the aged person's mental promotion. Each instructional session was scheduled once a week, lasting 100 minutes, over the course of an 18-week-long spring semester. A comprehensive curriculum cycle was organized over the course of a single semester, spanning four months, encompassing seven lectures, a midterm examination, two speeches, a project implementation lasting five weeks, and two presentations for the final outcome. The first presentation was internally between faculty and students. The second presentation invited all the clients and students to share their experiences. The lectures provided comprehensive coverage of the themes pertaining to behavior modification theory and techniques. The topics addressed in the speeches were delivered by professionals with expertise in behavior modification and experienced podcasters. During the phase of project implementation, students allocate their own time for client interviews and discussions with team members. However, the original school schedule was still reserved for additional question discussions with faculty. Since the implementation of the COVID lockdown, all activities except for the seven lectures have been conducted exclusively online. In the second year, the completed curriculum was delivered through in-person instruction, and the students opted to engage in a discussion with the client regarding the potential implementation of a behavior modification strategy for

additional target behaviors. The project report comprised a reflective statement on the project, an evaluation of peer contributions, and a podcast program as a group submission.

## Measures

The investigation involved the utilization of an online iteration of the University Career and Competency Assessment (UCAN), which encompasses a total of 54 inquiries specifically crafted to evaluate the generic career competencies of college students, as well as semi-structured interviews with students to gather additional information. These competencies in UCAN encompass eight distinct factors: communication, continuous learning, interpersonal skills, teamwork, problem-solving, creativity, discipline, and technology skills. The scale utilized in this assessment comprises a 5-point Likert rating system, with options ranging from 1 = *very difficult*, 2 = *I could finish if I learn*, 3 = *I could do it well if I learn*, 4 = *I could finish but some room for improvement*, and 5 = *I could do it very well*. The reliability analysis yielded a Cronbach's alpha ranging from .83 to .90 for the individual factors and an overall Cronbach's alpha exceeding .80 for the entire assessment. Additionally, the *Comparative Fit Index (CFI)* surpassed .9, the *Standardized Root Mean Square Residual (SRMR)* was below .08, and the *Root Mean Square Error of Approximation (RMSEA)* was also below .08 (Ministry of Education, 2012). Furthermore, within the context of a reflective essay, students were mandated to articulate the ways in which the course heightened their understanding of behavioral modification techniques, as well as to elucidate their experiences and insights gained from interacting with individuals from the community. The objective of the free-writing process was to elicit comprehensive descriptive narratives from students, employing a targeted prompt.

## Procedure and Analysis

At the commencement of the course, students were provided with information regarding the study and were encouraged to undertake the informed consent process. Subsequently, they were instructed to do the UCAN generic competency assessment online version as a pre-test during the initial week of the course. In the final week of the course, students were invited to complete the UCAN generic competency assessment as a post-test, and all students submitted their project reflection. The responses obtained from the pre-test and post-test of the UCAN were downloaded into a spreadsheet, subsequently coded, and then entered into SPSS Version 26 in order to facilitate analysis. The researcher attended the class twice to observe the interaction between instructors and students. In addition, researchers also participated in the presentation that faculty and elderly persons who attended the project were invited to at the end of the semester, and researchers gave feedback and recognition on the students' project results. In the last week, the researcher actively encouraged students to partake in the interview process in order to facilitate the dissemination of further information if they were selected. In the year 2023, a total of 13 students participated; 3 individuals volunteered, and 10 students were sampled and invited to represent each respective project group. In the preceding year of 2022, all 10 students were sampled and invited according to the mid-term exam scores, which were segregated into three groups from low to high for interview selection by the researcher. The objective of adopting two types of purposive sampling was for diversity to cover heterogeneous samples. Before the interview, all the project reflection reports from students were reviewed. Multiple data derived from observation and documents reviewed prior to the interview provided a more holistic and comprehensive understanding of phenomena and clues to dig out deeper insight in the interview (Patton, 1999).



The interviews were conducted subsequent to the conclusion of the summer vacation period. Prior to the commencement of the interviews, the students consented to their participation by means of a formal agreement. All semi-structured face-to-face interviews were administered within the confines of the same designated meeting room in the school. In the course of the interview, the researcher assessed comprehension levels by employing techniques such as paraphrasing and summarizing in response to the interviewee's statements before proceeding to the subsequent question. The researcher undertook the interviews within the span of one week, during the middle of September. Each interview was recorded utilizing a digital recorder. The scheduled duration for each interview was one hour, with the actual duration ranging between 50 and 75 minutes. The same qualitative methodology was consistently applied throughout the years 2022 and 2023. The open-ended question commences by contrasting the disparities between conventional education, comprising lectures and classroom examinations, with the integration of group projects within the community. Subsequently, the inquiries proceed to address the acquisition of competencies and the alteration of attitudes when interacting with older generations, as well as the impact of these experiences on individuals' behavioral patterns in their daily lives. Open-ended questions afford participants the opportunity to expound on their unique experiences in a comprehensive manner. The interview guide and questions underwent a thorough review and validation process by a psychology expert who possesses extensive experience in both online learning and social practice courses. The finalized list of questions was then distributed to the participants a day in advance via mobile applications. At the commencement of the interview, the participants were assured of the utmost confidentiality, anonymity, and permission to record the session. A written agreement was also signed to solidify these terms. Following this, the questions were elucidated to the participants. Subsequently, the research

facilitator posed general questions that had been previously defined while also assuming the role of an attentive listener who simultaneously analyzed the responses in order to delve deeper into the subject matter.

Data analysis was done step by step. First, data was collected from interviews, which were recorded and transcribed verbatim with confirmation by participants to ensure accuracy. Second, considering the scientific rigor of the research, the interview questions, data analysis process, verbatim, and themes identified were reviewed by another expert to ensure trustworthiness, accuracy, and credibility. Third, the researcher started the analysis concurrently, right after the first interview was conducted. Transcripts were coded line by line and reviewed to shape the experiences and perceptions of students to make sure the findings were based on participants' words instead of the researcher's own opinion. Fourth, identify the themes and verify that the data is good enough to support those themes and findings.

## Results

### **The attainment of growth in sustainability competencies**

Quantitative analysis was conducted to answer research question one. A comprehensive examination of the descriptive findings indicated that the cumulative academic achievements in creativity among students on the UCAN assessment in both 2022 and 2023 followed a normal distribution at the onset of their respective courses. The skewness values were found to be  $-.173$  and  $-.195$  for the respective years. The remaining variables exhibited skewness values ranging from  $-.007$  to  $-1.483$  ( $SE=.304$ ) in 2022 and from  $.005$  to  $-1.747$  ( $SE=.330$ ) in 2023. To address the research inquiry pertaining to the enhancement of competencies in problem-oriented projects, an examination was conducted comparing the means of posttest scores for paired samples with their

respective pretest scores (see Table 2) for the years 2022 and 2023 (see Table 3). The findings from Tables 2 and 3 reveal that the within-group analysis exhibited a noteworthy increase in the paired subjects' posttest mean scores across all eight factors, surpassing their pretest mean scores in both 2022 and 2023. In addition, in the year 2022, the paired *t*-test (see Table 4) revealed a significant difference between the participants' pre- and post-responses across the constructs of communication, continuous learning, problem-solving, and creativity. Similarly, in the 2023 paired sample *t*-test (see Table 5), significant distinctions were observed in the areas of communication, continuous learning, problem-solving, creativity, interpersonal skills, and technology skills. However, when comparing the years 2022 and 2023, the last two factors, namely interpersonal skills and technology skills, did not exhibit significant differences in the year 2022. Therefore, the outcome demonstrated that the project focused on addressing specific issues has an impact on performance in the areas of communication, continuous learning, problem-solving, and creativity for both the years 2022 and 2023. When comparing the results of online instruction in 2022 to the in-person setting in 2023, it is evident that the latter has a greater influence on interpersonal skills and technology skills. The findings revealed that the competency of the students in the UCAN domain experienced a noteworthy augmentation subsequent to their completion of the course.

This quantitative examination provided a response to the first research inquiry of whether a project focused on addressing a specific issue within a social practice course has the potential to enhance the acquisition of sustainability skills among students.

**Table 2**  
***Year 2022 Descriptive statistics for pre and post-test scores***

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Communication posttest	4.20	47.00	0.45	0.07
Communication pretest	3.97	47.00	0.47	0.07
Pair 2 Continuous Learning posttest	4.09	47.00	0.59	0.09
Continuous Learning pretest	3.84	47.00	0.55	0.08
Pair 3 Interpersonal Skills posttest	4.19	47.00	0.54	0.08
Interpersonal Skills pretest	4.02	47.00	0.53	0.08
Pair 4 Teamwork posttest	4.30	47.00	0.49	0.07
Teamwork pretest	4.15	47.00	0.53	0.08
Pair 5 Problem-solving posttest	4.31	47.00	0.51	0.07
Problem-solving pretest	3.88	47.00	0.56	0.08
Pair 6 Creativity posttest	4.13	47.00	0.54	0.08
Creativity pretest	3.73	47.00	0.68	0.10
Pair 7 Discipline posttest	4.30	47.00	0.54	0.08
Discipline pretest	4.17	47.00	0.57	0.08
Pair 8 Technology Skills posttest	4.12	47.00	0.60	0.09
Technology Skills pretest	3.84	47.00	0.82	0.12

**Table 3**  
*Year 2023 Descriptive statistics for pre and post-test scores*

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Communication posttest	4.22	38.00	0.52	0.08
Communication pretest	3.94	38.00	0.45	0.07
Pair 2 Continuous Learning posttest	4.14	38.00	0.66	0.11
Continuous Learning pretest	3.82	38.00	0.63	0.10
Pair 3 Interpersonal Skills posttest	4.32	38.00	0.65	0.11
Interpersonal Skills pretest	3.95	38.00	0.63	0.10
Pair 4 Teamwork posttest	4.20	38.00	0.60	0.10
Teamwork pretest	4.08	38.00	0.45	0.07
Pair 5 Problem-solving posttest	4.15	38.00	0.59	0.10
Problem-solving pretest	3.82	38.00	0.52	0.08
Pair 6 Creativity posttest	3.94	38.00	0.66	0.11
Creativity pretest	3.50	38.00	0.65	0.11
Pair 7 Discipline posttest	4.37	38.00	0.49	0.08
Discipline pretest	4.20	38.00	0.58	0.09
Pair 8 Technology Skills posttest	4.11	38.00	0.58	0.09
Technology Skills pretest	3.79	38.00	0.59	0.10

**Table 4**  
**Year 2022 Paired samples t-test results**

	2022	Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	Communication (posttest-pretest)	0.23	0.56	0.08	2.81	46.00	0.007**
Pair 2	Continuous Learning (posttest-pretest)	0.25	0.82	0.12	2.08	46.00	0.043*
Pair 3	Interpersonal Skills (posttest-pretest)	0.16	0.85	0.12	1.32	46.00	0.20
Pair 4	Teamwork (posttest-pretest)	0.15	0.79	0.12	1.29	46.00	0.20
Pair 5	Problem-solving (posttest-pretest)	0.43	0.77	0.11	3.87	46.00	0.000***
Pair 6	Creativity (posttest-pretest)	0.40	0.90	0.13	3.07	46.00	0.004**
Pair 7	Discipline (posttest-pretest)	0.13	0.77	0.11	1.14	46.00	0.26
Pair 8	Technology Skills (posttest-pretest)	0.29	1.02	0.15	1.93	46.00	0.06

*Note:* Correlation is significant at the .05 level (2-tailed)

**Table 5**  
**Year 2023 Paired samples t-test results**

	2023	Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	Communication (posttest-pretest)	0.28	0.63	0.10	2.78	37.00	0.009**
Pair 2	Continuous Learning (posttest-pretest)	0.33	0.76	0.12	2.65	37.00	0.012*
Pair 3	Interpersonal Skills (posttest-pretest)	0.37	0.77	0.13	2.99	37.00	0.005
Pair 4	Teamwork (posttest-pretest)	0.12	0.58	0.09	1.28	37.00	0.209
Pair 5	Problem-solving (posttest-pretest)	0.33	0.71	0.12	2.89	37.00	0.006**
Pair 6	Creativity (posttest-pretest)	0.44	0.76	0.12	3.57	37.00	0.001***
Pair 7	Discipline (posttest-pretest)	0.17	0.62	0.10	1.73	37.00	0.093
Pair 8	Technology Skills (posttest-pretest)	0.32	0.61	0.10	3.17	37.00	0.003**

*Note:* Correlation is significant at the .05 level (2-tailed)

## The core elements of the instructional setting

The qualitative analysis was adopted to address the second research inquiry. The outcomes of the qualitative analysis yielded supplementary perspectives that supplemented the quantitative discoveries, thereby facilitating the acquisition of a more thorough comprehension regarding the factors that might hold significance in the cultivation of students' sustainability competencies. The analysis revealed various unique course variations and contextual factors (see Table 6). The responses from the majority of students in

both years were thought-provoking, as they involved tackling real-life problems. The second most prevalent type of response in both years revolved around learning from faculty support. The third type of response focused on acquiring knowledge by engaging in novel work that required the integration of problem-solving, discovery, and theoretical and practical approaches. A significant proportion of the codes identified in the analysis were categorized under the theme of "situated learning". The second set of codes fell under the theme of "scaffolding instruction", while the third set of codes was grouped under the theme of "problem-oriented project". The underlying concept that emerged from these three clusters of learning was "deep-level cognitive processing".

**Table 6**  
*Codebook of themes, subthemes, and descriptions*

Themes	Sub-themes	Themes description	No. of times mentioned (%)
Situated learning	Learning in community	Learning comes from the integration of community involvement and serves to enhance the mutually beneficial process of learning and introspection.	14(20)
	Application of theory to practical scenarios	Students verify the validity of a theory through practical application that aligns with the local content and problem for devising a resolution.	26(37)
	Challenge in real world	Things are novel and arduous, necessitating significant effort and resolve for successful completion.	19(27)
	Achievement motivation	Students are motivated by older people who recognize their efforts, and that solution does help older people in some way.	11(16)

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**Table 6**  
**Codebook of themes, subthemes, and descriptions (續)**

Themes	Sub-themes	Themes description	No. of times mentioned (%)
Problem-oriented project	A tangible solution to real issues	A resolution that can be measured and implemented is intended to address a genuine problem.	9(15)
	Collaborative endeavors within groups	Collaborate in a small group to drive creativity, effective procedures, greater achievement, and task completion that meets expectations.	21(36)
	Independent mode of acquiring knowledge or skills	Students put in the effort to identify their own requirements, establish objectives, locate the essential resources, and investigate the solution. Self-learning was driven.	9(15)
	Intrinsic achievement	A feeling of personal achievement, professional growth, and a sense of pleasure and accomplishment from that project.	20(34)
Scaffolding Instruction	Attainable and challenging goal	A realistic goal that is achievable within a certain time frame. Based on the given knowledge and skills, explore the desired result.	5(15)
	Support promptly and with professionalism.	Assistance and response to students in their pursuit in a prompt and mature in nature.	10(30)
	Official evaluation to demonstrate the acquisition of knowledge	A formal assessment with well-defined evaluation criteria as well as to showcase the outcome in a public setting.	11(33)
	Instructor personality traits	Positive personnel traits such as patience, joy, and interaction Good at teaching skills in communication and listening.	7(21)
Deep-level cognitive processing		Mature comprehension involves the intricate mental manipulation of information, including exploring possibilities, organizing concepts, and deep analysis.	13(100)

### ***Situated learning***

In the situated learning paradigm, individuals acquire knowledge and skills within specific contexts and throughout the process of acquiring subject matter, considering the unique requirements and concerns of the learners (Stein, 1998). This approach also involves the active participation of fellow learners, individuals associated with real-world challenges, and the surrounding environment. These social learning processes occur within a particular context (O'Brien & Battista, 2020). It facilitates the construction of meaning within complex and ambiguous real-world activities, wherein previously acquired material is applied, critical thinking is employed, and kinesthetic abilities are harnessed to generate novel knowledge and skills. Codes in situated learning include learning with the community, a theory transfer to practice, and a challenge in the real world. Following are quotes from students.

S206: This was a wonderful experience and recollection. In light of this experience, occasionally I contemplated if that aged individual had the capacity to accomplish it, for what reason can't I endeavor to undertake something distinct to surmount obstacles when I bogged in my studies or in life?

S302: The textbook has furnished us with an initial framework; nevertheless, it is imperative to exercise prudence when attempting to implement it universally. I have reached this discernment by virtue of my active participation in this endeavor.

S311: I am inclined to lend my assistance to the clients due to their genuine affliction. This situation starkly contrasts with a simulated enactment. In the event that the clients do not concur with our declaration or empathetic response, they will promptly engage in deliberation. It is imperative that I rectify any errors without delay.

### ***Problem-oriented project***

Educational problems necessitate the ability to articulate and oversee them from the perspective of students and cultivate the propensity to actively seek resolutions. These problems may encompass various approaches to problem-solving and potential educational objectives, yet the subject matter remains the focal point. The problem that emerged from conflict in the ideal of critical theory, as stated by Roskilde, pertains to the deconstruction of reality in order to gain access to the concealed social framework that lies beyond the prevailing disciplinary boundaries. Undoubtedly, it is imperative to possess a comprehensive understanding of the theories in order to effectively deconstruct them. (Servant-Miklos, 2020). Project-based learning embodies a dynamic pedagogical approach wherein students actively engage in their own education. This instructional method is distinguished by students' self-governance, the pursuit of constructive inquiries, the establishment of objectives, collaborative endeavors, effective communication, and introspection grounded in real-world applications (Kokotsaki et al., 2016). The codes encompassed within this “problem-oriented project” consist of the resolution of tangible issues, collaborative endeavors within small groups, and an independent mode of acquiring knowledge. Following are quotes from students.

S302: In most cases, the sum of one plus one surpasses that of two.

When I assume the role of being in control of a particular task within a project, it is imperative that I engage in discussions with my team members in order to identify any potential areas of ignorance on my part.

S305: In the learning context, it is advisable to provide a restricted amount of information and impose limitations. Before project kickoff, it is crucial to clearly establish the intended goal and allocate sufficient time. From the perspective of motivating individuals to

learn, it is not conducive to compromising the quality of learning results due to time constraints. Conversely, it is essential for the project's objective to encompass a broader scope rather than being confined to a specific topic or answer.

S201 Sometimes, I find myself apprehensive about the prospect of failure, thus resulting in my reluctance to embark on novel endeavors. However, subsequent to the completion of this particular undertaking, it enabled me to try independently uncharted ventures in the future, as I had successfully surmounted a challenge in this project.

### ***Scaffolding instruction***

The notion of scaffolding instruction derives from the theoretical framework known as the 'Zone of Proximal Development' (ZPD), which aims to enhance children's linguistic and cognitive growth. Through the collaborative assistance of a proficient individual, a dialogue and interaction process is enacted to transform the child's haphazard and chaotic ideas into a more orderly and logical structure. Scaffolded instruction optimizes the acquisition of knowledge by students, as it establishes a nurturing context that simultaneously nurtures their autonomy and independence (Larkin, 2002). Scaffolding is a pedagogical approach wherein students receive necessary guidance and assistance until they can proficiently employ novel proficiencies and tactics autonomously (Rosenshine & Meister, 1992). The codes falling within this particular theme encompass an attainable and challenging goal, support in a timely manner and mature in nature, and an official evaluation to showcase the acquisition of knowledge. Following are quotes from students.

S313: The task necessitates a modest degree of difficulty, though not one that is exceedingly arduous to resolve. It cannot be resolved without concerted contemplation. No universally accepted solution

exists for this predicament, as each individual may contribute their own perspective. In the event that you encounter incorrect ideas, you are afforded the opportunity to rectify them. Consequently, others may possess divergent viewpoints. Subsequently, this will incrementally lead us to the desired outcome.

S308: We were not so uneasy because, throughout the whole process, our teacher accompanied us. Our evaluation was not confined to quantitative measures, but rather we received support and engaged with the teacher, especially when we had any inquiries.

S203: If one desires to acquire knowledge on the application and processing of this technique, it is advisable to consult an individual with genuine expertise. Whether one conducts a web search or peruses a textbook, it proves challenging to discern the intricacies within the given context.

## **The main cognitive factor in the learning process**

### ***Deep-level cognitive processing***

In the qualitative analysis, the primary cognitive factor was identified to answer the third research inquiry (see Table 6). Learning can be defined as a cognitive phenomenon involving the process of adapting one's behavior based on the patterns observed in the surrounding environment (De Houwer et al., 2013). This process entails the development of stable adjustments in stimulus-response relations through functional interaction with the environment via the senses (Lachman, 1997). In academic discourse, there is a strong correlation between learning and memory. Learning, being a cognitive process, encompasses the acquisition of skills and knowledge. In contrast, memory serves as the cognitive manifestation of the information and experiences that have been acquired (Kazdin, 2000). The levels of processing theory proposes

that the depth of processing contributes to the formation of more robust memory traces (Morris et al., 1977). Throughout the entire process of the executive journey in the project, students encounter difficulties in identifying the demand, interacting with individuals from different generations, applying theories, communicating with peers, and acquiring the necessary skills to carry out the project work, specifically in this case, the podcast. Based on the students' feedback, these challenges motivate them to delve deeper into their learning. A strategy for problem-solving involves conducting a means-ends analysis, whereby one addresses the obstacles that hinder progress from the initial problem state to the desired goal state. The adequacy of problem-solving as a pedagogical tool lies in the sufficient overlap between the cognitive processes involved in problem-solving and those required for learning. Additionally, traditional problem-solving, specifically through means-ends analysis, demands a significantly high level of cognitive processing capacity, which consequently hinders the acquisition of schemas (Sweller, 1988). Following are quotes from students.

S313: Traditional learning from lectures and textbooks can be easily forgotten if not applied in practice. Through this project, I have personally experienced this and have applied it to a real client, thereby gaining a deeper understanding. The implications of this will become evident in the near future. Moreover, it is worth noting that the retrieval of memory becomes more efficient in this context.

S322: Comparing the acquisition of knowledge through the act of listening to a story and the active engagement in the process of behavior modification, it can be argued that the latter facilitates a more authentic learning experience due to its direct application.

S203: I am unable to recall the instance that the instructor conveyed during the lecture. Nevertheless, we were able to retain the events that

transpired in that particular situation and how I employed the theoretical knowledge to offer a resolution for this client. After all, I always think about this in the executive time frame.

From this qualitative analysis, the third research question was addressed, elucidating the process of cultivating sustainability competencies. This process originated from a project that aimed to address a specific problem, which in turn facilitated a more profound cognitive process within the social context. Furthermore, this approach facilitated the acquisition of sustainability competencies through the problem-oriented project and the teacher's scaffolding instruction in the situated learning environment.

## Discussion

### **Constraints and facilitators on the development of sustainability competencies**

This study sought to examine the development of sustainability competencies among students who are enrolled in an undergraduate psychology course that incorporates social practice. In light of the inquiry posed in research question one, the numerical results derived from the descriptive examination exposed that there was a growth observed in all eight factors that were identified in the UCAN model. The online course offered in 2022 and the in-person course in 2023 greatly improved communication, continuous learning, problem-solving, creativity, and technology application, as evidenced by the significant enhancement observed in the paired sample *t*-test results (see Tables 4 and 5). Notably, interpersonal skills were only significantly enhanced in the in-person course in 2023, in the results of the paired sample *t*-test (see Tables 4 and 5). Teamwork did not show any significant improvement in the results of the paired sample *t*-test conducted in both the years 2022 and 2023, as indicated in Tables

4 and 5. Based on the design of the project task, the features of the course, and the setting of the context, whether it is online or in-person, it presents a remarkable opportunity to compare and explore the investigation. Specifically, the insights gained from the students' interview feedback provide valuable observations on the research phenomena.

### ***Communication***

The importance of communication, which falls under the umbrella of 21st-century skill clusters, is greatly emphasized in the context of education and the workforce in our present society and economy. The learning skills encompass the domains of creativity and innovation, critical thinking and problem-solving, as well as communication and collaboration (Skills, 2007). The Organization for Economic Cooperation and Development (OECD) has stated in its report titled "Future of Education and Skills 2030" that the 21st century is distinguished by the interconnectedness between nations, which is facilitated by global communication. Moreover, workplaces have undergone significant changes, becoming more egalitarian, inclusive, adaptable, and transparent (OECD, 2019). As a prospective psychologist or counselor, the psychology student recognizes the significance of proficient communication skills in fostering trust with clients and comprehending their thoughts, emotions, and needs, thereby enabling them to offer professional solutions to assist individuals. In this investigation, the principal objective of the project assigned to the student is to examine the distinctive behavior exhibited by the client that has led to their success or to propose a solution for modifying a desired behavior. For individuals who are currently enrolled in college, engaging in effective communication with individuals who are over the age of 60 presents not only a challenge due to the generational gap but also requires adept utilization of appropriate terminology. Hence, no matter whether online or in-person course,



communication growth is significant.

### ***Continuous learning***

Continuous learning, often known as lifelong, and perpetual learning is the act of acquiring new abilities, understandings, and perspectives on an ongoing life journey. Its significance extends to the journey towards professionalism for all individuals. We reside in an uncertain future that has been influenced by advancements in technology, fluctuations in climate, and sudden occurrences of natural and humanitarian crises. The swiftness at which these changes occur necessitates ongoing endeavors to reshape the abilities we require, which is even more crucial in contemporary society (Pelster, 2017). In this environment, the key to survival and triumph for individuals lies in having an understanding of the circumstances, adaptability, and a commitment to continuous learning (Knowland & Thomas, 2014). In this particular study, the students were tasked with a project that immersed them in an authentic context. Their goal was to gain a deep understanding of a problem within a limited time span and propose a solution within a specific academic discipline. The students drew upon their prior knowledge and engaged in interactive discussions with real-life cases immediately. This process can be seen as a means of acquiring knowledge and skills necessary for functioning effectively in the world.

### ***Problem-solving***

The act of problem-solving empowers us to effectively address difficult or unforeseen circumstances, thereby conquering the obstacle and exerting influence over coming events. Both individuals and organizations rely heavily on problem-solving skills and the problem-solving process in their day-to-day lives. This process encompasses the techniques we employ to comprehend the current state of our surroundings, identify areas in need of modification, and subsequently determine the necessary actions to achieve the desired result

(Davidson et al., 1994; Davidson & Sternberg, 1998). There exist various categories of problems, comprising well-defined problems that possess concrete objectives and projected resolutions as well as ill-defined problems that lack explicit solutions (Helmold & Helmold, 2021). In the present study, the development of problem-solving skills was derived from the utilization of project objectives, wherein theoretical knowledge was employed to analyze and execute a podcast product aimed at elucidating the process of behavior modification in an authentic manner. The complex nature of the subject matter was further compounded by the unpredictable responses from clients and individuals with diverse backgrounds. Conversely, the disparities in generational perspectives compelled younger students to refine their communication practices. This was particularly evident in the online course of the year 2022, where both application and communication posed greater challenges, as evidenced by the notable significance observed in the paired sample *t*-test results.

### ***Creativity***

Creativity enables the generation of novel and innovative solutions to complex and systemic sustainability problems, like environmental and social issues. Creativity facilitates the ability to think beyond traditional linear models, embracing ambiguity and systemic thinking for radical breakthroughs. It plays a crucial role in problem-solving to allow a more comprehensive understanding, framing of problems, and feasible resolutions (Mitchell & Walinga, 2017). The current study involves a qualitative interview that uncovers the development of creativity through group brainstorming in order to address challenges in a social practice group project. Furthermore, creativity enables students to approach and resolve problems in a more open and innovative manner. The sub-theme of flexibility, which falls under the category of creativity, was observed to

demonstrate the manifestation of innovative resolutions and instigate a profound level of self-awareness regarding the acquisition of ability subsequent to the completion of the course.

### *Teamwork*

Teamwork, at a higher echelon, among team members encompasses the mechanism by which task objectives are attained. Teamwork refers to the endeavors by which team contributions are transformed into team consequences, such as team effectiveness and contentment (Driskell et al., 2018). The acquisition of teamwork abilities holds significant importance within professional environments, thereby prompting organizations to frequently appraise these aptitudes as part of performance evaluations. Project-based learning (PBL) is widely acknowledged for its capacity to cultivate students' proficiency in collaborative engagement (Bakare et al., 2020). However, in the present study, the teamwork in both the years 2022 and 2023 did not exhibit significant improvement. First, the outcomes were influenced by the feature of project work, the podcast, which is usually achieved sequentially. The process involved distinct stages, with each stage's content being entirely distinct. Although students may provide mutual assistance when team members encounter questions regarding their assignments, this assistance does not significantly impact the overall project outcome. Second, students were sovereign in establishing their respective groups. The majority of these groups were composed of individuals who were already acquainted with one another, had considerable cooperative experiences, and had implicit comprehension. Last, the project completion timeline was constrained to six weeks, and each team member's assignment was almost based on their proficiency rather than their desire to supplement a particular area. Although the facilitation of teamwork was absent in the execution of the project, the students acknowledged the

significance of teamwork and conceded that it is a determining factor impacting both the project's quality and the learning process. Due to the distinct assignment, the team permeated with observational learning.

From this investigation, the growth of sustainability competencies emerged as a result of an interactive process involving four key components: the social context, the scaffolding instruction, the establishment of appropriate project goals, and deep-level cognitive processing of students. This dynamic interaction potentially influences the outcomes of diverse sustainability competencies growth. Moving further, structuring the learning environment to accelerate sustainability competencies is the main topic that merits efforts from educators.

## **Building positive learning environment to facilitate sustainability competencies**

### ***Situated learning***

A situated learning approach allows for a deeper understanding and application of knowledge. It offers a more hands-on and engaging educational experience, as it enables students to gain practical skills and implement theoretical knowledge in real-life situations. There were four sub-themes called learning in community, application of theory to practical scenarios, challenge in the real world, and achievement motivation under this theme of situated learning in this study (see Table 6). Before engaging the local community in mutual learning activities, it is critical to have a consensus on the learning objective and target issue intended to be fixed. It means people from the local community are well aware of the main purpose of pursuit. It narrows the problem that relates to the main objective and eliminates the barriers that are not related to the discipline or issue set to result at all. Any experience of solving problems could lift students' abilities, but it must keep track of learning objectives. From this

approach, students could verify the validity of a theory through practical application that aligns with the local content and then derive a resolution, as mentioned in the second sub-theme of this study. However, the expected resolution to the problem that students will face will be challenging and achievable. Otherwise, it may frustrate students or lead to a give-up situation. The majority of the students were driven by the result and motivated by the appreciation expressed by the local community. The course design shall include an official interaction session to allow students and people involved in community activities to share opinions and recognition with each other when the project is done.

### ***Problem-oriented project***

A well-designed, problem-oriented project offers students the opportunity to build up their sustainability competencies. There were four sub-themes revealed in this theme: a tangible solution to real issues, collaborative endeavors within groups, an independent mode of acquiring knowledge or skills, and intrinsic achievement. These sub-themes are essential for problem-oriented project design. A resolution that targets addressing a genuine problem shall be measured and implemented. It is important to set up at the initiate stage. A tangible resolution serves as a baseline for students to work with. Collaboration in a small project group could provide students with a proactive opportunity to learn from each other. However, occasionally, if team members have not worked on a group project before or do not know each other before, it takes extra time to adjust or accommodate communication. Since addressing the real-world problem involves interdisciplinary and different skills, a flexible learning schedule and a diverse way of presenting the resolution shall be allowed. Behind this process, self-learning is driven. The process concludes with a sense of personal achievement as one overcomes the challenge,

experiences professional growth through the application, and finds pleasure and fulfillment in the completion of the project.

### ***Scaffolding Instruction***

In order to successfully incorporate scaffolding into instruction, the educator must engage the students' existing knowledge and establish an environment that fosters learning. As students grow more skilled, the teacher gradually lessens their guidance and assistance. The support provided can encompass various aspects, such as subject matter, procedures, and approaches to learning. There are four sub-themes discovered in the themes of scaffolding instruction: attainable and challenging goals, support promptly and with professionalism, official evaluation to demonstrate the acquisition of knowledge, and instructor personality traits. In a project that aligns with sustainable issues, the instructor shall scope a realistic goal that could be achieved within a certain time frame. Students explore the desired result based on the given knowledge and skills. The assistance and response to students in their pursuit in a prompt and mature manner guide and motivate students moving forward. A scaffolding includes the formal assessment with well-defined evaluation criteria as well as the opportunity to showcase the outcome in a public setting. Students reported that most of the knowledge they could research on their own from different resources and media; however, the personnel experience or real-world application that the instructor had was the key factor driving their focus on learning in class. Particularly for instructors with positive personality traits such as patience, joy, and interaction, it will make the whole learning journey enjoyable.

### ***Deep-level cognitive processing***

According to Bloom's taxonomy, the acquisition of knowledge encompasses six cognitive skill categories. These categories span from skills

that necessitate minimal cognitive processing to skills that demand more profound learning and a higher level of cognitive processing (Adams, 2015). Knowledge and abilities are applied to a wider range of tasks and circumstances through deep-level cognitive processing. In a problem-oriented project that addresses a sustainable issue with a resolution, mature comprehension involves the intricate mental manipulation of information, including exploring possibilities, organizing concepts, and deep analysis. The key design is to drive the resolution to fix the complex issue through understanding the theory, applying it to practice, analyzing the context and possible solutions, evaluating the implementation, and transferring personnel experience as competencies for further challenge. When formulating the deep-level cognitive process, the instructor shall monitor that the driving force is at an affordable level. Then, the learning will be accomplished.

## **Limitations and Future Directions**

The findings derived from this investigation are subject to certain restrictions. Firstly, we did not incorporate a control or comparative group within the framework of this study in order to ascertain whether there were any discernible disparities in the growth of students' sustainable competencies between those who participated in a social practice project and those who did not. Secondly, the subjects were not randomly assigned. The individuals who enrolled in this advanced practical course may have possessed a high level of motivation toward this particular topic. Consequently, the results may only be applicable to highly motivated students and social practice courses. Thirdly, most students in this study are psychology major.

The application of experimental research methodologies is constrained by the nature of educational settings. The internal validity of current findings is under threat. However, the application of current findings in various fields has

the potential to enhance the extension of the external validity of research results. In order to produce more robust conclusions, future research endeavors should take into consideration the utilization of a more diverse sample and include students from other academic areas to determine the effects and provide more definitive guidance. Future study could potentially analyze the methods for constructing suitable project objectives, establishing connections with learning objectives, choosing real-world case studies, and developing scaffolding techniques to facilitate a deeper cognitive process.

## **Conclusion**

Competencies pertaining to sustainability encompass a wide range of knowledge, skills, and attitudes that facilitate the effective execution of tasks and the resolution of problems associated with real-world sustainability issues, obstacles, and prospects. Currently, the entire membership of the educational community plays a crucial role in fostering the development of key competencies pertaining to the sustainability of students. This endeavor not only enhances the quality of our existence but also safeguards our ecosystem and conserves natural resources for the benefit of future generations. Within the corporate realm, this concept is intrinsically linked to an organization's comprehensive approach. In one's personal life, it is related to an individual's resilience and ability to adapt.

In the current investigation, it has been suggested that carefully crafted instruction and problem-oriented project have the potential to foster the advancement of communication, continuous learning, interpersonal skills, problem-solving, creativity, and technology application. Within the realm of higher education, an authentic setting provides a chance for students to acquire the essential skills and competencies through the utilization of scaffolding instruction to support a problem-oriented project. This research elucidated the



driving factors of deep-level cognitive processing that contribute to the development of competencies.

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# 結合問題導向專案之社會實踐課程對於 大學生發展永續共通職能之研究

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## 摘要

本研究探討在社會實踐課程中，採用問題導向學習歷程對大學生發展永續共通職能的影響。研究者檢驗教師在課程中，採用情境式學習、鷹架教學與問題導向的專案實施對學生職能的影響。本研究採質量混合研究方法，量化研究部分，透過共通職能診斷的前後測配對比較，檢驗職能的改變；質化研究部分，透過立意抽樣，訪談學生感知的學習歷程與成效。研究對象來自臺北一所私立大學心理學系修習「行為改變技術」課程的學生，包括 85 名完成前後測量的學生與 23 名接受半結構訪談的學生。共通職能量化檢驗揭示學生在「溝通表達」、「持續學習」、「問題解決」、「創新」、和「資訊技術應用」等職能上有的顯著成長，然而在「人際互動」、「團隊合作」和「工作責任及紀律」並無顯著成長；質化主題內容分析揭示了四個發生在學習歷程中的核心主題（1）情境式學習，（2）鷹架式教學，（3）問題導向專題，和（4）深層次的認知處理。本研究顯示，社會實踐課程可藉由合宜的鷹架教學、問題導向的專案設計與社會情境學習的設置，提升學生永續共通職能的成長。

**關鍵詞：**深層次的認知處理、問題導向專題、鷹架式教學、情境式學習、永續共通職能

