Journal of Information Technology Education: Research

An Official Publication of the Informing Science Institute
InformingScience.org

JITEResearch.org

Volume 22, 2023

LET'S GET READY FOR WORK – EMPLOYABILITY SKILLS DEVELOPMENT IN AN IS CAPSTONE PROJECT

Ruti Gafni*	The Academic College of Tel Aviv Yaffo, Tel Aviv, Israel	rutigafn@mta.ac.il
Moshe Leiba	The Academic College of Tel Aviv Yaffo, Tel Aviv, Israel	mosheli@mta.ac.il
Sofia Sherman	The Academic College of Tel Aviv Yaffo, Tel Aviv, Israel	sofiash@mta.ac.il

* Corresponding author -
[Note: Authorship order is alphabetical - all authors contributed roughly equally to the research.]

ABSTRACT

Aim/Purpose	This study aims to explore undergraduate IS students' employability skills development while performing their final capstone project during their academic studies.
Background	The importance of soft skills in the Information Systems industry is not an arguable fact and has been broadly discussed both in the industry and the academic literature. The ability of professionals to collaborate, communicate, manage time, negotiate, solve problems, make decisions, and self-learning, called employability skills, are essential skills needed in today's industry. The development of these skills during undergraduate studies is essential for graduate students' readiness for work.
Methodology	A mixed methods approach was employed using exploratory research design, including qualitative and quantitative approaches. First, a qualitative analysis of 156 reflections was performed, resulting in the conceptual framework of facets. Then, a quantitative analysis of the data was performed to examine the facets and the differences between the stages of the capstone project.
Contribution	This study contributes to both academy and industry. The former may use this study's findings to upgrade academy courses and capstone projects in order to raise students' readiness for the industry. The later may learn the approaches the academy use and give appropriate feedback.

Accepted by Editor Kathryn MacCallum | Received: March 12, 2023 | Revised: April 15, May 2, 2023 | Accepted: June 8, 2023.
Cite as: Gafni, R., Leiba, M., & Sherman, S. (2023). Let's get ready for work – Employability skills development in an IS capstone project. *Journal of Information Technology Education: Research, 22,* 235-261.
https://doi.org/10.28945/5157

Findings	The results showed that students' reflections on their motivation, knowledge, and skills (teamwork, time management, and inter-communication) demonstrate the importance of those facets in the process they underwent, especially since the reflections collected were unstructured.
Recommendations for Practitioners	Information Systems undergraduate academic programs should develop structured capstone projects to provide the students with a better platform to learn and experience the employability skills the industry requires.
Recommendations for Researchers	The study presents a conceptual model based on students' reflections on their experience performing a capstone project. The impact and influence of each of the model's components should be further researched and measured.
Impact on Society	Moreover, it is very important to prepare the students for employability by including a "real-life" capstone project at the end of their undergraduate studies to prepare them to be valuable in the workforce, even at their start point as juniors.
Future Research	To evaluate the process of employability skills development, a further study can examine students' perceptions prior to the capstone, during, and after to assess the progress and changes. To generalize the results, it would be valuable to investigate whether the findings of this study are consistent across different institutions and disciplines

Keywords	employability skills, capstone projects, soft skills, motivation, information systems studies, student reflections

INTRODUCTION

The importance of soft skills in the Information Systems (IS) industry is no longer an arguable fact and has been broadly discussed both in the industry and the academic literature (Adelakun-Adeyemo, 2021; Jiracheewewong, 2022; St. Louis et al., 2021). The ability of professionals to collaborate, communicate, manage time, negotiate, solve problems, make decisions, and so forth, are sometimes more essential skills than knowledge of new technologies (Acuna et al., 2006; Garousi et al., 2020; Matturro et al., 2019). Soft skills contribute significantly to individual learning, team performance, client relations, and awareness of the business context (Stevens & Norman, 2016). Some employees find soft skills as a more important asset to the first industry position than technical skills (Jones et al., 2018). The list of soft skills defining the human aspects of IS professionals varies and is not fully defined. Following the Matturro et al. (2019) mapping study, the most referred soft skills in the academic literature are communication skills and teamwork skills.

While experienced IS professionals acquire those skills in the field, fresh graduates usually do not have field experience, and there is a gap between the skills learned in undergraduate education and those needed in the industry (Garousi et al., 2020). Nowadays, there is no doubt about the importance of soft skills. However, the academy is still struggling to bring them to undergraduate classes. Some studies raise doubts regarding the ability to train soft skills in the workplace (Stevens & Norman, 2016) and raise the need to develop those skills during undergraduate studies (Aasheim et al., 2009; Jiracheewewong, 2022; St. Louis et al., 2021).

The School of Information Systems at The Academic College of Tel Aviv Yaffo, Israel, prepares highly skilled professionals to address a permanently growing demand of the high-tech industry. The IS School graduates are equipped with a multidisciplinary background combining both technological and management disciplines required to develop and deploy the most advanced information systems and technologies. The studies combine theoretical and practical courses, which are led by industry-

accomplished faculty. The aim is to provide a unique environment for applying the acquired knowledge, skills needed in the work field, and practical experience in real-world projects already during the studies.

Students, before graduating, need to participate in two practical work courses constituting the stages of the capstone project of their studies: (1) *Empirical research seminar*, (2) *Analysis and design of a real information system*. To successfully accomplish the capstone project, students must integrate all the knowledge they gained in courses learned in prior years and study some issues by themselves, according to the subject of their project, which is chosen by the students. The requirements for the capstone projects are precisely defined, the processes held in these courses are standard, and all the faculty and mentors act the same way, therefore, preventing possible difficulties as described by previous research (Din et al., 2010; Villamañe et al., 2014). Each stage is managed by two faculty members, who explain the way the course is conducted, teach how to prepare different parts of the project, and monitor during the semester the progression of the teams. Each stage of the capstone project is performed by self-organized teams of three students during one semester. The stages have a Learning Management System (LMS) in which all the materials and explanations needed for performing the project are stored: a precise schedule of the course, the roadmap of the process, forums for questions and answers, and where they submit each deliverable. The structured nature of the capstone project, from the very beginning, prevents students' disappointment (Din et al., 2010).

Despite its significance, few studies have explored students' reflections and the development of soft skills during their final project (e.g., Devi & Abraham, 2020). Thus, this study aims to explore undergraduate IS students' soft skills development through their final project reflections using a case study approach.

The remaining parts of this paper are structured as follows. First, the review of relevant literature is presented in the Theoretical Framework section, followed by the research question. Second, an explanation of the case study on which this research is based is presented. Third, the methodology used is detailed. Fourth, the results of the study, including the facet conceptual framework, are exposed, followed by a discussion and conclusions.

THEORETICAL FRAMEWORK

The capstone project is a critical component of the undergraduate degree program in information systems. This project provides students with an opportunity to apply the knowledge, skills, and techniques acquired throughout their coursework to solve real-world problems. It is an essential learning experience that enables students to demonstrate their proficiency in information systems and their ability to use technology to solve complex problems. The capstone project is one of the ways to develop employability skills using the project-based learning (PBL) methodology.

EMPLOYABILITY SKILLS

Employability is a set of skills that refers to the qualities that make a graduate very suitable for employment (Jiracheewewong, 2022). Employers increasingly look for soft skills in employees which, along with strong technical and subject knowledge, can help their organization continue to develop and prosper. Soft skills refer to all competencies that are not directly related to a specific task but to a broad range of personal and interpersonal skills that are essential for effective communication, collaboration, and problem-solving in the workplace (Cimatti, 2016). Graduates with low employability skills are at risk of not finding work, stagnating in their careers, or losing their jobs to newcomers with high employability skills (Jiracheewewong, 2022). Therefore, academia struggles to find a way to bring those skills to the classes. Two types of courses teaching human aspects are identified:

(a) A primary course – a course whose main goal is to raise awareness of these aspects by defining, simulating, and discussing a model. For example, Hadar et al. (2008) developed a course called *Human Aspects of Software Engineering* where they aimed to teach collaborative software

development. For this aim, they used simulations of collaborative software development assignments in which students actively practiced collaboration, followed by reflections in which students analyzed different aspects of their own experience, and ended with group discussion. Kilamo et al. (2012) used a reputation system to support the social aspect of the environment and thus support the learners' collaboration with each other.

(b) A secondary course – a course whose primary goal is to teach technical aspects of the field and the soft aspects are raised as a side effect and discussed by instructors. For example, Weicker (2020) proposes a teaching concept to support students in developing the ability to cooperative problem-solving using a combination of cooperative learning groups in the course of algorithms and data structures. Raibulet and Fontana (2018) described a software engineering course where students developed a software project while simulating collaboration and teamwork activities.

Teamwork

Teamwork is considered one of the essential soft skills required by the industry (Cimatti, 2016). Academia fosters collaboration and teamwork and emphasizes its benefits. For example, Keller et al. (2011) conducted a qualitative study aimed at investigating whether information systems students undertaking a team-based capstone had enhanced their employability skills. This study reports on improvements in the ability to work collaboratively in teams (Keller et al., 2011). Sherman et al. (2022) reported on a study aimed to explore the specific characteristics of students' teamwork in a practical course delivered in an industrial setting. In this qualitative study, students reported on communication, coordination, and member contributions balance as the main factors of project success. Those factors are part of the Teamwork Quality (TWQ) model proposed by Hoegl and Gemuenden (2001). This model aims to capture the collaboration within the teams and is constructed from six facets: communication, coordination, member contributions balance, mutual support, effort, and cohesion. The authors show that the model links between the project's success as measured by team performance (effectiveness and efficiency) and team members' personal success (satisfaction and learning). This model was further used while qualitatively studying students' reflections (Hoegl & Gemuenden, 2001).

Time managing – Planning and Organizing

Time management is an essential employability skill that enables individuals to achieve their goals and be successful in their careers. Time management skills refer to the ability to prioritize, plan, and organize one's time effectively to achieve specific goals and can be identified as clusters of behavioral skills that are important in the organization of study and course load (Lay & Schouwenburg, 1993). Cottrell (2019) argues that in today's fast-paced working environment, individuals who possess effective time management skills are better equipped to cope with the demands of their jobs, stay on top of their tasks, and accomplish their objectives in a timely and efficient manner. Any lack of these skills makes a graduate a poor job candidate and a worse employee (Osmani et al., 2019). During capstone projects, students must plan their work and manage themselves throughout the semester towards completing their work on time and with quality results (Auvinen et al., 2020). Because self-management is so interdependent with employability skills such as teamwork and inter-communication, most students performing capstone projects did not explicitly report improvements in this area (Keller et al., 2011). However, efficient time management focused on the required course deliverables, as well as group cohesion, resulted in the most significant outcomes (Ball et al., 2020).

Inter-Communication

Inter-communication is communication with project stakeholders who are not part of the project team. The inter-communication is a necessary skill for dealing with coworkers and communicating with clients and other stakeholders at work and elsewhere (Idkhan et al., 2021; Kleckner & Butz,

2022). Students collaborate closely with their assigned supervisors, who guide them on a learning path throughout their project work (Adelakun-Adeyemo, 2021). The team mentor in project-based learning plays a significant role in the quality of the overall outcome (Adelakun-Adeyemo, 2021), facilitates collaboration within the team (Sherman et al., 2022), and mentors students to develop professional and soft skills (Bastarrica et al., 2017; Nghia, 2019).

Knowledge

Capstone projects provide an opportunity for undergraduate IS students to showcase their knowledge and skills in a real-world setting. In their capstone projects, students must integrate their prior knowledge, new knowledge, and skills to develop a solution to a complex problem. Knowledge can be conceptualized as comprising three facets: prior knowledge, new knowledge, and knowledge integration.

Prior knowledge refers to the knowledge that students bring with them to the capstone project. This knowledge can come from previous coursework, work experience, or other sources. As shown by Greene et al. (2008), high prior knowledge students could demonstrate more self-reflective and monitoring behaviors than lower prior knowledge students. Additionally, Bernacki et al. (2012) indicated that students with high prior knowledge could usually use a more active learning approach while those with low prior knowledge passively followed the instructions. Sung et al. (2016) found that prior knowledge was a key factor in students' learning performance.

New knowledge refers to the knowledge that students acquire during the capstone project. This knowledge can come from a variety of sources, including research, collaboration with peers, and feedback from instructors. New knowledge is a critical aspect of capstone projects. Holdsworth et al. (2009) noted that capstone projects provided an opportunity for students to develop new knowledge and skills that they could apply in their future careers.

Knowledge integration refers to the process by which students combine their prior knowledge and new knowledge to create a comprehensive understanding of the topic. According to Steiger (2009), knowledge integration is a crucial aspect of capstone projects, and such knowledge integration is critical to graduating IS students since they will be expected to apply their specialized knowledge to a wide variety of business problems. Similarly, Mehta and Mehta (2018) indicated that both learning and performance-prove goal orientations positively influenced team knowledge integration, and knowledge integration impacted both objective and subjective dimensions of team effectiveness.

Project-Based Learning (PBL)

Project-Based Learning (PBL) is a student-centered teaching methodology that is increasingly being adopted in higher education as it has been found to develop and enhance students' engagement, critical thinking skills, problem-solving skills, and team collaboration skills (e.g., Krajcik & Shin, 2014). The approach involves students working on real-world problems that require them to apply their knowledge and skills to find solutions as a basis for learning (Hmelo-Silver et al., 2007). PBL fosters active learning, which was found to increase students' engagement and academic achievement in STEM-related courses (e.g., Aji & Khan, 2019; Ralph, 2016).

Guo et al. (2020) conducted a meta-analysis of 76 studies on PBL in undergraduate education. The authors found that learners' knowledge, strategies, and skills were frequently measured. These learning outcomes received much attention due to employers' reports that basic knowledge and skills are essential for students' readiness to work. Several studies have shown that PBL is an effective teaching methodology for information systems education and has been used to enhance student learning outcomes in various courses, including research, analysis, and design of information systems. Kardoyo et al. (2019) used PBL to teach management information systems courses to graduate students. The study found that PBL improved students' ability to apply project management concepts and tools in real-world situations, leading to better critical and creative thinking skills.

As part of a research seminar leading to the analysis and design of information systems, students are required to tackle a new concept, use prior knowledge, acquire new one, and integrate both while approaching different perspectives (Steiger, 2009). Zen and Ariani (2022) investigated the impact of PBL on the development of information literacy skills in undergraduate students. The authors found that PBL was an effective method for developing students' information literacy skills, including the ability to locate, evaluate, and use information effectively.

PBL has been found to foster the development of key skills that are highly valued by employers, such as teamwork, communication, and project management (e.g., St. Louis et al., 2021). PBL enhances student engagement by providing students with opportunities to work on real-world contexts and problems to learn from (Jurdak, 2016) and is relevant to their future careers (LaForce et al., 2017). Woodward et al. (2010) found that PBL was successful in teaching information systems management by providing students with opportunities to practice these skills in a real-world context. This approach allows students to see the practical application of what they are learning, leading to higher motivation and engagement.

In the context of information systems, students often work in teams to solve complex problems, and PBL provides an excellent opportunity for students to develop teamwork and collaboration skills. This approach prepares students for the collaborative nature of the workplace, where teamwork is essential for project success (Rajabzadeh, et al., 2022).

PBL promotes and enhances students' problem-solving skills and encourages them to think critically about the material (Loyens et al., 2023). According to Bell and Kozlowski (2008), PBL requires students to use higher-order thinking skills, including analysis, synthesis, and evaluation. These skills are essential in the research, analysis, and design of information systems, where students need to analyze complex problems and develop innovative solutions. PBL has also been found to improve student engagement and motivation. In a study by Hwang and Kim (2006), students who participated in a PBL course reported higher levels of engagement and motivation compared to those who participated in a traditional lecture-based course. This is likely because PBL allows students to take ownership of their learning and work collaboratively with their peers.$

In information systems settings, Hussein (2021) conducted a study to explore the effectiveness of PBL in teaching information systems to undergraduate students. The author found that PBL was an effective method for teaching information systems concepts and skills, as it helped students to develop problem-solving, critical thinking, and teamwork skills. The study also found that PBL increased students' motivation and engagement in the learning process. In another research by Naqvi et al. (2019), it was found that PBL significantly improved students' academic performance, and students who participated in PBL reported higher levels of satisfaction with the course. The study also found that PBL helped to develop students' communication, collaboration, and leadership skills.

While PBL has many benefits, there are also challenges associated with its implementation. One of the biggest challenges is the amount of time and resources required to design and implement effective PBL activities (Aldabbus, 2018). In addition, some instructors may lack experience or training in PBL, which can make it difficult for them to effectively design and facilitate PBL activities (Albanese & Mitchell, 1993). Another challenge is the difficulty in assessing students' learning in PBL. PBL activities are often complex and multifaceted, which can make it challenging to evaluate students' learning outcomes (Guo et al., 2020). Additionally, students may have different roles and responsibilities within a PBL group, which can make it difficult to assess individual student learning (Boss, 2012). One way to assess the effectiveness of PBL is to use qualitative tools that can capture students' reflections and experiences.

Students' Reflections

Reflection is a process of thinking deeply about one's experiences, analyzing them, and making connections to prior knowledge. Reflective practices can be defined as "the process of internally examining and exploring an issue of concern, triggered by an experience, which creates and clarifies meaning in terms of self, and which results in a changed conceptual perspective" (Boud et al., 2013, p. 19). In PBL, reflection is essential for students to make connections between theory and practice and to develop a deeper understanding of the learning outcomes (e.g., Kolb, 1984; Savery, 2015). Reflection also helps students to identify areas where they need to improve and to set goals for future learning.

Reflective practices can help students to identify their own learning needs and to develop their critical thinking skills (Schön, 1984), to make connections between theory and practice, develop their problem-solving skills, and reflect on their own learning process (Hmelo-Silver et al., 2007; Savery & Duffy, 1995). Saltiel (2009) noted that "Reflective practice engages with the messiness, the unpredictability, the uncertainty of practice, focusing not on abstract theory but on the real experiences of practitioners and the skills they develop as they try to make sense of those experiences. It emphasizes the expertise – the skill and artistry."

Reflective practices have been used to support the development of students' communication skills (Karnieli-Miller, 2020), teamwork skills (Rania et al., 2021), and critical thinking skills (Mills et al., 2006). Reflective practices have been suggested as a way to support the development of students' problem-solving skills in the context of PBL (Hmelo-Silver et al., 2007). Reflective practices have also been used to support the development of students' meta-cognitive skills, which involve the ability to monitor and regulate one's own learning process (Savery & Duffy, 1995). Reflective practices can take many forms, including journaling, group discussions, and individual reflections (Boud et al., 2013). A reflection is a valuable tool for assessing student knowledge, skills, and motivation, as it allows educators to gain insight into the students' learning process, their understanding of the subject matter, and their experiences of the learning environment (Schön, 1984). Student reflections are a valuable qualitative research tool that can provide rich insights into students' learning experiences and outcomes in information. Specifically, student reflections can be used to explore the following areas:

1. Perceptions of technology: student reflections can reveal students' perceptions of technology, including their attitudes towards specific technologies, their experiences using them, and their perceived benefits and challenges. For example, in a study by Gallegos et al. (2017), student reflections were used to explore their experiences using a gamified learning platform, revealing their positive attitudes toward the platform's interactive features and the benefits of gamification for learning.
2. Learning outcomes: student reflections can provide insights into the effectiveness of teaching methods and strategies, as well as the impact of learning activities on students' knowledge, skills, and attitudes. For example, in a study by Jaeger-Helton et al. (2019), student reflections were used to evaluate the effectiveness of a collaborative project-based learning approach in developing students' teamwork, communication, and skills. Student's reflections focused on specific technical skills, along with project management; when asked what they learned about themselves, they mentioned communication, teamwork, and personal development skills such as time management, perseverance, and tolerance for ambiguity.
3. Personal development: student reflections can also reveal students' personal growth and development, including their self-awareness, values, and goals. For example, in a study by Tiernan (2021), student reflections were used to explore their perceptions of their own digital literacy skills.

Unstructured student reflections refer to a process in which students are given the freedom to reflect on their learning experiences in an open-ended manner without any specific prompts or guidelines (Moon, 2013). Several studies have explored the use of unstructured student reflection as a research tool for assessing student learning. For example, Minott (2008) examined the use of unstructured written reflections and found that unstructured reflections provided valuable insight into student thinking, as students were able to express their ideas and beliefs in a non-judgmental environment. The use of unstructured reflections is also useful for assessing student motivation and engagement, as students can express their feelings about their learning experiences (Wurdinger & Carlson, 2009). Denton (2018), who incorporated unstructured written reflections into an introductory statistics course, pointed out a major challenge in this method, for researchers and students alike. Some students may find the writing process to be particularly burdensome.

RESEARCH QUESTION

This study explores undergraduate IS students' soft skills development while performing their final capstone project during their academic studies. One overarching research question guided this study:

> **RQ**: What are the facets that the capstone project exposed the IS students to, according to their reflections?

THE CASE STUDY

The capstone project is an integral component of undergraduate education in The Information Systems (IS) School at The Academic College of Tel Aviv Yaffo, Israel. The capstone allows students to apply theoretical knowledge to practical problem-solving in two parts: (1) *Empirical research seminar*, and (2) *Analysis and design of a real information system*. The students need to demonstrate the integration of all the knowledge they gained in courses learned in prior years and study some issues by themselves, according to the subject of their project.

The *empirical research seminar* consists of a "mini-thesis". The learning process begins by choosing a topic, which the students are curious about, and is relevant to the field of information systems or cybersecurity, according to the specialty they study. They formulate research questions, define the research process, collect data, and analyze the results, according to the principles of the scientific approach.

The *analysis and design of a real information system*, which the students choose, include learning the current situation of the system/processes, determining the goals, objectives, and scope of the new system, identification of stakeholders and gathering user requirements, defining the new processes, data, and technology to be used, and finally, preparing a mock-up of the new system.

There are five meetings during the semester for all the students participating in each course, arranged by the academic teachers, thus, supporting the students and avoiding students' feelings as 'under-supported, stressed, or isolated' during the process (Villamañe et al., 2014). The process carried out in the courses has several steps:

1. The first meeting, in which the students learn about the essence of the capstone project and the proposals they must write.
2. The project subject and scope are proposed by the students according to their interests. After the first meeting, each team meets with the academic teacher to discuss the project proposal, redefine it if needed, and is finally approved by the teacher.
3. For each team whose proposal was approved, a professional mentor, from industry or academy, is assigned to guide them during the semester. This mentor is selected according to the subject matter of the project to ensure relevance. The work must be done autonomously by the students.

4. In the second meeting, the students learn how to write the work plan for the project. This plan includes the definition of the tasks to be performed, a Gantt, including the distribution of work between the teammates, and risk analysis, with a plan to mitigate the risks. The work plan of each team is approved by their mentor prior to starting the work.
5. Before the third meeting, the students need to handle a status review. During the meeting, different aspects, according to the progress of the works, are explained.
6. Before the fourth meeting, the students need to handle a second report on their progress status. In this meeting, the students learn how to handle the written report and all outcomes of the project and how to prepare the oral presentation, which will be accompanied by a poster they design.
7. At the end of the semester, the students submit all their outcomes to the mentors and academic teachers. The mentors evaluate the outcomes and the teams' process during the semester according to a standard indicator. This report is given to the academic teachers who grade the work.
8. Finally, the students present their work to the academic teachers, mentors, faculty, guests, and other students, in a festive ending event, where the Top-10 projects are nominated (Kar et al., 2013).

After completing the work, and before the presentations and grading, they must handle a written personal reflection. Bastarrica et al. (2017), according to their research, claim that the perceived relative value of the technical challenge drops by the end of the capstone, and students are already technically prepared and able to face real-world projects, and they acknowledge that soft skills are also determinant for the success of the projects. Therefore, in this study, the students were asked to reflect after finishing the capstone. The students had no guidance or format to write the reflections. Each student could write whatever he or she wanted or felt. The students knew that the reflections were not part of the grading.

RESEARCH METHODOLOGY

A singular case study (Thomas, 2011) was conducted to examine the IS students' development of skills and to gain a better understanding of students' perceptions and attitudes during their final project. This methodology, according to Stake (1995), is a "study of the particularity and complexity of a single case, coming to understand its activity within important circumstances" (p. xi). The characteristics of a case study are Holistic (considering the interrelationship between the phenomenon and its contexts); Empirical (basing the study on their observations in the field); Interpretive (resting upon their intuition and seeing research basically as a researcher-subject interaction); and Emphatic (reflecting the vicarious experiences of the subjects in an emic perspective) (Yazan, 2015).

Due to the exploratory nature of this research, a mixed methods approach was employed (Venkatesh et al., 2016) using qualitative and quantitative approaches methods. The process of the data analysis is graphically displayed in Figure 1.

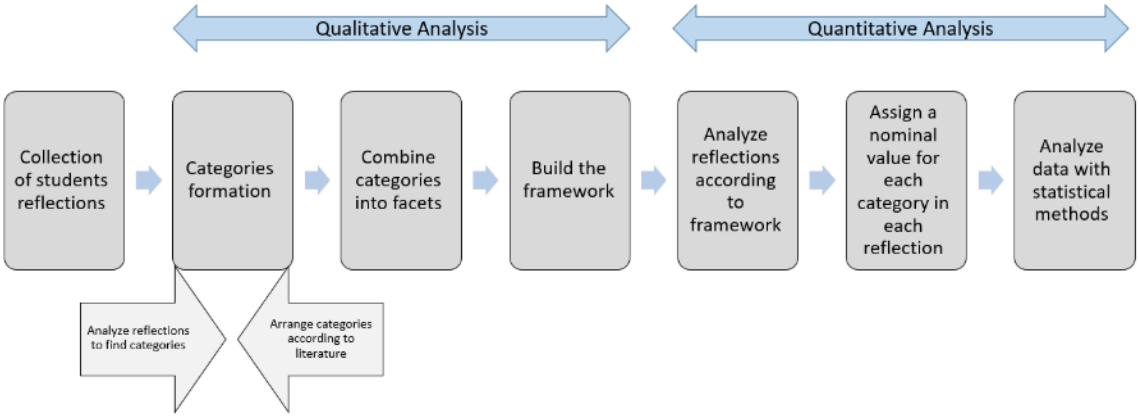

Figure 1. Graphical description of the process conducted

Qualitative data analysis

The study's data was collected from unstructured students' reflections. Unstructured students' reflections refer to a process in which students are encouraged to explore and express their thoughts, feelings, and experiences related to a learning activity or an event without any specific guidance or structure. According to Henderson et al. (2017), an unstructured reflection involves "a process of critical self-awareness in which the learner seeks to develop a deeper understanding of his or her own experiences, attitudes, and beliefs, often through open-ended and unstructured dialogue with others or through reflective writing" (p. 1571).

A qualitative approach was applied to understand the phenomena via empirical observations of human behavior and experience (Bogdan & Biklen, 2007). The students' unstructured reflections were analyzed following the principles of grounded analysis (Strauss & Corbin, 1998). The data analysis was an iterative exploratory process of going back and forth between the empirical materials and literature, assessing and interpreting theoretical constructs with the analyzed data, and using Microsoft Word® and Excel® to code, categorize and identify themes in the empirical material. The data were categorized in terms of content, using categories derived from the analysis.

A framework was developed derived from the data itself that captures the analytically significant features of the data. Initially, the framework included a list of categories, which was organized according to higher-order code categories, accompanied by their definitions. The framework constitutes the analytic instrument with which the raw data was then reduced, classified, and synthesized (Gaskell, 2000). Each step of the categorizing method was done by one researcher and then was discussed with the other researchers until arriving at an agreement in a joint session (a consensus approach), changing their roles from step to step. This was done to maintain a continuous dialogue between researchers and consistency of the coding (Walther et al., 2008) and to establish inter-rater reliability (IRR) to ensure the trustworthiness of the study (Miles & Huberman, 1994). The conceptual framework proposed in this study does not include categories that were not substantive enough to be supported by sufficient quotes (e.g., the category "technical issues", which had only three quotes, was omitted). TWQ (Hoegl & Gemuenden, 2001) framework was utilized as a base for the conceptual framework for teamwork, which consists of six facets, including communication, coordination, member contributions balance, mutual support, effort, and cohesion. The qualitative analysis resulted in the construction of a conceptual framework with categories and facets.

Quantitative data analysis

The quantitative analysis involved a systematic process of coding and analyzing qualitative data. The coding scheme involved two bottom-up phases. (1) The data was first coded using the basic catego-

ries derived from the qualitative data analysis to code the occurrences of the categories in the reflection as positive, negative, or not found in the text. Each was assigned a nominal value of -1, 0, or 1 to the category to represent the negative sentiment (-1), absence sentiment (0), or positive sentiment (1) of the category. This process of coding categorical data with numerical values is a common technique used in the quantitative analysis of qualitative data to enable analyzing the data using statistical methods (Guest et al., 2012). This coding process was based on a grounded theory approach, which emphasizes the importance of allowing the data to speak for itself (Charmaz, 2014). (2) After the initial coding was complete, to create a more comprehensive analysis, the categories were combined into the facets found, by summing the categories related to the corresponding facet, thus creating variables that are considered ordinal. For instance, the facet "Knowledge" was created by combining three categories: prior knowledge, new knowledge, and integrating knowledge, each one of which was coded as a nominal variable (-1, 0, 1). The resulting ordinal variable for the facet was their sum, which ranged from -3 to 3, ranking the report of knowledge in the reflections. The new ordinal variable for the facet "Teamwork" was created by combining the five categories of the TWQ model (out of the original six), each one of which was coded as a nominal variable (-1, 0, 1). The resulting ordinal variable for the facet was their sum, which ranged from -5 to 5, ranking the report of teamwork in the reflections. This technique of combining related categories to create composite variables is widely used in qualitative research (Bryman, 2016). One study that highlights the use of nominal and ordinal variables in qualitative data analysis is by Buckingham Shum et al. (2016), who used a similar coding scheme to analyze the reflections of medical students. They found that using nominal and ordinal variables allowed for a more detailed and precise analysis of the data, which in turn led to a better understanding of the students' learning experiences.

Overall, the use of quantitative coding in the analysis of qualitative data allowed for a rigorous and systematic approach to identifying patterns and themes in the reflections. The combination of nominal and ordinal variables allowed for a more nuanced understanding of the data, and the use of grounded theory ensured that the analysis was firmly rooted in the data itself.

Case Description and Data Collection

Data was collected from 2nd and 3rd year IS students in a higher education institution, performing their final project. This study is based on an unstructured personal reflection given at the end of the capstone project (two stages: *Empirical research seminar* and *Analysis and design of a real information system*). The reflection was not graded as part of the final course's grade. The capstone project was performed between February 2022 and June 2022. The data was collected from four final project cohorts (seminar A, seminar B, seminar C, and Analysis and Design A) containing 156 reflections from 170 students in 57 teams (Table 1). The cohorts of seminars were in parallel and divided randomly.

Table 1. Study participants

Course Cohort	N Participants	N Reflections
Seminar A	38 students 13 teams	30 reflections
Seminar B	40 students 13 teams	39 reflections
Seminar C	48 students 16 teams	45 reflections
Analysis and design A	44 students 15 teams	42 reflections
Total	**170 students** **57 teams**	**156 reflections**

The quotes in this study are translations of the original excerpts, staying as close as possible to the original expressions and idiomatic nuances. To secure anonymity and confidentiality, the respondents have been anonymized.

RESULTS

Among the 170 students participating in the courses, 156 completed their unstructured reflections at the end of the capstone process and after submitting their final academic product. The qualitative findings of the mixed methods approach identified three main factors in the students' reflections: knowledge (prior knowledge, new knowledge, and knowledge integration), skills (teamwork, time management, and inter-communication), and motivation (personal, social, and constraint). According to this framework, three recurring themes were identified regarding knowledge, three recurring themes regarding skills, and three recurring themes regarding motivation. The facets conceptual framework based on all the categories and facets identified is presented below (Figure 2), followed, first, by a description of each facet and examples from students' reflections; and next, by the quantitative findings of the mixed methods approach based on the facets conceptual framework identified. The distribution of the facets conceptual framework was explored (N=156) and the differences between the two stages of the capstone: Empirical research seminar (N=114) and analysis and design of real information systems (N=42) regarding the facets conceptual framework.

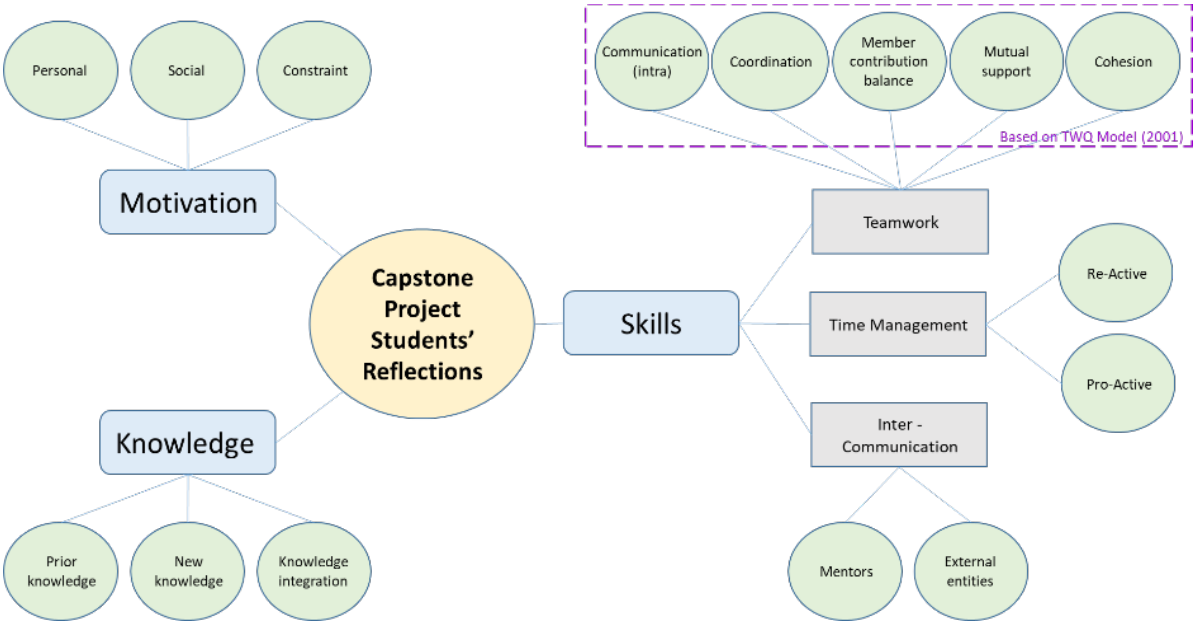

Figure 2. The facets conceptual framework

MOTIVATION

Choosing a topic for a final capstone project is a complex task that lasts for about two weeks at the beginning of the semester, during which students change and refine their proposal until the final approval is received. On the one hand, all project requirements must be met, and on the other hand, students desire to do work in the field of content close to them. Behind this choice, there are many constraints, such as project scope requirements, team preferences, and feasibility. During the data analysis, three types of motivation were identified for the capstone project choice: personal motivation, social motivation, and constraint. Table 2 summarizes these categories, followed by explanations and examples from students' reflections.

Table 2. Motivation factor data analysis

Personal Motivation	Students have a personal motivation for choosing the subject. It can be an early acquaintance with a field, a desire to be exposed to a new field, or a goal to deepen some topic.	*"Choosing the subject of the seminar was very significant for me because I wanted to carry out research on a topic relevant to everyday life and this research may be of benefit to the individual."* *"We chose to do the project about a gym. In my daily routine, I like to exercise and spend at least three times a week at the gym, on which we performed the work. When I started thinking about the system, I came up with the idea of a full package that a gym needs."*
Social Motivation	Choosing a topic due to the potential contribution to the community.	*"The issue is important to the professional knowledge community."* *"When we approached the project, I tried to find an idea that would be interesting to implement, and also of added value to the company."*
Constraint	Choosing a subject due to external constraints (sometimes of their teammates) and not a free choice.	*"The subject we wanted was already chosen, so we chose something else."*

When examining the motivation facet and its three aspects, personal, social, and constraint, it was found that 46.49% at the empirical research seminar stage vs. 55.81% at the analysis and design stage reported having a personal or social motivation for choosing the selected topic and only 7.89% at the empirical research seminar stage vs. 6.98% at the analysis and design stage reported have both (Figure 3). When examining each aspect separately, there is a significant difference between the stage of the capstone and social motivation ($\chi^2 = 11$, $df = 1$, $p < 0.01$). No differences were found ($\chi^2 = 5.19$, $df = 2$, $p > 0.05$) when reporting personal motivation between stages. Students from the analysis and design stage of the capstone reported having chosen topics out of social motivation more than the students in the empirical research seminar. When examining the aspect of constraint, there is a significant difference between the stage of the capstone and a constraint ($\chi^2 = 4.3$, $df = 1$, $p < 0.05$). Students from the analysis and design stage of the capstone reported having fewer constraints than the students in the empirical research seminar.

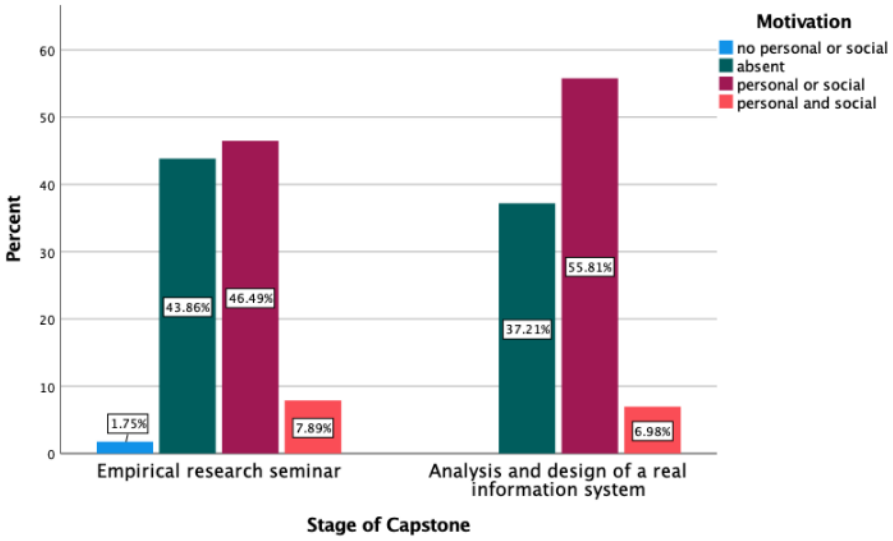

Figure 3. Clustered bar percent of the stage of the capstone by motivation (N=156)

KNOWLEDGE

While working on a final capstone project, the students are not only required to apply the knowledge they have gained during their undergraduate studies but also to study new topics on their own. In the reflections, three categories of learning were identified: prior knowledge – review of materials learned in previous courses (e.g., statistics, research methods, project management, system analysis, and design, etc.), learning new content, and integrating knowledge. Table 3 summarizes these categories, followed by explanations and examples from students' reflections.

Table 3. Knowledge factor data analysis

Prior knowledge	To refresh their memory, students returned to relevant topics learned in previous courses and reviewed the materials.	*"I needed to review materials we have learned."*
Learning new Knowledge (content and process)	Refers to declarative knowledge (facts) and procedural knowledge (process). Students learned by themselves new topics and tools they needed from the internet or other sources and from relevant literature references.	*"The background and the tools for performing various statistical tests, since we did not perform data analysis at the level required of us in any of the statistics courses before. Despite this, we were able to overcome these difficulties by reading from several different sources about different statistical tools and how to use them, in addition, I learned to work with the SPSS software."*
Knowledge integration	Knowledge integration between and among the courses they studied in the past and with the new knowledge they gained	*"I learned a lot of new things about the field and its connection to the field of information security that we studied in the courses."*

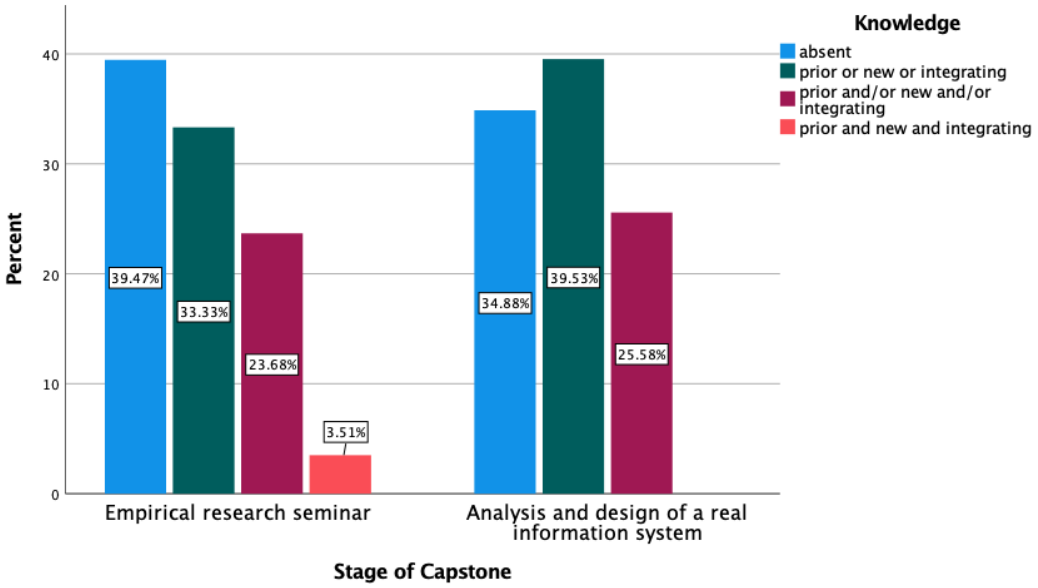

Figure 4. Clustered bar percent of the stage of the capstone by knowledge (N=156)

When examining the knowledge facet and its three aspects, prior knowledge, new knowledge, and knowledge integration, it was found that 33.33% at the empirical research seminar stage vs. 34.88% at the analysis and design stage reported using prior knowledge or learning new knowledge or integrating knowledge, and only 3.51% at the empirical research seminar stage vs. 25.58% at the analysis and design stage reported to use prior knowledge, learn new one and integrate both (Figure 4). When examining each aspect separately, there is a significant difference between the stage of the capstone and knowledge integration ($\chi^2 = 9.55$, df = 2, $p < 0.01$). On both aspects of prior knowledge and new knowledge, no differences were found ($\chi^2 = 0.95$, df = 1, $p > 0.05$; $\chi^2 = 4.5$, df = 2, $p > 0.05$ respectively). Students from the analysis and design stage of the capstone report about integrating knowledge more than the students in the empirical research seminar.

SKILLS

Teamwork

The teamwork quality model, known as the TWQ model (Hoegl & Gemuenden, 2001), contains six facets, including communication, coordination, member contributions balance, mutual support, effort, and cohesion. During data analysis, five out of six facets were identified. Table 4 summarizes these facets, explanations, and examples from students' reflections.

Table 4. TWQ facets data analysis

TWQ facet	Explanation (Hoegl & Gemuenden, 2001)	Example
Communication (intra)	The means for information exchange among team members (intra-communication). "The quality of communication within a team can be described in terms of the frequency, formalization, structure, and openness of the information exchange" (p. 347).	*"We made all the choices together following a brainstorming session. All the decisions were carried out in a collaborative manner and everything was agreed upon by everyone - client, project, and content distribution."* *"The cooperation of the team members was perfect and we integrated perfectly both with each other and with our mentor, whether it was in group discussions, consultations, or whether it was in individual conversations and discussions about how to perform the tasks."* *"We held many group meetings on Zoom and face-to-face to discuss the research topic and the structure and content of the final submission."*
Coordination	"Coordination means that the teams have to develop and agree upon a common task-related goal structure that has sufficiently clear sub-goals for each team member, free of gaps and overlaps" (p. 347).	*"We held joint discussion sessions and occasionally split up to optimize our times. In my opinion, the group worked very well, we focused our attention without any distractions, we set up the goals for each meeting and finally we integrated and read the research together, and corrected notes until the final submission was formulated."*
Member contributions balance	"It is considered essential to TWQ that contributions to the team task are balanced with respect to each member's specific knowledge and experience" (p. 347).	*"The distribution of the workload was relatively equal among the team members."* *"I think that as a group we worked in collaboration, we identify what are the strengths of each of the team members and we knew how to take advantage of that."* *"The distribution of workloads was divided evenly and harmoniously when each team member expressed his/her opinions."*
Mutual support	"Team members working on a common goal should display mutual respect, grant assistance when needed, and develop other team members' ideas and contributions rather than trying to outdo each other" (p. 348).	*"During the research, there were occasional disagreements between the team members, which led to deepening the theoretical background and statistical analyses. The differences of opinion challenged us to explore and get a different perspective. Through the ability to have a conversation we were able to reach a consensus and finally reach a finished product."* *"In addition, the collaboration between us was excellent, and sometimes group work and individual work was done according to loads of each member of the group."*

TWQ facet	Explanation (Hoegl & Gemuenden, 2001)	Example
Cohesion	"Refers to the degree to which team members desire to remain on the team" (p. 348).	*"I wouldn't have done better with others."* *"I enjoyed working with the team members and the dynamics improved over time as we progressed towards the final product."*

As explained in the data analysis section, the new ordinal variable "Teamwork" was created by combining the five categories of the TWQ model (out of the original six), each one of which was coded as a nominal variable (-1, 0, 1). The resulting ordinal variable for the facet was their sum, which ranged from -5 to 5, ranking the report of teamwork in the reflections. When examining the teamwork facet, it was found that 52.86% of the students (N=156) reported to had more than three elements of teamwork (Figure 5). When examining the two stages of the capstone, there is no difference between the stage of the capstone and the teamwork ($t = .322$, $df = 155$, $p > 0.05$). Specifically, students from both stages of the capstone (the seminar: M=2.33, SD=1.76; the analysis and design: M=2.21, SD=2.06) have similar teamwork scores.

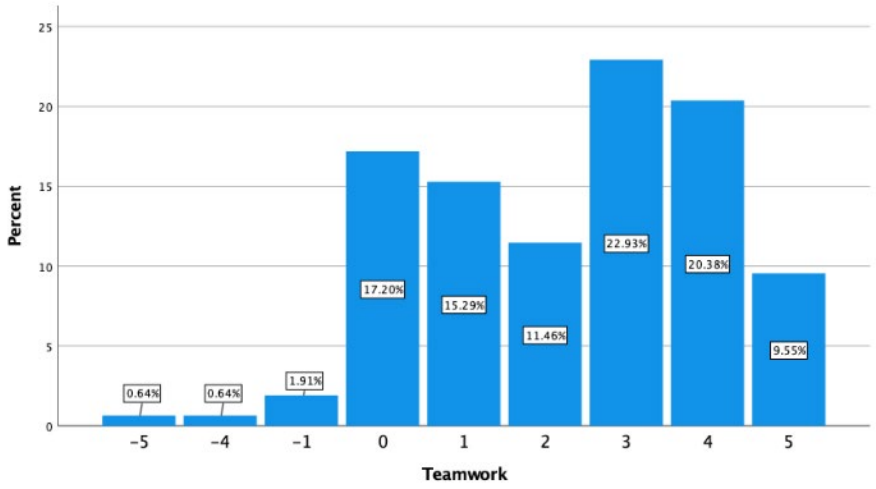

Figure 5. Distribution of teamwork facet (N=156)

Inter-Communication

Communication emerged from the data analysis in several contexts, in the context of communication in teamwork, mentioned as intra-communication (in Table 4), and in the context of other entities. Inter-communication refers to the students' communication with stakeholders. These stakeholders include project mentors, the course coordinators, and real clients (for the analysis and design-based capstone) or research samples (for a research-based capstone). Table 5 summarizes these categories, followed by explanations and examples from students' reflections.

Table 5. Inter-communication factor data analysis

Inter-Communication with mentors	Students referred to the help, constructive feedback, and support they received from the mentors.	*"He contributed a lot to us with the help of his knowledge and experience."* *"We received positive and negative feedback, an in-depth and instructive discussion."*
Inter-communication with external entities	Students referred to their communication with external entities such as experts, project clients, and/or the research participants.	*"We received cooperation from people I don't know."* *"Reached senior officials in the industry."*

When examining the inter-communication facet, it was found that 38.6% at the empirical research seminar stage vs. 51.16% at the analysis and design stage reported using communication with mentors or external entities, while 6.14% at the empirical research seminar stage vs. 30.23% at the analysis and design stage reported doing both (Figure 6). There is a significant difference between the stage of the capstone and the inter-communication ($\chi^2 = 24.67$, df = 2, $p < 0.01$). Students from the analysis and design stage of the capstone report to use more inter-communication with mentors and external entities.

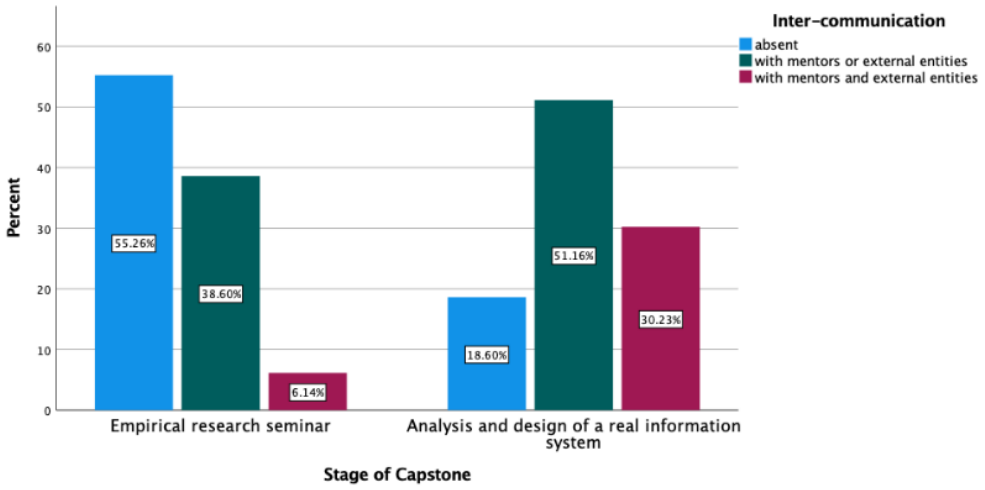

Figure 6. Clustered bar percent of the stage of the capstone by inter-communication (N=156)

Time Management

A final capstone project is carried out according to a strict schedule. The first meeting with the students takes place in the first week of the semester, and the submission of the final product takes place in the week before the end of the semester. To meet all the milestones defined in the final project and to practice the preparation of work plans as they studied in previous project-management courses, the students must plan their time in an optimal way. To meet the deadline, it is not possible to deviate from this schedule. In their reflections, the students referred to time management in two aspects: proactively while they reflect on the importance of planning time in advance, and reactively while they reflect on the problems they experienced with time management. Table 6 summarizes these categories, followed by explanations and examples from students' reflections.

Table 6. Time management factor data analysis

Pro-active	Students reported that planning their work in advance was an important factor that prevented them from reactive time management and procrastination.	*"A work plan that prevented procrastination."* *"Everything was planned in a realistic and good way - including 'Buffers' for unexpected issues and schedule changes and allowed us to be flexible without affecting the delivery times."*
Re-active	Even though students planned their work, unexpected tasks impacted the pace of the project's progress. In those cases, students acted proactively. In some cases, students reflected that they worked under pressure and chaos but mostly managed to meet the set goals.	*"It should be noted that despite the planning and anticipation, personal constraints affected the dates of the meetings and the progress of the project, which in my opinion, is an integral part since we will never work on one project or assignment and therefore need to learn how to prioritize and divide the time (in our case between different assignments and courses)."* *"I felt that our weak point while working on the project was time management. I felt that many times we could have managed the time more efficiently and correctly."* *"I learned how to distribute loads and how to optimize my work processes and those of the other team members."*

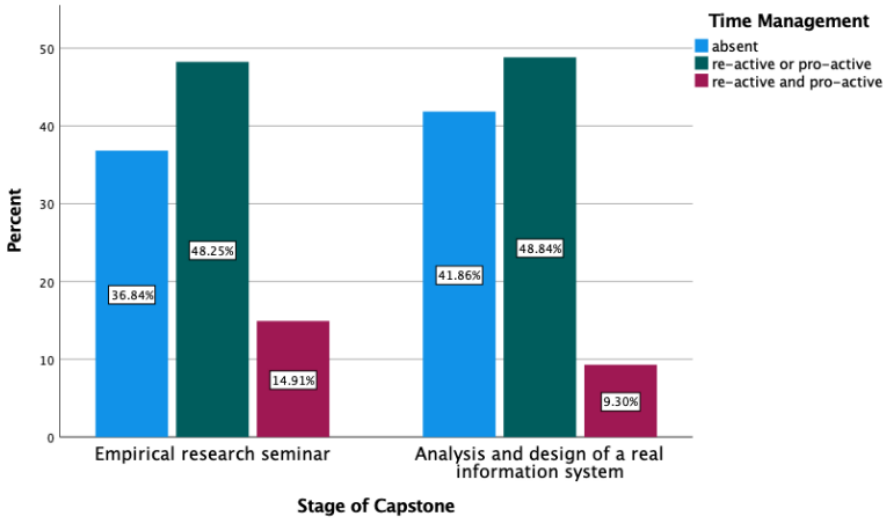

Figure 7. Clustered bar percent of the stage of the capstone by re-active time management (N=156)

When examining the time management facet and its two aspects, re-active and pro-active, it was found that 48.25% at the empirical research seminar stage vs. 48.84% at the analysis and design stage reported being re-active or pro-active in time management and only 14.91% at the empirical research seminar stage vs. 9.3% at the analysis and design stage reported to do both (Figure 7). There is no difference between the stage of the capstone and both aspects of time management, re-active and pro-active ($\chi^2 = .19$, df = 1, $p > 0.05$; $\chi^2 = 0.16$, df = 1, $p > 0.05$ respectively). Specifically, students from both stages of the capstone manage their time in a similar manner.

DISCUSSION

The findings of this study contribute to the understanding of the facets and factors that students experienced during a capstone project in Information System undergraduate studies, based on 156 reflections out of 170 students in four different courses participating in the capstone project during the specific semester. The main aim of the capstone project is to provide students with the opportunity to apply theoretical knowledge to practical problem-solving. Employability and soft skills were not explicitly defined or graded. The reflections were unstructured, and the students did not receive any specific instructions on what to refer to and how to write them. However, students learned in previous courses the meaning and essence of reflecting. Students could have referred to any aspects of their work. Nevertheless, they referred to the soft aspects and employability skills.

A mixed methodology was employed to explore the students' reflections. The qualitative analysis showed that students' reflections on their motivation, knowledge, and skills resembled the importance of those facets in the process they underwent. The quantitative analysis provided further insights into the differences between the two stages of the capstone project. Accordingly, a facets conceptual framework was constructed (Figure 2), which identified three main factors in the students' reflections: motivation, knowledge, and skills. The motivation facet is composed of three factors: personal motivation, social motivation, and constraints in choosing a topic. The knowledge facet is composed of three factors: prior knowledge, new knowledge gained during the project, and knowledge integration. The skills facet is composed of three factors: teamwork, time management, and inter-communication, and each of these factors is further decomposed.

Motivation is essential to perform a capstone project, which is very demanding work performed in a team. Students' motivation can be influenced by expectations of success and the perceived value of the task (Eccles & Wigfield, 2002). To succeed in a timely, engaging, effective, and satisfying manner and to accomplish a high-level outcome, students need strong motivation (Halim et al., 2014), either a personal motivation or social motivation to contribute to society. Personal motivation can derive from an early acquaintance with a field, a desire to be exposed to a new field, or a goal to deepen some topic. Social responsibility is becoming increasingly important in today's society, with more and more emphasis being placed on the role of individuals and organizations in creating a better world for all. This trend has also made its way into the academic world, with many universities requiring students to engage in social responsibility initiatives as part of their academic requirements. Choosing a topic for the capstone project can have many constraints, such as project scope requirements, team preferences, and feasibility. Thus some students consider their topic as not a free choice (Braught & Siddiqui, 2022). This study revealed that students from the analysis and design stage of the capstone (second stage) reported having chosen topics out of social motivation and had fewer constraints in comparison to the students in the empirical research seminar (first stage). This can be explained by the maturity of the capstone project's process and the different characteristics of the second stage, being more practical and less theoretical than the first stage. This finding also suggests that students in the analysis and design stage of the project were more likely to choose topics out of social motivation. This may be because students in this stage of the project are able to analyze and make more informed decisions regarding the need and requirements to construct new information systems.

The use of learned knowledge, acquiring new knowledge, and integrating all together to solve the problem they face, are important skills needed in the information systems industry. As previous research claimed (e.g., Sung et al., 2016), high-level prior knowledge is a key factor for successful projects. The integration of different kinds of knowledge allows for better understanding and higher-quality solutions (Mehta & Mehta, 2018; Steiger, 2009). Moreover, technology changes at a very fast pace, so students need to learn, during their undergraduate studies, how to cope with new subjects and investigate them by themselves to solve new problems with new unknown technologies. In this study, students from the analysis and design stage (second stage) of the capstone report about integrating knowledge more than the students in the empirical research seminar (first stage). It suggests

that students in the analysis and design stage of the project were more likely to integrate their prior knowledge with new knowledge. This may be because students in this stage of the project have a deeper understanding of the project and need to integrate more subjects from previous courses and new topics to assist them in the completion of the project.

The Skills facets and factors revealed in this research strengthen prior research, which found them as essential employability skills needed by undergraduates to enter the workforce (St. Louis et al., 2021), especially in the field of Information Systems: time management (Auvinen et al., 2020; Cottrell, 2019; Osmani et al., 2019), teamwork (Cimatti, 2016; Matturro et al., 2019), and inter-communication (Idkhan et al., 2021; Kleckner & Butz, 2022). There were no significant statistical differences between the two stages of the capstone project in terms of time management or teamwork. The finding suggests that students were able to maintain similar levels of these skills throughout the project, regardless of the stage they were at. This may be because time management (Lay & Schouwenburg, 1993) and teamwork are fundamental skills that are required throughout the entire capstone project. On the contrary, there were significant statistical differences in inter-communication between the two stages of the capstone project. This finding suggests that students in the analysis and design stage of the project were more likely to use communication with mentors or external entities. This may be because students in this stage of the project are working on a more advanced stage and require more input from external sources.

Overall, the findings of this study highlight the importance of reflection and analysis in the capstone project. By analyzing students' reflections, specific areas for improvement and tailoring the teaching and support to address these areas can be identified. The results also suggest that time management and teamwork are fundamental skills that should be developed throughout the entire capstone project, while inter-communication, knowledge integration, and social motivation require more attention in the later stages of the project. Moreover, it is very important to prepare the students for employability (Jiracheewewong, 2022) by including a "real-life" capstone project at the end of their undergraduate studies in order to prepare the students to be valuable in the workforce, even at their start point as juniors.

CONCLUSIONS

The aim of this study was to investigate the facets and factors that students experienced during a capstone project by analyzing students' reflections at two stages of the project.

As mentioned in the Methodology section, the reflections collected were unstructured, and the students did not receive any instructions on what and how to write their reflections. Thus, students could have referred to any aspects of their work. Nevertheless, they referred to the soft aspects and employability skills. This can be seen as one of the strengths of the current research as it reflects the importance attributed by the students to the capstone project's contribution.

The results showed that the three main facets identified in the students' reflections were motivation, knowledge, and skills, as presented in Figure 2. The skills facet revealed three main factors: Teamwork, Time management, and Inter-communication, which are important employability skills needed in today's fast-changing and demanding industry. The qualitative analysis identified recurring themes in each facet, and a conceptual framework was developed to illustrate the factors of each facet. The quantitative analysis revealed that there were no significant differences between the two stages of the capstone project in terms of time management and teamwork, but there were significant differences in inter-communication, knowledge integration, social motivation, and motivation constraints.

The findings of this study provide useful insights into the facets and factors that are important to students during a capstone project in Information Systems studies. It is highly recommended for IS faculty, teachers, and mentors emphasize the importance of developing employability skills during the capstone project to prepare undergraduate students for the workforce. This can be done through

specific well-designed guided instruction and workshops in addition to ongoing personal and team reflections throughout the capstone project.

Limitations

Several limitations must be considered when interpreting the results of this study. The data collection was limited to the students in one higher education institution. Moreover, and in addition to the advantages specified in the conclusions, the reflections collected were unstructured and can also be seen as a limitation. The students did not receive any instructions on what and how to write their reflections. Thus, the lack of references on some of the facets and factors in some of the reflections cannot indicate the students did not experience them.

Future Work

To evaluate the process of employability skills development, a further study can examine students' perceptions prior to the capstone, during, and after to assess the progress and changes. Students' readiness for the industry and their employability skills are extremely important in all disciplines. It would be valuable to investigate whether the findings of this study are consistent across different institutions and disciplines. This would help to establish the generalizability of the results. The study could be extended to explore the impact of the identified facets and factors on project outcomes, such as the quality of the final product or student satisfaction. In addition, it is recommended to conduct a confirmatory analysis to measure the relationship and influence of each of the model's components.

References

Aasheim, C. L., Williams, S., & Butler, E. S. (2009). Knowledge and skill requirements for IT graduates. *Journal of Computer Information Systems, 49*(3), 48–53.

Acuna, S. T., Juristo, N., & Moreno, A. M. (2006). Emphasizing human capabilities in software development. *IEEE Software, 23*(2), 94-101. https://doi.org/10.1109/MS.2006.47

Adelakun-Adeyemo, O. (2021). The computer science final year project: A time to mentor. *International Journal of Research and Innovation in Social Science, 5*(8), 500–508.

Aji, C., & Khan, M. (2019). The impact of active learning on students' academic performance. *Open Journal of Social Sciences*, **7**, 204–211. https://doi.org/10.4236/jss.2019.73017

Albanese, M. A., & Mitchell, S. (1993). Problem-based learning: A review of literature on its outcomes and implementation issues. *Academic Medicine, 68*(1), 52–81.

Aldabbus, S. (2018). Project-based learning: Implementation & challenges. *International Journal of Education, Learning and Development*, *6*(3), 71-79.

Auvinen, T., Falkner, N., Hellas, A., Ihantola, P., Karavirta, V., & Seppälä, O. (2020, October). Relation of individual time management practices and time management of teams. *Proceedings of the IEEE Frontiers in Education Conference, Uppsala, Sweden*. https://doi.org/10.1109/FIE44824.2020.9274203

Ball, Z., Bessette, J., & Lewis, K. (2020, August). Who, what, and when? Exploring student focus in the capstone design experience. *Proceedings of the International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. American Society of Mechanical Engineers. https://doi.org/10.1115/DETC2020-22027

Bastarrica, M. C., Perovich, D., & Samary, M. M. (2017, May). What can students get from a software engineering capstone course? *Proceedings of the IEEE/ACM 39th International Conference on Software Engineering, Buenos Aires, Argentina,* 137–145. https://doi.org/10.1109/ICSE-SEET.2017.15

Bell, B. S., & Kozlowski, S. W. (2008). Active learning: Effects of core training design elements on self-regulatory processes, learning, and adaptability. *Journal of Applied Psychology, 93*(2), 296–316. https://doi.org/10.1037/0021-9010.93.2.296

Bernacki, M. L., Byrnes, J. P., & Cromley, J. G. (2012). The effects of achievement goals and self-regulated learning behaviors on reading comprehension in technology-enhanced learning environments. *Contemporary Educational Psychology*, *37*(2), 148–161. https://doi.org/10.1016/j.cedpsych.2011.12.001

Bogdan, R. C., & Biklen, S. K. (2007). *Qualitative Research for Education: An Introduction to Theory and Methods* (5th ed.). Allyn & Bacon.

Boss, S. (2012). The challenge of assessing project-based learning. *District Administration*, *48*(9), 46.

Boud, D., Keogh, R., & Walker, D. (2013). Promoting reflection in learning: A model. In D. Boud, R. Keogh, & D. Walker (Eds.), *Reflection: Turning experience into learning* (pp. 18–40). Routledge.

Braught, G., & Siddiqui, F. (2022). Factors affecting project selection in an open-source capstone. *Proceedings of the 27th ACM Conference on Innovation and Technology in Computer Science Education Vol. 1* (pp. 358–364). Association for Computing Machinery https://doi.org/10.1145/3502718.3524760

Bryman, A. (2016). *Social research methods*. Oxford University Press.

Buckingham Shum, S., Sándor, Á., Goldsmith, R., Wang, X., Bass, R., & McWilliams, M. (2016, April). Reflecting on reflective writing analytics: Assessment challenges and iterative evaluation of a prototype tool. In *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge* (pp. 213–222). http://dx.doi.org/10.1145/2883851.2883955

Charmaz, K. (2014). *Constructing grounded theory* (2nd ed.). Sage Publications.

Cimatti, B. (2016). Definition, development, assessment of soft skills and their role for the quality of organizations and enterprises. *International Journal for Quality Research, 10*(1), 97. https://doi.org/10.18421/IJQR10.01-05

Cottrell, S. (2019). *The study skills handbook*. Bloomsbury Publishing.

Denton, A. W. (2018). The use of a reflective learning journal in an introductory statistics course. *Psychology Learning & Teaching*, *17*(1), 84–93. https://doi.org/10.1177/1475725717728676

Devi, V., & Abraham, R. R. (2020). Evaluation of a mentored student project programme using reflective summaries. *National Medical Journal of India, 33*(2), 102–106. https://doi.org/10.4103/0970-258X.310920

Din, U. K. S., Shahabuddin, F. A., Rambely, A. S., Suradi, N. R. M., Ahmad, R. R., Majid, N., Ali, Z. M., & Mamat, N. J. Z. (2010). Student's perceptions on the implementation of the final year research project: A case study. *Procedia-Social and Behavioral Sciences, 8*, 439–445. https://doi.org/10.1016/j.sbspro.2010.12.060

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology, 53*(1), 109–132. https://doi.org/10.1146/annurev.psych.53.100901.135153

Gallegos, C., Tesar, A. J., Connor, K., & Martz, K. (2017). The use of a game-based learning platform to engage nursing students: A descriptive, qualitative study. *Nurse Education in Practice*, *27*, 101-106. https://doi.org/10.1016/j.nepr.2017.08.019

Garousi, V., Giray, G., Tuzun, E., Catal, C., & Felderer, M. (2020). Closing the gap between software engineering education and industrial needs. *IEEE Software, 37*(2), 68–77. https://doi.org/10.1109/MS.2018.2880823

Gaskell, G. (2000). Individual and group interviewing. In M. W. Bauer & G. Gaskell (Eds.), *Qualitative researching with text, image, and sound: A practical handbook* (pp. 38–56). Sage Publications. https://doi.org/10.4135/9781849209731.n3

Greene, J. A., Moos, D. C., Azevedo, R., & Winters, F. I. (2008). Exploring differences between gifted and grade-level students' use of self-regulatory learning processes with hypermedia. *Computers & Education*, *50*(3), 1069-1083. https://doi.org/10.1016/j.compedu.2006.10.004

Guest, G., MacQueen, K. M., & Namey, E. E. (2012). *Applied thematic analysis*. Sage Publications. https://doi.org/10.4135/9781483384436

Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research, 102*, 101586. https://doi.org/10.1016/j.ijer.2020.101586

Hadar, I., Sherman, S., & Hazzan, O. (2008). Learning human aspects of collaborative software development. *Journal of Information Systems Education, 19*(3), 311–320.

Halim, M. A., Buniyamin, N., Imazawa, A., Naoe, N., & Ito, M. (2014, December). The role of Final Year Project and Capstone Project in undergraduate engineering education in Malaysia and Japan. *Proceedings of the 2014 IEEE 6th Conference on Engineering Education, Kuala Lumpur, Malaysia,* 1–6. https://doi.org/10.1109/ICEED.2014.7194678

Henderson, M., Selwyn, N., & Aston, R. (2017). What works and why? Student perceptions of 'useful' digital technology in university teaching and learning. *Studies in Higher Education, 42*(8), 1567–1579. https://doi.org/10.1080/03075079.2015.1007946

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006). *Educational Psychologist, 42*(2), 99–107. https://doi.org/10.1080/00461520701263368

Hoegl, M., & Gemuenden, H. G. (2001). Teamwork quality and the success of innovative projects: A theoretical concept and empirical evidence. *Organization Science, 12*(4), 435–449. https://doi.org/10.1287/orsc.12.4.435.10635

Holdsworth, A., Watty, K., & Davies, M. (2009). *Developing capstone experiences*. Deakin University.

Hussein, B. (2021). Addressing collaboration challenges in project-based learning: The student's perspective. *Education Sciences, 11*(8), 434. https://doi.org/10.3390/educsci11080434

Hwang, S. Y., & Kim, M. J. (2006). A comparison of problem-based learning and lecture-based learning in an adult health nursing course. *Nurse Education Today*, *26*(4), 315-321. https://doi.org/10.1016/j.nedt.2005.11.002

Idkhan, A. M., Syam, H., & Hasim, A. H. (2021). The employability skills of engineering students: Assessment at the university. *International Journal of Instruction, 14*(4), 119–134. https://doi.org/10.29333/iji.2021.1448a

Jaeger-Helton, K., Smyser, B. M., & McManus, H. L. (2019, June). Capstone prepares engineers for the real world, right? ABET outcomes and student perceptions. In *2019 ASEE annual conference & exposition*. https://doi.org/10.18260/1-2--32496

Jiracheewewong, E. (2022). Does higher education enhance employability skills enough for today's graduates? *STOU Education Journal, 15*(2), 1-20.

Jones, K., Leonard, L. N., & Lang, G. (2018). Desired skills for entry level IS positions: Identification and assessment. *Journal of Computer Information Systems*, *58*(3), 214–220. https://doi.org/10.1080/08874417.2016.1229144

Jurdak, M. (2016). STEM Education as a context for real-world problem solving. In M. Jurdak, *Learning and teaching real world problem solving in school mathematics* (pp. 151-163). Springer. https://doi.org/10.1007/978-3-319-08204-2_10

Kar, S. A. C., Mukahar, N., Enzai, N. I. M., Rais, S. S., & Sabri, S. M. (2013). Enhancing final year project through exhibition and competition. *World Applied Sciences Journal, 23*, 8–11.

Kardoyo, Nurkhin, A., Muhsin, & Pramusinto, H. (2019). Problem-based learning strategy: Its impact on students' critical and creative thinking skills. *European Journal of Educational Research, 9*(3), 1141–1150. https://doi.org/10.12973/eu-jer.9.3.1141

Karnieli-Miller, O. (2020). Reflective practice in the teaching of communication skills. *Patient Education and Counseling*, *103*(10), 2166-2172. https://doi.org/10.1016/j.pec.2020.06.021

Keller, S., Parker, C. M., & Chan, C. (2011). Employability skills: Student perceptions of an IS final year capstone subject. *Innovation in Teaching and Learning in Information and Computer Sciences, 10(*2), 4–15. https://doi.org/10.11120/ital.2011.10020004

Kilamo, T., Hammouda, I., & Chatti, M. A. (2012, June). Teaching collaborative software development: A case study. Proceedings of the *34th International Conference on Software Engineering, Zurich, Switzerland,* 1165–1174. https://doi.org/10.1109/ICSE.2012.6227026

Kleckner, M. J., & Butz, N. T. (2022). Developing entry-level communication skills: A comparison of student and employer perceptions. *Business and Professional Communication Quarterly*, *85*(2), 192–221. https://doi.org/10.1177/23294906221078300

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall.

Krajcik, J., & Shin, N. (2014). Project-based learning. In R. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 275-297). Cambridge University Press. https://doi.org/10.1017/CBO9781139519526.018

LaForce, M., Noble, E., & Blackwell, C. (2017). Problem-based learning (PBL) and student interest in STEM careers: The roles of motivation and ability beliefs. *Education Sciences*, *7*(4), 92. http://dx.doi.org/10.3390/educsci7040092

Lay, C. H., & Schouwenburg, H. C. (1993). Trait procrastination, time management, and academic behavior. *Journal of Social Behavior and Personality*, *8*, 647-662.

Loyens, S. M., Van Meerten, J. E., Schaap, L., & Wijnia, L. (2023). Situating higher-order, critical, and critical-analytic thinking in problem-and project-based learning environments: A systematic review. *Educational Psychology Review*, *35*(2), 39. https://doi.org/10.1007/s10648-023-09757-x

Matturro, G., Raschetti, F., & Fontán, C. (2019). A systematic mapping study on soft skills in software engineering. *Journal of Universal Computer Science, 25*(1), 16–41. https://doi.org/10.3217/jucs-025-01-0016

Mehta, A., & Mehta, N. (2018). Knowledge integration and team effectiveness: A team goal orientation approach. *Decision Sciences, 49*(3), 445–486. https://doi.org/10.1111/deci.12280

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Sage Publications.

Mills, M. J., Bonner, J. M., & Francis, J. J. (2006). The development of constructivist grounded theory. *International Journal of Qualitative Methods, 14*(5), 1–10.

Minott, M. A. (2008). Valli's typology of reflection and the analysis of pre-service teachers' reflective journals. *Australian Journal of Teacher Education*, *33*(5), 55-65.

Moon, J. A. (2013). *A handbook of reflective and experiential learning: Theory and practice*. Routledge.

Naqvi, S. R., Akram, T., Haider, S. A., Khan, W., Kamran, M., Muhammad, N., & Nawaz Qadri, N. (2019). Learning outcomes and assessment methodology: Case study of an undergraduate engineering project. *The International Journal of Electrical Engineering & Education, 56*(2), 140–162. https://doi.org/10.1177/0020720918790108

Nghia, T. L. H. (2019). *Building soft skills for employability: Challenges and practices in Vietnam*. Routledge. https://doi.org/10.4324/9780429276491

Osmani, M., Weerakkody, V., Hindi, N., & Eldabi, T. (2019). Graduates employability skills: A review of literature against market demand. *Journal of Education for Business, 94*(7), 423–432. https://doi.org/10.1080/08832323.2018.1545629

Raibulet, C., & Fontana, F. A. (2018). Collaborative and teamwork software development in an undergraduate software engineering course. *Journal of Systems and Software*, *144*, 409–422. https://doi.org/10.1016/j.jss.2018.07.010

Rajabzadeh, A. R., Long, J., Saini, G., & Zeadin, M. (2022). Engineering student experiences of group work. *Education Sciences, 12*(5), 288. https://doi.org/10.3390/educsci12050288

Ralph, R. A. (2016). Post secondary project-based learning in science, technology, engineering and mathematics. *Journal of Technology and Science Education, 6*(1), 26–35. https://doi.org/10.3926/jotse.155

Rania, N., Coppola, I., & Pinna, L. (2021). Reflective practices to study group dynamics: Implement empowerment and understand the functioning of groups. *Frontiers in Psychology*, 5534. https://doi.org/10.3389/fpsyg.2021.786754

Saltiel, D. (2009). Judgement, narrative and discourse: A critique of reflective practice. In H. Bradbury, N. Frost, S. Kilminster, & M. Zukas (Eds.). *Beyond reflective practice: New approaches to professional lifelong learning* (1st ed.). 130–141. Routledge. https://doi.org/10.4324/9780203873175

Savery, J. R. (2015). Overview of problem-based learning: Definitions and distinctions. In A. Walker, H. Leary, C. E. Hmelo-Silver, & P. A. Ertmer (Eds.), *Essential readings in problem-based learning: Exploring and extending the legacy of Howard S. Barrows* (pp. 5–16). Purdue University Press. https://doi.org/10.2307/j.ctt6wq6fh.6

Savery, J. R., & Duffy, T. M. (1995). Problem based learning: An instructional model and its constructivist framework. *Educational Technology, 35*(5), 31–38.

Schön, D. A. (1984). *The reflective practitioner: How professionals think in action*. Basic Books.

Sherman, S., Kantsepolsky, B., & Roth, I. (2022). Teamwork skills: The case of a practical course. *Issues in Information Systems, 23*(2). https://doi.org/10.48009/2_iis_2022_102

Stake, R. E. (1995). *The art of case study research*. Sage Publications.

Steiger, D. M. (2009). Teaching case: Enhancing knowledge integration: An information system capstone project. *Journal of Information Systems Education*, *20*(1), 17.

Stevens, M., & Norman, R. (2016). Industry expectations of soft skills in IT graduates: A regional survey. *Proceedings of the Australasian Computer Science Week Multiconference* (pp. 1–9). Association for Computing Machinery. https://doi.org/10.1145/2843043.2843068

St. Louis, A. T., Thompson, P., Sulak, T. N., Harvill, M. L., & Moore, M. E. (2021). Infusing 21st century skill development into the undergraduate curriculum: The formation of the iBEARS network. *Journal of Microbiology & Biology Education, 22*(2), e00180–21. https://doi.org/10.1128/jmbe.00180-21

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Sage Publications.

Sung, Y. T., Liao, C. N., Chang, T. H., Chen, C. L., & Chang, K. E. (2016). The effect of online summary assessment and feedback system on the summary writing on 6th graders: The LSA-based technique. *Computers & Education*, *95*, 1-18. https://doi.org/10.1016/j.compedu.2015.12.003

Thomas, G. (2011). A typology for the case study in social science following a review of definition, discourse, and structure. *Qualitative Inquiry, 17*(6), 511–521. https://doi.org/10.1177/1077800411409884

Tiernan, P. (2021). Exploring digital literacy: How do undergraduate students evaluate digital video for inclusion in assignment work? *Digital Education Review*, *40*, 110-121.

Venkatesh, V., Thong, J. Y., & Xu, X. (2016). Unified theory of acceptance and use of technology: A synthesis and the road ahead. *Journal of the Association for Information Systems*, *17*(5), 328-376.

Villamañe, M., Ferrero, B., Álvarez, A., Larrañaga, M., Arruarte, A., & Elorriaga, J. A. (2014, October). Dealing with common problems in engineering degrees' final year projects. *Proceedings of the IEEE Frontiers in Education Conference, Madrid, Spain,* 1–8. https://doi.org/10.1109/FIE.2014.7044431

Walther, J. B., Van Der Heide, B., Kim, S. Y., Westerman, D., & Tong, S. T. (2008). The role of friends' appearance and behavior on evaluations of individuals on Facebook: Are we known by the company we keep? *Human Communication Research*, *34*(1), 28-49. https://doi.org/10.1111/j.1468-2958.2007.00312.x

Weicker, K. (2020, June). Teaching cooperative problem solving. *Proceedings of the 4th European Conference on Software Engineering Education* (pp. 6–11). Association for Computing Machinery. https://doi.org/10.1145/3396802.3396819

Woodward, B. S., Sendall, P., & Ceccucci, W. (2010). Integrating soft skill competencies through project-based learning across the information systems curriculum. *Information Systems Education Journal*, *8*(8), n8.

Wurdinger, S. D., & Carlson, J. A. (2009). *Teaching for experiential learning: Five approaches that work*. Rowman & Littlefield Education.

Yazan, B. (2015). Three approaches to case study methods in education: Yin, Merriam, and Stake. *The Qualitative Report, 20*(2), 134–152. https://doi.org/10.46743/2160-3715/2015.2102

Zen, Z., & Ariani, F. (2022). Academic achievement: The effect of project-based online learning method and student engagement. *Heliyon, 8*(11), e11509. https://doi.org/10.1016/j.heliyon.2022.e11509

AUTHORS

Ruti Gafni is an Associate Professor and Dean of the School of Information Systems at The Academic College of Tel Aviv Yaffo. She holds a Ph.D. from Bar-Ilan University, Israel (in the Business Administration School), focusing on Information Systems, an M.Sc. from Tel Aviv University, and a BA (Cum Laude) in Economics and Computer Science from Bar-Ilan University. She has more than 40 years of practical experience as a Project Manager and Analyst of information systems and participated in the In2IT EU ERASMUS+ project.

Moshe Leiba is a Lecturer at the School of Information Systems at The Academic College of Tel Aviv Yaffo. He also acts as Chief Pedagogical Officer of World ORT Kadima Mada. Moshe holds a B.Sc in Electrical Engineering, a Teaching Certificate, a MA (Magna cum Laude), and a Ph.D. focusing on Digital Education from Tel Aviv University, Israel. Moshe participated in several European ICT research programs (FP7, FP6, Erasmus, GIF) as a researcher and has experience as a policy maker in the Israeli education system at governmental and municipal levels.

Sofia Sherman is a Senior Lecturer in the School of Information Systems at The Academic College of Tel Aviv Yaffo. Her research interests include requirements engineering, architecture processes and the role of the architect in different development methodologies, and human aspects of software engineering. Sherman received her Ph.D. from the Department of Information Systems at the University of Haifa, Israel.