

**SELF-DIRECTED SUSTAINABLE LEARNING IN RESEARCH BASED
INTERNSHIP**

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ABSTRACT

Sustainable learning becomes a significant concern for future professionals including software engineers due to its impact on the society. Continuous and tremendous change in technology contribute to many software and apps which are used by large society and their lifestyle. Internship appears to be appropriate opportunity in undergraduate education to experience sustainable learning. Project based internship serves as a platform to transfer and apply the learned skills or knowledge from classroom context to society or industry contexts. The objective of this paper is to propose a model of sustainable learning in multimedia project internship. This case study is conducted through self-reflective of learning processes among virtual research-based internship program members in a serious game development and evaluation project. Assessment using modified self-directed learning model in sustainable development and learning considers interns' experience throughout the training in professional competencies. The model aims to guide instructors, institutions and students on the required content of research-based internship period of multimedia program.

1. Introduction

In software engineering education, students are trained with software technologies, processes, and practices of the industries. The multimedia programme falls under the field that offer an understanding of multimedia software production through the

analysis, design, development and implementation of the system. The programme emphasises on the dynamic of Multimedia System Development by giving particular attention to train students to be creative and innovative designers, and be able to adapt to various working environments.

The multimedia programme also deal with the dual nature of computer science and engineering learning content that requires instructors to discuss both theoretical and practical learning activities (Lin 2021). Furthermore, the class also addresses industrial demands and how multimedia has potential as problem solution to many practical and real life scenarios (Alhammad & Moreno 2018; Mia et al. 2020). The principles apply organised, methodical and measureable procedures in the software development life cycle.

Internship period offers students with various types of career embark such as user experience and user interface designer, multimedia software engineer, multimedia programmer, games developer and digital media producer (Anjum 2020; Mia et al. 2020; Ruggiero & Boehm 2017). The high demand of related skills from multimedia and software engineering sector especially from the entertainment and broadcasting industries appear to be a pull factor for multimedia program students to be in the suitable and right places (Hora et al. 2021).

The traditional internship provides benefit for both the intern and the organizations, under the spirit of partnership between industry and higher education (Alias 2019; Ruggiero & Boehm 2017; Zainal et al. 2021). The internship offers student some valuable experiences including participating in authentic practices to support sustainable learning. Sustainable learning contributes to knowledge co-creation and sharing in community by infusing students to apply and enhance their skills in complex

and challenging settings (Nanjundaswamy et al. 2021). The features of learners in sustainable learning could be described in self-directed model as those who manage not only to direct their studies but also to accept responsibility, to construct meaning and to cognitively monitor one's learning process (Burkšaitienė et al. 2021).

Nevertheless, the growing interest in multimedia research leads to fundamental and application projects that cover conceptual analysis, design implementation and performance evaluation that embrace the multimedia elements (Mia et al. 2020). Project-based internship emerges with the increase of students undertaking undergraduate programmes including multimedia field where the internship surrounds by the normal academic life rather than the industry portfolio fashion (Ruggiero & Boehm 2017).

While Internships have played significant role in multimedia program, concerns regarding what comprise successful internships, in research-based internship continue arises especially in the context of transferring the gained experience to other and future context (Ruggiero & Boehm 2017; Tractenberg et al. 2017). To avoid research-based internship processes to be commonly described as boring and wasteful, careful design and evaluation of the internship based on sound theoretical foundations and assumptions in Multimedia (Ruggiero & Boehm 2016).

The software engineering professional competence ensures the efficient activities of a software engineer for sustainable development and learning (Semerikov et al. 2020). Although the professional software engineer training system design aims at developing the system knowledge, communications and professional skills in solving problems in the software engineering field, its practical application in software engineering education has yet to be tested (Striuk et al. 2020; Varava et al. 2021).

The career-oriented learning experiences can be gained through effective internship programs that involve three levels of collaboration, including organizational level, departmental level, and instructor level (Li & Craig 2020). However, an overly focus on subject and course learning experiences might run the risk of vanishing the internship experience and unique project involvement. Therefore, an integrated software engineering internship development should consider fostering new elements of internship activities to contain the necessary skills for academic and professional success. In essence, technical training should complement academic education to create an integrated and comprehensive e-learning curriculum.

Research-based internship design with the incorporation of educational institution, software industry and project team has long been accepted as an important step in the developmental process of future software engineers (Ruggiero & Boehm 2017). The research-based internship platform in a virtual environment overcome many limitations of professional skill development among final year software engineering students or fresh graduates (Mia et al. 2020). In this research, we modify and apply the software engineering professional competence in internship program that measures the sustainable development and learning of software engineers.

This study aims to address this issue by focusing on multimedia programme. The objective of this paper is to propose a model of sustainable learning in multimedia project internship. The model aims to guide instructors, institutions and students on the required content of research-based internship period of multimedia program. This is to answer the issue of what is included in the internship program to equip students with necessary skills and experience.

2. Sustainable Learning and Software Engineering Multimedia Program

Sustainable learning gains attention from researchers and educators especially those in higher education institution since the past 20 years. In a Sustainable Learning course, the desire to produce the skills and outlook for students to prosper in the challenging, ever changing and complex context usually fuels by the understanding of balance in the society (Nanjundaswamy et al. 2021; Yassin et al. 2020). Higher education institution plays significant role in the development of capabilities connected to the innovative and sustainable economy (García-Jiménez, Eduardo Gallego-Noche & Gómez-Ruíz 2015).

To create a sustainable learning, students should be prepared to respond efficaciously to the universal challenges in their career path. New jobs emerge in the new market that require components such as abstract reasoning, knowledge management, real-time response, integrity and accountability (Peris-Ortiz & Lindahl 2015). New trends and challenging situations continue to appear in near future due to the modernisation of humanity, globalization of society, and technological revolution.

Likewise, in software engineering courses, higher education institution requires a model based on the acquisition of competencies to plan the software engineering curriculums that suit the necessities of industries (Fadhel et al. 2020). The application of models in the software engineering curriculum helps to improve the students' skills and to enable their inclusion in the work path. Internship appears to be appropriate opportunity in undergraduate education to experience sustainable learning (Burkšaitienė et al. 2021). Internship offers tremendous chances for students to transfer and apply the learned skills or knowledge from classroom context to society or industry contexts (Tractenberg et al. 2017).

To embed Sustainable learning in software engineering curriculum, educators need to consider its four discrete features: lifelong learning; behavioural adjustment; personal growth; reconstruction (Schwänke 2008). The Lifelong learning exposure provides an additional level of depth in the course for students to experience the medium or advanced topic as opposed to the regular primary topic. Behaviour adjustment calls for new learning behavior by modifying learning strategy concerning fact-finding, thinking, understanding of something, or approach to learning something new. Personal growth involves a continuous process of personal development beyond the course. Any learning or training experience other than formal education could serve the purpose. Reconstruction suggests modification of previously assumed idea or concept to confirm the sound understanding.

In software engineering specialist training, sustainable development and learning concerns a system of general professional competencies (Semerikov et al. 2020). The system considers professional competencies designed to build sustainable professional competence of software engineering specialist that comprises of 15 items. The framework includes ability for abstract thinking, analysis and synthesis; ability to apply knowledge in practical situations; ability to communicate in native language; ability to communicate in a foreign language; ability to learn and acquire up-to-date knowledge. The system emphasizes for software engineering student to address the urge apply and enhance the gained knowledge into new situations (Nanjundaswamy et al. 2021).

3. Multimedia Project Internship and Self-Directed Learning

Internships and any work-based learning programme are considered as among essential experiences for university students (Hora et al. 2021). Benefits of internship include its role to help students develop transferable skills, apply academic knowledge to

authentic situations, develop professional networks, and facilitate students' socialization and entry into the professions. Due to Covid-19, internship programmes are being held online and the interns are expected to be working from home. Work-from-home or also known as WFH is defined by working in the home environment (Mei & Wong 2021). Virtual internships represent unique transitional and temporary learning experiences including the use of technology integration (Jeskea & Axtell 2018). Supervisory engagement and commitment to the interns play a critical role to create meaningful learning. Likewise, the customized use of technology to interact, monitor, and engage with interns determine effectiveness in the program.

The development of sustainable learning in software engineering program suggests an endlessly academic journey of looking for knowledge in the field and beyond (Velazquez et al. 2011). The development considers academic practice, skills beyond disciplines in multifaceted nature viable for collaborating and networking interdisciplinary (Nanjundaswamy et al. 2021). At the heart of education and the system for sustainable learning lies digital collaboration that calls for authentic learning, collaborative learning, open conversation, creativity and innovation (Mystakidis et al. 2019). In internship programme, digital collaboration suggests smart partnership between supervisors and interns (Nanjundaswamy et al. 2021).

Internships serve as pedagogical moments for students to learn and practice soft skills, which consist of interpersonal attributes like communication, collaboration, ethics, and critical thinking (J Bay 2021). These attributes require students to learn the value and respond effectively in various workplace situations, people, technologies, and problems.

Multimedia project internship entails not only designing and developing multimedia products, but also disseminating research ideas and findings verbally and

written. Multimedia project combines text, graphics, animation, video and sound to delivering a content in the form of narration, onscreen text, or illustration (Abdurasulovich et al. 2020). Multimedia products such as game help learning process by integrating narration and graphics to be presented simultaneously (Wan Irma Sabrina & Rafiza 2021).

Multimedia learning has evolved from static text and images to a proper visualizations which is animation. Animation is defined as the process of generating a series of frames containing objects that would made each frame appears as an alteration of previous frame in order to produce motion (Gonzales, 1996). Animation can be separated by three levels of analysis, that is technical, semiotic and psychological (Schnotz & Lowe, 2003; Betrancourt & Mayer, 2005). Besides, interactivity is also an important element of multimedia project. It is defined as the ability of someone to choose what will appear on the next frame or to change the frame sequence.

The internship offering using Multimedia project also considers sustainable learning element. Sustainable learning emphasises continuous learning process after initial exposure to it and may involve a process of learning to learn (Hays & Reinders 2020). In the context of project internship, interns need to develop their self-directed learning capability, which allows them to identify what knowledge is required and how it may be obtained. Self-directed learning appears to be the driving force behind the intern's ability to exercise control over learning decisions including internship process.

Self-directed learning may be observed as any accumulation of knowledge, development of skills, completion of tasks or self-development that individual students decide any approach or technique under any conditions at the appropriate time (Burkšaitienė et al. 2021). Thus, in project internship focus, the similar framework could

be utilized and consists of the appropriate component: accumulation of knowledge, development of skills, completion of tasks and self-development. The measurement consists of item to represent development of skills (technical readiness, discussion capabilities, research capability), accumulation of knowledge (goal setting, time management), completion of task (research commitment, research readiness), and self-development (procrastination management, and stress management).

4. Project Internship Experience using Self-Directed Learning Model

The programme structure offered by university aim to develop sustainable learning among student. However, students are only partially prepared for sustainable learning at the institution (Burkšaitienė et al. 2021). Despite fulfilling the indispensable technical and soft skills for engagement in the learning process, students are inclined to procrastination.

To develop sustainable learning in higher education institution, assessment plays an important role to empower students in the learning process and motivate them to apply the knowledge in the future (García-Jiménez, Eduardo Gallego-Noche & Gómez-Ruíz 2015). Assessment strategy is centred on three key challenges: (a) involving students in the assessment of their own learning; (b) giving feedforward designed to provide information about the results of assessment that can be acted upon proactively; and (c) implementing high-quality assessment tasks.

Feedback in terms of formative and summative assessment is a scaffolding process that facilitates continuity of student learning (García-Jiménez, Eduardo Gallego-Noche & Gómez-Ruíz 2015; Karupaiah et al. 2016). In internship programme, feedback from supervisor serves as critical element to support formative assessment to allow interns enhance and improve their learning. As feedback is considered as a vital element

to maintain or upgrade intern's motivation and performance, quality of internship programs and professional training of students, a proper feedback should be provided by company and academic supervisor regarding the intern's progress (Anjum 2020).

This case study is conducted through self-reflective of learning processes among virtual research-based internship program members in a serious game development and evaluation project. The method used is an empirical self-reflective approach to data collection, analysis and presentation of results. This self-reflective approach serves to establish research methodological trustworthiness and authenticity (Christensen et al. 2021).

Assessment using modified self-directed learning model in sustainable development and learning considers interns' experience throughout the training in professional competencies (Burkšaitienė et al. 2021). The original ten items instrument measures students' preparedness for sustainable learning from the perspective of self-directedness in the classroom setting. To suit internship setting, modification of internship environment takes place for example, changes from class readiness to research readiness and omission of examination preparation.

Two interns participate in Multimedia project internship study programme in a computer science faculty at a public Malaysian university. The instrument consists of nine items in self-directed learning in sustainable development and learning. These items measure readiness and preparation of sustainable learning at the institution (Burkšaitienė et al. 2021). The response applies a five Likert scale namely 1: very little, 2: little 3: moderate, 4: high and 5: very high. Likert scale could give more flexible range for respondents to express their opinions regarding the extent to which they possess the features in conducting Multimedia project internship.

Figure 1 presents the interns response on self-directed learning measurement during the internship. The radar chart compares the response from Intern1 (I1) and Intern2 (I2). Both interns report high score (scale 4 and 5) in the following items: Technical readiness, discussion capabilities, research capability, research commitment, research readiness, and stress management. At least one of the interns report moderate score (scale 3) in the following items: goal setting, time management, and procrastination management.

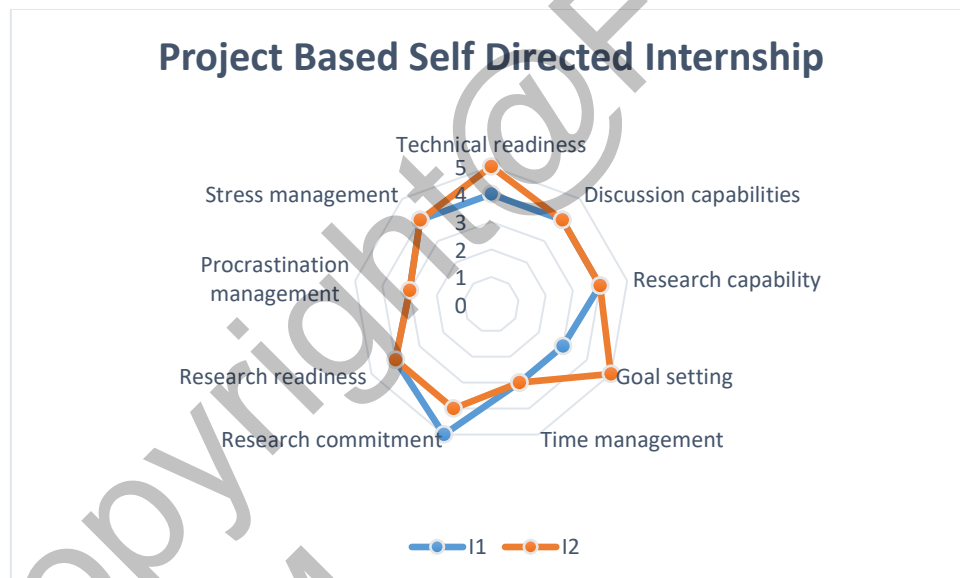


Fig. 1 Project Based Self Directed Internship

5. Discussion and Conclusion

Sustainable learning becomes a significant concern for future professionals and more so for Information Technology (IT) professionals and software engineers due to its

impact on the society (Mishra & Mishra 2020). It is significant to motivate and raise concern among students and faculty members regarding sustainability by including it into Software Engineering curriculum.

The case study applies experience of two interns in the Multimedia project internship using self-directed learning measures of the interns' preparedness for sustainable learning. Modified instrument using nine indicators comprise of technical readiness, discussion capabilities, research capability, goal setting, time management, research commitment, research readiness, procrastination management, and stress management. Both interns report high score (scale 4 and 5) in the following items: Technical readiness, discussion capabilities, research capability, research commitment, research readiness, and stress management. At least one of the interns report moderate score (scale 3) in the following items: goal setting, time management, and procrastination management.

Consistently, the interns express confident (high rating) in technical readiness, discussion capabilities, research capability, research commitment, research readiness, and stress management. They articulate moderately in three items: goal setting, time management, and procrastination management. The results suggest the interns' enthusiasm in project essential competencies in terms of technical skills in game development, communication capabilities in terms of providing verbal and written discussion and argument of research ideas, capable of conducting research and follow the research methodology. Furthermore, they display capabilities in conducting research as a committed researcher, and to manage research readiness, and related pressure out of the research such as fulfilling important dateline along other research duties within short time.

The interns appear to face some difficulties in certain areas. They concern regarding goal setting, particularly the required progress in the research timeline and manage their project activities at different stages of the research. In related issue, difficulties to fulfil the research goals according to the schedule suggests the interns to improve engagement in the research constructively and consistently.

Overall, the interns seem to be best equipped with research competencies comprise of technical readiness, discussion capabilities, research capability, research commitment, and research readiness. These competencies consent for effective involvement in the research process and is relevant for self-directed internship. This is consistent with previous research who found that students have the technical skills, soft skills, and infrastructure required for success virtual internship (J Bay 2021; Jennifer Bay 2017; Dent 2020). Nevertheless, research capabilities which are vital for self-directedness in project internship, they do not the only factors to support sustainable learning (Burkšaitienė et al. 2021).

The interns perceive themselves to be the least competent in goal setting, time management, and procrastination management. Their difficulties could be related to virtual working environment. Significant distractions appear while interns try to focus on their screens from their online communication and search dealings (Teng et al. 2021). The scenario results in procrastination, and procrastination can result in a confusion of what was required of them while doing the research, what to be achieved first, and research task priority (Burkšaitienė et al. 2021). Those difficulties invite for improvement by reflecting on those experiences, and adapting technological solutions to the specific circumstances of interns and supervisors (J Bay 2021).

The case study using descriptive presentation offers initial step to understand the challenges to fill in the gaps in the selected scope. In order to gain further insight of the goals, further investigations will be required. The limited sample in this study should be addressed in next stage to involve varieties of scope under project based internship. The project based internship continues to be a viable activity for the learning and growth of software engineering students for essential exposure to real world problems.

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