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Experiential Learning in Work-Integrated Learning (WIL) Projects for Metacognition: Integrating Theory with Practice

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Full research paper

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Abstract

Work-Integrated Learning (WIL) is an educational approach to improve workplace readiness. WIL achieves this by integrating theory with practice. The emphasis is on real experiences and practical problem-solving. Low-code platforms are a suitable teaching tool for the theory-practice integration. Yet, graduates also need metacognition to be workplace ready. Through metacognition, students learn how to learn by deeply reflecting on their thinking. However, WIL focuses on domain learning, lesser on metacognitive thinking. This study draws on experiential learning theory to examine WIL aspects on their influence on metacognitive thinking. In a survey, we test experiential learning factors (authenticity, active learning, self-relevance, and utility) and metacognition when students develop a software app. Results show that authenticity, active learning, and utility influence metacognition; however, self-relevance of the WIL does not. Consequently, IS educators should tailor the WIL to be authentic and useful, for active learners to support metacognition in low-code WIL teaching.

Keywords Experiential learning, metacognition, work-integrated learning, Mendix low-code platform, WIL.

1 Introduction

University education globally is challenged with creating workplace-ready graduates (Baska 2019). Indeed, companies feel a need for additional training of their newly hired graduates before they start in their jobs (Baker 2020). Although Information Systems (IS) graduates have an advantage because of the applied nature of the discipline, various reports suggest that also IS graduates are not 'workplace-ready' (Tonkin 2019). The use of textbooks and structured exercises may be the reason that the industry perceives teaching as failing to emulate workplaces with customer-driven uncertainties and dynamics (Maruping and Matook 2020b; Topi and Spurrier 2019).

Innovative educational approaches aim to create learning experiences for enhancing students' workplace readiness (Riordan et al. 2017). In particular, experiential learning theory proposes that students best learn when they acquire knowledge and skills from experiencing it (Kolb and Kolb 2017). In an experiential learning classroom, the students *learn through reflection on their doing*. Thus, experiential learning focuses on hands-on activities and reflections about them (Lewis and Williams 1994). The environment and relevant solutions are the experiences to develop new abilities and skills.

In Work-Integrated Learning (WIL) projects, an immersive experience is created to improve workplace readiness (Jackson 2017). WIL aligns with the fundamental understanding of experiential learning in emulating current workplaces (Wood et al., 2020). Both WIL and experiential learning focus on 'learning-by-doing' within real-world experiences. Indeed, WIL may allow for addressing calls in prior research that "*a quality university business education program must include an experiential learning component*" (Riordan et al. 2017, p. 60).

In IS education, WIL can utilize low-code platforms to develop software applications (apps) to create 'learning-by-doing' experiences (Wenham et al. 2020). In WIL low-code platform projects, students are tasked with developing an app based on inputs from external industry stakeholders. A low-code ISD task is a suitable learning experience for business school students because it requires only basic knowledge of user interface design, visual programming, and databases (Rymer and Koplowitz 2019).

We posit that graduates need metacognition to effectively perform work tasks while responding to organizational pressures (Krell et al. 2009). Metacognitive skills capture how well a learner learns new knowledge (Flavell 1979). Through metacognition, learners can control their thinking processes and know how to best organise, manage, and adapt their learning (Tanner 2012). The focus of metacognition is on *'thinking about thinking'* independent of a certain domain. Metacognition is essential for graduates to succeed in ever-changing workplaces and information systems (Krell et al. 2011). When graduates possess metacognition, they can adapt easily and quickly to innovations and changes because they acquired knowledge on how to learn new skills.

Experiential learning and WIL focus on domain learning, less on metacognitive abilities (Kolb and Kolb 2017; McCarthy 2016). The learning experience in WIL seeks to enhance the skills and knowledge related to the domain. For example, WIL in an information systems development (ISD) course focuses on the entire suite of development activities, including planning, designing, and implementing client requirements to create an information system (Matook et al. 2021). The intensified focus on practical problems and their solution moved away attention from reflections about learning. Yet, without metacognition, students are challenged to master their future workplace (Flavell 1979).

Therefore, in this study, we examine to which extent students in WIL projects are able to create metacognition. In particular, we examine to which extent experiential learning factors (authenticity, active learning style, self-relevance, and utility) are associated with higher levels of metacognition. We test the hypotheses in a quantitative study with 359 students in a university masters program with a large WIL project. The WIL project uses the low-code platform Mendix to create an app for a non-governmental organization (NGO). Results show that some aspects of WIL experiential learning create metacognition while others do not. The study contributes to the IS education research by showing the positive implications of WIL experiential learning and low-code platforms for improving students' workplace readiness. We also provide insights on WIL in technology-mediated experiences.

2 Background on Experiential Learning and WIL with Mendix

2.1 Experiential Learning and Metacognition

Experiential learning enables learners to create knowledge through experience (Hamilton and Klebba 2011; Kolb and Kolb 2017). The theory describes the value of learning-by-doing for knowledge retainment. Through a cycle of applying learned theory and conceptualizing it in practical settings, students gradually learn new knowledge. The experiences can range from small hands-on exercises to curriculum-integrated internships.

Experiential learning is commonly practiced across various disciplines, including IS (Bliemel and Ali-Hassan 2014; Carver 1996). For example, IS management students are given a computer simulation to *"better internalize the course curriculum by experiencing first-hand how budgets, risks, and employees behave in a dynamic environment"* (Bliemel and Ali-Hassan (2014, p. 118). Similarly, for agile project management, Hefley and Thouin (2016 show how a simulation game creates a learning experience and enhances IS students' knowledge on risk management approaches.

Experiential learning, sometimes also referred to as active learning, requires learners to be actively engaged in the experience to allow effective learning to happen (Jeffery 2010). Prior research shows that experiential learners develop new skills and are motivated to solve practical problems (Clem et al. 2014). Learners process the domain knowledge by taking the initiative in the experience, albeit in different ways (Sharp et al. 2020). Indeed, the theory acknowledges that learners prefer their engagement in the learning-by-doing cycle (Kolb 2015).

Metacognition is an important concept in higher education and has been argued to enable workplace-ready graduates (Bennett 2017). In its purest form, metacognition is conceptualized as *'thinking about one's own thinking'* (Flavell 1979). Metacognitive skills empower students to control their thinking processes and to learn how to learn: How to best organize, manage, and adapt their learning (Tanner 2012). As IS graduates are confronted with ever-changing workplaces, they need to know how to continuously learn new knowledge (Topi and Spurrier 2019). Thus, IS graduates need to have metacognition to be able to succeed in lifelong learning (Flavell 1979; Tanner 2012).

Metacognitive skilled learners assume the role traditionally filled by educators, e.g., planning, monitoring, or adapting learning methods and the learning process (Mugisha and Mugimu 2015). To achieve this, learners need to engage in reflections about their own thinking (Flavell 1979). Importantly, these reflections are metacognitive and thus, not the same kind of reflections expected in experiential learning. The difference in reflection is that metacognition focuses on *'thinking about thinking'* and experiential learning focuses on 'thinking about the problem-space and the context' (Tanner 2012).

Experiential learning needs to create metacognition to prepare students for lifelong learning (Flavell 1979). In a knowledge society, abilities about how to learn new knowledge are important because knowledge acquired during university education may not be useful for an entire work-life (Tanaka et al. 2016). Indeed, experiential learning prepares students for the workplace (Riordan et al. 2017). To emulate working in practice, IS educators can draw on an array of course designs (e.g., WIL) (Santoso et al. 2017). Yet, higher education needs to prepare students for a workplace far ahead in the future. To date, limited research exists that theorizes how a WIL experience can aid with building metacognition.

2.2 WIL Blended Learning with the Low-code Platform Mendix

WIL is "*an educational approach that uses relevant work-based experiences to allow students to integrate theory with the meaningful practice of work as an intentional component of the curriculum"* (Wood et al. 2020, p. 331). In a WIL classroom, students apply previously learned theory in practical contexts (Jackson 2017). In WIL, a structure is created so that learners can combine classroom learning with real work tasks provided by the industry. For example, students undertake real-world projects within the classroom (Jackson 2017). Over the last decades, WIL programs have become increasingly common in universities' curriculums. The focus of WIL is on problems and their solving to deliver concrete outcomes (Patrick et al. 2009).

Low-code development is a visual approach to software production that allows fast development of applications. Compared to traditional approaches, which include tasks of manual coding, testing, and deploying code and syntax, low code includes minimal hand-coding (Topi and Spurrier 2019). Students can use the app to build e-commerce reference models (Esswein et al. 2004) and various artificial intelligence applications (Maruping and Matook 2020a).

Low code programmers are not required to be fluent in coding languages and system architectures (such as Java or C+). In contrast, the development work is undertaken through visual interfaces, configurations, and a graphical drag-and-drop approach in the low-code ISD (Crumbly and Field 2020). As a leading full-stack platform, Mendix enables accelerated delivery of enterprise applications. Indeed, the Mendix platform is used across industries and by any size of an organization allowing to develop information systems of different majority (Crumbly and Field 2020; Zumpe and Ihme 2006). Therefore, using the Mendix platform in university education provides opportunities to embed employability (Crumbly and Field 2020; Litman and Field 2018).

Experiencing a real-world problem that is highly complex and uncertain is at the core of WIL. Using low-code platforms to develop an app provides this experience for students. When the request comes from real clients, the requirements are real and the deadlines are fixed. The WIL students undertake is a real experience of an ISD project as found in current workplaces. This study investigates to which extent the experience stimulates 'thinking about one's own thinking'.

3 Hypothesis

The hypotheses on WIL metacognitive experiential learning are based on experiential learning theory and metacognition enriched with the ISD literature.

Authenticity of the experience: A learning experience is authentic when it provides activities similar to those found in practice (Clem et al. 2014). In this case, the learner would be confronted with task characteristics - such as customer requirements and technology capabilities – similar to those that occur naturally in workplaces (Carver 1996). Thus, an authentic experience is one where learners are living through challenges, and complexities of real workplaces (Hamilton and Klebba 2011). The WIL project in this course was not a pre-planned, or simplified simulation/ case study (Patrick et al. 2009). Authenticity related to (1) ISD task of an app with the Mendix platform; (2) two industry partners (Variety QLD and Siemens Digital Service Industries AU); and 3) requirements lists, delivery dates.

The student's perceptions of how authentic the WIL is can vary. Thus, the students may also experience variations of the influence on metacognition. The more real the experience is perceived, the more the student wants to satisfy the client's requirements. Thus, the students engage in thinking about their thinking (metacognition), and ultimately, students want to be able to better approach the next ISD challenge. When learners approach the ISD task metacognitively, they undertake thinking on how to best plan and monitor the process of creating the solution (Tanaka et al. 2016). However, when students perceive the WIL not as authentic and rather as a structured teaching tool, they are going to exert less cognitive effort to learn how to satisfy the clients. Thus, the student would not reflect on how to improve their ISD abilities. Thus, we hypothesize:

H1: Perceptions of WIL authenticity have a positive impact on the learner's metacognition.

Active learning in the experience: Vygotsky's (1978) social constructivist theory argues that involvement with an experience influences the knowledge creation process (Cummings et al. 2017). An active learner is one who participates in the 'physically doing of something and the reflection of it", either individually or collectively (Bernstein, 2018). The WIL classroom – virtual or face-to-face – affords physical doing opportunities through the real project of developing the Mendix apps for the client. For example, students were tasked to develop new features (bookmarks, password recovery function). In particular, their app development was self-directed and not guided by a teacher.

When WIL is undertaken in a university course, some students may feel overwhelmed by the complexities and dynamics of the project (Patrick et al. 2009). Hence, the students might choose not to get actively involved in the app development. Prior research shows that when students experience delivery pressure, they seek to simplify the path to achievement and resort to surface learning to pass the course or unit (Carver 1996). In cases where students do not actively learn, they miss out on metacognitive learning. Eventually, the educator provides students with the theoretical knowledge on how to implement a feature, and this requires no learner's reflections. Only when students actively learn, they think about their thinking and how new knowledge has been created (Tanaka et al. 2016). This reflection includes thinking about which approaches were used, which sources were drawn on in the pursuit of the app development. Thus, we hypothesize:

H2: Active learning in the WIL has a positive impact on the learner's metacognition.

Self-relevance of the experience: Key for a successful experiential learning experiences is the students' understanding of the experience as relevant to the *Self* (Carver 1996). When students perceive something as self-relevant, then they learn in ways that allow them "*to internalize and reflect on their past experiences to connect new and old information*" (Clem et al. 2014). For example, the more the students perceive a personal connection with the ISD task, the customer [NGO], and Mendix, the more likely they are to reflect on how to learn better. The extent of the metacognitive reflections increases with growing perceptions of self-relevance that are stimulated by personal connections.

When students lack perceptions of self-relevance, they may disengage from the experience and potentially withdraw from it as documented for high school dropouts (Bridgeland et al. 2006). In the WIL project, students may be less clear about why they are asked to create the app for the NGO and thus, they may question their participation in the development work (Carver 1996). The lower self-relevance reception may inhibit students from reflecting on how to develop a better app.

Only when the students' perceptions of self-relevance are high, they start internalizing and reflecting on the learning behaviours (Vansteenkiste et al. 2018). Metacognitive students increase their efforts in the WIL tasks, and start to closely monitor, adapt, and enhance the learning with and about Mendix (Carver 1996). The more students can relate the app and the ISD process to themselves and esp. their interests and personal preferences, the more likely they will utilize richer metacognitive activities (thinking aloud, reflection in Scrum retrospectives) (Boud et al, 1994). Thus, we hypothesize:

H3: Self-relevance perceptions of WIL have a positive impact on the learner's metacognition.

Utility of the experience: The value of learning in a 'here and now' experience manifests when it supports the achievement of employability goals (Priniski et al. 2018). The WIL project in the courses is directed towards enhancing the students' success in finding a job. The utility of the experiences captures its future-oriented practical value for the students (Carver 1996). When students are able to connect ongoing and past experiences from the WIL to possible future experiences in the job, they perceive high levels of learning utility (Clem et al. 2014).

In the course, the theoretical content is linked to the practical context of future workplaces through the WIL (Patrick et al. 2009). Indeed, the learning of theoretical ISD concepts in the initial lectures (first four to six classes at the beginning of the semester) was used to undertake the app development. When students believe in the utility of the WIL project, and the context of experiential learning (i.e., the app for NGO), then their reflection should focus on their thought processes and how to better approach the learning next time. Thus, we hypothesize:

H4: Perceptions of utility of WIL have a positive impact on the learner's metacognition.

4 Method

4.1 Participants

For the study, participants are postgraduate students in a large IS course that offered a comprehensive WIL experience. The course offered two lectures per week. A total of 236 students who were enrolled in the first lecture were invited to participate in the study. Of those, 231 students attempted the survey. After deleting incomplete responses, the sample is 226 participants (response rate of 95.8 percent).

The sample of our study includes 63 percent females with an average age of 25 years. On average, participants spent about 7.8 hours per week studying for the course outside the teaching (i.e., lectures and tutorials). The participants were mainly international students (98 percent South East Asia) and 97 percent of participants were enrolled in business programs, i.e., 65 percent in Master of Commerce, 32 percent in Master of Business, and only 3 percent were from a Computer Science program.

The primary WIL activity is the development of a Communication App for the Kids programs at the non-government organisation, Variety Queensland (NGO). The students had to use the low-code platform Mendix. They worked in teams to experiences the benefits and challenges of interpersonal relationships in real-world ISD workplaces (Madsen and Matook 2010). The NGO served as the software client and the technology partner Siemens Digital Industry Services was a mentor for the Mendix platform. The NGO provided requirements, gave feedback, and undertook acceptance testing of software deliverables. The WIL took place in a virtual classroom environment, and all teaching and learning were done via Zoom.

The WIL project was created so that multiple touchpoints with the technology partner and the NGO during the app development provided opportunities for feedback and reflection. Specifically, training sessions and *design sprint meetings* were held in the form of guest lectures to undertake the requirements gathering for the app development. In these sessions, students interviewed the customers (i.e., project coordinator and youth ambassadors) and interacted with developers from the partner organizations. The requirements were captured in the low-code platform Mendix. In addition, students participated in sprint retrospectives to review past design meetings, identify areas of strengths and weaknesses, and set actionable goals (Stark 2016; Wiesche 2021).

4.2 Data Collection

Students were recruited to participate in this research through course Blackboard announcements and instructors' (lecturer and tutors) introductions in class. The instructor gave a 5-minute introduction to the study during the lectures, followed by tutors giving the same introduction during tutorials of the same week. Participants were asked to complete the surveys online via a Qualtric's link.

Various measures were adopted to incentivize participation for a high response rate and to minimize dropouts, including notification of the data collection, endorsement of the research project by the lecturer and tutors, and the assurance of data privacy and security for all participants. We kept the survey length reasonably short by, as noted, collecting different constructs at different time periods.

4.3 Measures

The survey instrument included constructs with multiple items. We adapted existing scales from the literature wherever possible; however, we made adjustments in the wording to account for the study context, focusing on WIL blended learning in a university course on systems analysis and design.

Dependent variable: Metacognition was assessed with a reflective seven-item scale adapted to our systems analysis and design context based on Schmidt and Ford (2003), Ford et al. (1998) and Pintrich et al. (1991). The scale assessed to what extent students control their thinking processes about learned knowledge by monitoring, reflecting, and adapting their learning during the course. Example items include: *When I practiced a new skill in the Mendix development, I monitored how well I was learning its requirements.*

Independent variables: The variables for experiential learning – authenticity, active learning, self-relevance, and utility – were adopted to measure our WIL experience (Clem 2014). Clem and colleagues (2014) developed items to evaluate learners' perceptions of different components of experiential learning activities. Example items include: Authenticity-*I expect real-world problems to come up during my learning experience*. Active learning-*The learning experience requires me to really think about the information*. Self-relevance-*The learning experience is enjoyable to me*. Utility-*The learning in the course will be useful to me in the future*.

Control variables: We include three control variables, viz. age, gender, and study time (hours/week).

5 Results

5.1 Measurement Evaluation

We first tested the validity and reliability of the measures following the guidelines suggested by Fornell and Larcker (1981). Internal consistency reliabilities were first evaluated using Cronbach's alpha, which exceeded the recommended value of 0.70 for all constructs (see Table 1; Hair et al. 1998). As the second test of reliability, we consider the composite reliability measure. Scales with *pc* greater than 0.7 are reliable (Straub et al. 2004). Table 1 indicates that all constructs met the required *pc* cut-off value.

To test convergent validity, we used the three criteria suggested by Fornell and Larcker (1981): 1) all indicator factor loadings (λ) should be significant and exceed 0.6; 2) composite reliability (*pc*) should exceed 0.7, and 3) average variance explained (AVE) should surpass 0.5. Table 1 shows that all factor loadings (λ) were significant at $\rho < 0.001$ and exceed the threshold of 0.6. Furthermore, AVEs were also examined. We found they were above 0.5, indicating sufficient convergent validity.

Latent variable	Items	Mean	Standard deviation	Factor loading	Cronba-ch's α	Composite reliability [*pc*]	AVE
Metacognition	Metacognition_1	4.21	.74	.81	.91	.91	.60
	Metacognition_2	4.23	.75	.74			
	Metacognition_3	4.06	.82	.77			
	Metacognition_4	4.16	.86	.77			
	Metacognition_5	4.25	.77	.75			
	Metacognition_6	4.23	.78	.85			
	Metacognition_7	4.16	.75	.71			
Authenticity	Authenticity_1	4.25	.73	.70	.78	.76	.51
	Authenticity_2	3.94	.92	.60			

	Authenticity_3	4.12	.76	.83			
Active Learning	ActiveLearning_1	4.46	.76	.86	.78	.83	.63
	ActiveLearning_2	4.24	.79	.83			
	ActiveLearning_3	4.39	.73	.68			
Self-Relevance	SelfRelevance_1	4.46	.65	.65	.78	.77	.53
	SelfRelevance_2	4.19	.79	.70			
	SelfRelevance_3	4.28	.77	.82			
Utility	Utility_1	4.26	.70	.86	.88	.85	.58
	Utility_2	4.34	.73	.80			
	Utility_3	4.23	.83	.71			
	Utility_4	4.43	.66	.67			

Table 1. Reliabilities and Validity of Measures

Ensuring discriminant validity, we examined constructs correlations through square root of AVE (Fornell and Larcker 1981). In Table 2, the diagonal displays the square roots of AVEs and it suggests that discriminant validity was met. We noticed, as per Table 2, some correlations between independent variables were relatively high, but still below the conventionally accepted threshold of 0.8. Thus, we decided to further investigate to which extent our independent variables exhibit multicollinearity. Hence, we examined multicollinearity by estimating the variance inflation factors (VIFs). The results show all VIFs were well below the conservative threshold 3.33, which evidenced there were no multicollinearity issues in our dataset (1.01 < VIF < 2.62; Cenfetelli and Bassellier 2009). We also tested for common method biases and found no issues (e.g., Harman's one factor passed).

Latent variable	Mean (SD)	VIF	1	2	3	4	5	6	7	8
1: Metacognition	4.19 (.63)	n/a	**.77**							
2: Authenticity	4.10 (.67)	2.05	.63**	**.71**						
3: Active Learning	4.37 (.64)	1.84	.59**	.59**	**.79**					
4: Self-Relevance	4.31 (.61)	2.30	.57**	.57**	.56**	**.73**				
5: Utility	4.31 (.63)	2.61	.64**	.65**	.57**	.72**	**.76**			
6: Age	24.6 (5.18)	1.02	0.09	0.08	0.08	0.08	0.07	**n/a**		
7: Gender	1.64 (.48)	1.07	0.02	0.00	.13*	-0.05	0.07	0.09	**n/a**	
8: Study Time	7.61 (5.79)	1.03	.15*	.14*	0.02	0.07	0.11	-0.03	-0.06	**n/a**

*Table 2. Construct Correlation and Multicollinearity Assessment (Note: * p < .05, ** p < .01)*

5.2 Hypothesis Testing

Following Cohen et al. (2003, we employed hierarchical linear regression to test the hypotheses using SPSS 27. Hierarchical linear regression is a special type of multiple linear regression which is used to statistically control for certain variables (e.g., demographic factors), to assess whether adding hypothesized variables significantly improves the model's ability to predict the dependent variable. The variables were entered in two hierarchical steps. In Step 1, we entered the control variables of age, study time, and gender. In Step 2, the hypothesized constructs of experiential learning were entered.

Table 3 shows the results for the controls only model and the full model. The controls-only model is not significant ($F(3,222) = 2.398$, $p=0.069$). When adding the four constructs, a significant regression equation is found ($F(7,218) = 35.343$, $p<0.001$). The controls-only model has an R^2 of 0.031, indicating that the control variables account for 3.1% of the variance in metacognition. When the four constructs are added, R^2 increases to 0.532 (53.2% of the variance in the metacognition explained by the seven variables in the model), suggesting a 'large' effect size. We also conducted incremental F test of the R2 change. An R^2 change of 0.500 suggest that the addition of four hypothesized constructs contributes 50% additional variance accounted for in metacognition (F change = 58.197, p < 0.001).

As hypothesized, authenticity is significant ($Beta$=0.240, p<0.001), as is active learning (Beta=0.230, p<0.001), and utility (Beta=0.258, p=0.001). Self-relevance is not significant (Beta=0.101, p=0.163). Thus, hypotheses H1, H2, H4 are supported, however hypothesis H3 is not supported.

	Step 1: Controls Only Model	Step 2: Full Model	Outcome
Constant	3.742*** (.247)	.548* (.278)	
Age	.011 (.008)	.004 (.006)	
Gender	.024 (.087)	-.032 (.063)	
Study Time	.017* (.007)	.008 (.005)	
Authenticity		.240*** (.062)	H1 supported
Active Learning		.230*** (.062)	H2 supported
Self-relevance		.101 (.072)	H3 not supported
Utility		.258*** (.075)	H4 supported
R^2	.031	.532	
Adjusted R^2	.018	.517	
R^2 Change	.031	.500***	
F Change	2.398	58.197***	

*Table 3. Results of Hierarchical Linear Regression (Note: unstandardized regression coefficients are shown, with robust standard errors in the bracket. Significance at * p<.05, ** p<.01, *** p<.001)*

6 Discussion

6.1 Theoretical Implications and Contributions

This research provides several contributions to the literature. First, it enriches our understanding of IS education with WIL as the course pedagogy. Prior research suggests metacognition as an important enabler for high performance in various domains, including in higher education (Flavell 1979; Tanner 2012). However, prior research has not examined metacognition in WIL. This study is the first to show that even in classrooms with a strong focus on real-world problems, students can build metacognition. Thus, we provide initial evidence on how to increase workplace readiness in IS graduates while also nurturing their reflections and advancing their thinking processes.

Second, we contribute to the literature on experiential learning. Prior research shows the positive effects when students perform learn-by-doing (Kolb and Kolb 2017; McCarthy 2016). With a focus on the experience, students obtain new knowledge on the domain and can directly apply it to the task. ISD as an applied discipline provides various opportunities for experiential WIL. This study is the first to examine experiential learning in a context (WIL) that expects a fully working product at the end. The results confirm that students perceived the learning to be an authentic and concrete experience similar to those they expect to find in workplaces. The utility of the WIL is clear to the students and they relate it to their *Self* because they perceive it as preparing them for their future workplaces. Further, students actively engage in the learning. Thus, our study shows that WIL is effective experiential learning.

Third, we also contribute to the theoretical understanding of metacognition. Qualitative work suggests experiential learning needs to create metacognition (Tanaka et al. 2016). Yet, quantitative studies (surveys, experiments) with statistically significant results are missing. This study is the first that shows that factors of experiential learning significantly impact the thinking of students about their thinking (i.e., metacognition). Experiential learning promotes reflections on the experience and our study shows it also promotes reflections on the thinking (i.e., learning how to learn). Yet, the factor of self-relevance was not significant suggesting. We can only speculate why this is the case. It is possible that students struggled to develop a personal connection with the WIL environment. This lack of perceived relevance may be the result that students did not know the NGO personally, or that they could not perceive a connection to the technology partner Mendix. Furthermore, prior research shows the differences between face-to-face teaching and online teaching (Young and Duncan 2014). As such, the delivery of the course with all classes being delivered via zoom may have further contributed to the lack of self-relevance impacting the creation of metacognitive skills.

Finally, we contribute to the IS literature on low-code platforms as a CASE tool for app development by novice users. Low-code platforms are an approach to development that utilizes visual interfaces (e.g., graphical drag-and-drop) to create apps with minimal hand-coding (Litman and Field 2018). Through low-code platforms, students in business school IS programs are provided with the experience of creating apps, which would otherwise be outside the educational goals of the program. The business students may be contextualized as novice users of CASE tools, and their successful development may revive the discussion of user-led ISD initiatives (Lawrence and Low 1993).

6.2 Contributions to Practice

The impacts of the research are related to various areas. Findings impact on practices of teaching at higher education and on ISD work using low-code platforms with novice users (i.e., students). At universities, experiential learning philosophies benefit from a focus on metacognition as a means to enhance employability. It is of crucial importance to build skills at the 'meta' level to encourage reflections about students' thinking processes so that they can learn how to learn.

Our findings also impact ISD practices by providing insights into the use of low-code platforms by business users and novice users. The students may serve as a proxy for practitioners who lack IT coding skills but have training on ISD analysis and design. The WIL blended learning shows how non-IT professionals can self-direct the development of apps of value to the business. When students believe in the authenticity of the WIL, are active learners, and believe in the utility of the WIL experiences, then they create metacognition for mastering the demands of today's workplaces.

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