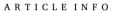Enable (Education and Learning)

Stop sanitizing project management education: Embracing Desirable Difficulties to enhance practice-relevant online learning

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ABSTRACT

By resisting the temptation to "sanitize" project management education, we show how embracing unpredictability and authenticity can enhance learning. In response to COVID-19 restrictions, we moved an interactive role-play online and explored the resultant learning through analysis of student performance and students' individual reflections. Findings suggest that the online role-play boosted learning by exposing students to a challenging environment, which included tasks that stretched their capabilities and thus enhanced the level of "Desirable Difficulties". Drawing on the concepts of Desirable Difficulties and "role-play-as-rehearsal", we discuss the benefits of formative "testing" and propose a new concept: "role-play-as-testing". Additionally, benefits to learning were attributed to the online setting, which reflects the increasing virtualization of practice. We hope to inspire other educators to embrace Desirable Difficulties and resist the temptation to sanitize project management education to create opportunities for future project leaders to test their learning in authentic settings.

1. Introduction

Project management education quickly moved online due to COVID-19 restrictions in 2020, which raised many questions about the methods to employ and the effects on student learning. We moved a role-play online and explored how this online role-play affected student learning. Findings suggest that students can benefit from "Desirable Difficulties" in project management education, particularly when embedded in authentic educational settings. Exposing students to challenging environments and setting tasks that stretch their capabilities ("difficulties") can boost the depth of learning. We present evidence that Desirable Difficulties, when appropriately integrated into an online educational experience, can enhance the ability of students to adapt and respond to unpredictable aspects of project management practice. The resultant learning can build technical and procedural knowledge as well as human skills for interaction, collaboration, reflection and the appreciation of team member differences.

This diversity of learning is important because methodological and technical acumen is insufficient to deliver projects; human skills are a key capability for project managers (Brière et al., 2015; Caniëls et al., 2019; Keil et al., 2013; Stevenson and Starkweather, 2010; Syed et al., 2010; Van Der Hoorn and Whitty, 2017). Furthermore, project work is

contingent on external factors; this demands that project managers reflect upon their practice and adapt to suit the context. (Bredillet et al., 2015; Rasnacis and Berzisa, 2017; Sewchurran and Barron, 2008; Tripp and Armstrong, 2018; Winter et al., 2006). Preparing students for professional practice is enhanced by the use of "authentic" tasks and assessments that reflect the practices and outputs encountered in the profession (Way et al., 2021; Wiggins, 1989). Although educational experiences cannot be fully authentic, degrees of authenticity can be incorporated by referring to or simulating workplace environments and processes, and by assigning assessments that resemble deliverables from project management practice.

Consequently, as the interactions between people are an essential part of project management, simulating workplace interactions in the classroom better prepares students for practice. Likewise, project management education that embeds opportunities for unpredictable change and the resulting challenge, discomfort, improvisation and adaptation can help prepare students for the reality of project work. Role-playing during in-person classes is an effective method for enabling students to cultivate project management capabilities (Geithner and Menzel, 2016; Schmitz, 2018); however, the project management literature does not discuss the use of online role-plays. It could be that role-plays, which allow students to follow a range of strategies, are considered too

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unpredictable for online learning environments. Educators may be tempted to "sanitize" classroom experiences and minimize unpredictable aspects by presenting "clean" and predictable material to ensure that specific learning outcomes are achieved. This temptation may be stronger when preparing material for online learning; however, in online environments, it is equally important to avoid sanitizing project management education and to prepare students for the ambiguities of project practice (Connolly et al., 2020).

With this in mind, we drew upon the concepts of Desirable Difficulties (conditions that, while challenging, lead to enhanced learning) and "role-play-as-rehearsal" (akin to rehearsing before a theatre performance to gain experience) to create and evaluate an online learning module on agile project management practices that offered an authentic experience for students. Findings reveal that Desirable Difficulties boosted student learning and that the learning was enhanced by the authenticity of the experience. Two major themes were evident from the students' individual reflections on the online role-play experience. First, students consistently reported that the role-play, while challenging and at times confusing, served to clarify agile practices and resulted in enhanced understanding of and confidence in using the agile methodology. Second, and surprisingly, our study revealed that rather than the online format acting as an obstacle to overcome in order to learn, it served to deliver additional learnings by enhancing the authenticity of the environment and strengthening the students' understanding of project management in practice.

These findings make two key contributions, spanning both the education and project management literature. First, we add to the Desirable Difficulties literature by finding benefit in "testing" for learning in authentic settings and proposing the term "role-play-as-testing". Second, we show how project management education that embraces the complex challenges of the lived experience (in this case through working online) can create learning opportunities that increase authenticity and therefore prepare students for the "real world" of project leadership.

This article is organized as follows. We start with the theoretical context for our study in section 2, elaborating on our motivation and introducing the concepts of Desirable Difficulties and role-play-as-rehearsal. We then describe the online role-play in section 3 and our evaluation methodology in section 4 before presenting the findings in section 5. To conclude, our discussion in section 6 addresses the research questions on how role-plays and an online format affect student learning, followed by a summary of the implications and future research, with our final remarks presented in section 7.

2. Theoretical context

2.1. Preparing students for the lived experience of project management

Project management research finds that project management practice is context dependent; benefits from reflective practice; and requires more than technical or methodological acumen. Research on project management education increasingly recognizes these aspects of the "lived experience" and notes the challenge educators face in embodying this reality in project management education (Leimbach and Goodall, 2017; Ramazani and Jergeas, 2015).

The workplace is becoming increasingly projectified, with an increasing range of activities conducted in project form (Hodgson et al., 2019; Maylor and Turkulainen, 2019). However, the resulting proliferation of projects does not equate to "one-size-fits-all" in terms of project management practice. A contingency perspective on managing projects highlights the importance of tailoring the approach to the context (Ahimbisibwe et al., 2015; Chipulu and Vahidi, 2020; Shenhar, 2001). Similarly, the phrase "no project is an island" emphasizes the situatedness of projects in diverse and unique contexts; projects and their management must be considered with reference to their history and context (Engwall, 2003: 789). Relevant to this study is the recognition that agile methodologies need to be tailored to the environments in which they are deployed (Rasnacis and Berzisa, 2017; Tripp and Armstrong, 2018).

Educating project managers to evaluate the context of the project and tailor their management approach presents a challenge for educators. Practitioners have criticized project management education for failing to equip students with the ability to adapt their approach to a project's context, and call for teaching experiences that enable students to "act out" project management scenarios in "real settings" (Ramazani and Jergeas, 2015: 45, 47). This ability to adapt project management practice to specific real-world contexts has links with the cultivation of reflective practice (Leimbach and Goodall, 2017).

There are benefits to practitioners continually reflecting on their practice (Bredillet et al., 2015; Sewchurran and Barron, 2008; Winter et al., 2006) and widespread calls for reflective practice to be embedded in project management education. For example, programs targeting practicing managers ask students to reflect on their own professional experiences (Berggren and Söderlund, 2008); this can take the form of "relevating" (disrupting dominant logics they may have come to accept) through provocations that cause students to think differently about their practice (Paton et al., 2013). Reflective practice can help close the theory–practice gap through active educational experiences that better support practitioners in reflecting on how to act in pluralistic contexts (Bredillet et al., 2015). A similar sentiment is expressed by Cicmil and Gaggiotti (2018); their Responsible Project Management Education proposal takes issue with a universally applicable approach to practice and argues for theoretical plurality in curriculum design and the inclusion of reflective experiential pedagogies.

Project management education plays an important role in building students' interpersonal skills and their awareness of aesthetics to support modern project management approaches (Louw and Rwelamila, 2012; Pant and Baroudi, 2008; Ramazani and Jergeas, 2015; Sewchurran, 2008; Stevenson and Starkweather, 2010; Van Der Hoorn and Whitty, 2016). Project management has evolved from a largely technical and rational approach that favours methodological and technical acumen to one with a broader perspective that appreciates the socio-political nature of project work (Cicmil et al., 2006; Lindgren and Packendorff, 2006; Van Der Hoorn and Whitty, 2015). Interpersonal capabilities, such as facilitating collaboration, creating a vision and motivating teams, are central to project work and are deemed core project management competencies (Brière et al., 2015; Caniëls et al., 2019; Keil et al., 2013; Stevenson and Starkweather, 2010; Syed et al., 2010; Van Der Hoorn and Whitty, 2017). The practice of such capabilities is strongly contextual and therefore difficult to formalize; such tacit knowledge is often better developed through experiential learning (Pant and Baroudi, 2008; Van Der Hoorn and Whitty, 2019).

2.2. Role-plays-as-rehearsal

Role-plays are a form of experiential learning that provide students with a taste of the "lived experience" of project managing and forms a bridge between theory and practice. Experiential learning commonly enables students to apply or experience generic tools and techniques in specific contexts and includes a critical reflection; Kolb's experiential cycle is synonymous with this educational approach (Kolb and Kolb, 2018). Management education regularly employs role-plays for experiential learning (Chen et al., 2020; Gibson et al., 2017; Hamdani, 2018). Role-plays create a hypothetical reality that reflects everyday life and by engaging in a role in this "make-believe" reality, the participants discover new insights (Heinrich, 2018). Role-plays can create the "opportunity to drop other competing demands to pay full attention to the phenomenon of an interaction, to become aware perhaps for the first time of questions, fears, and personal concerns, and to develop the courage and resources to begin to address them" (Heinrich, 2018: 4–5).

Role-play-as-rehearsal is a type of role-play that enables participants, with the support of sympathetic teachers, to build their competence in an environment of trust and group learning (Heinrich, 2018). This style

of role-play appreciates that there will be a trial and error period and focuses on process rather than outcome; in role-play-as-rehearsal, the "performance" is not assessed (Heinrich, 2018). As role-play participants in previous studies focused on leadership education have reflected, "you learn more when you have to act" and "it's a way of preparing for working life" (Westrup and Planander, 2013: 204–5).

Role-plays have been found to be effective in building students' project management capability during in-person learning. For example, Geithner and Menzel (2016) found that a two-day role-play leveraging Lego Serious Play built conceptual project management knowledge and related soft-skills. Schmitz (2018) tested an in-person role-play to build knowledge and skills in the Scrum process, and Maxim et al. (2017) described a role-play, set in a game studio, that prepared students for real-life software projects by building their soft-skills. These studies demonstrate the educational benefits of in-person role-plays; however, the literature does not evaluate the use of *online* role-plays for project management education. We note that the term "role-play" has been used to describe interactions in virtual worlds through software mediated simulations in literature such as Maratou et al. (2016); however, for the purposes of this paper, role-play refers to situations where students adopt roles and interact with each other synchronously. The type of role-play we refer to can be in-person or online, but it is not mediated by a virtual world.

Authentic settings enhance the ability of role-plays to function as a "rehearsal" for real-world practice. Even before the COVID-19 pandemic, project management was increasingly conducted in online environments, generating interest in virtual teams and online project management that is reflected in a wide body of literature (see, e.g. Walker and Lloyd-Walker (2019); Zhang et al. (2018); Zuofa and Ochieng (2021)). The COVID-19 pandemic accelerated virtual working and strengthened the importance of project managers' ability to collaborate virtually (Müller and Klein, 2020). Since online settings increasingly reflect the reality of project management working environments, it follows that there would be benefits from conducting role-play-as-rehearsal in online settings. Online project management education that best reflects the realities and uncertainties of practice is recommended to prepare students for managing projects and project teams (Connolly et al., 2020); however, the literature has not yet evaluated the use of role-plays for project management education in online settings.

2.3. Desirable Difficulties in education

Role-play-as-rehearsal can be viewed as a trial and error approach that enhances learning in a way that is aligned with the "generation effect" that can result from Desirable Difficulties. The Desirable Difficulties concept, grounded in human learning and memory research, draws attention to conditions that promote long-term retention and transfer of learning (Bjork and Bjork, 2020). The term "desirable" emphasizes that an appropriate use of "difficult" tasks or conditions can support long-term learning outcomes; Bjork and Bjork (2011: 56) use the phrase "making things hard on yourself, but in a good way". The Desirable Difficulties literature draws attention to the difference between learning and performance (Bjork and Bjork, 2011; Bjork, 1994). Learning can be thought of as a long-term change that we infer from the ensuing performance. However, learning can occur without evidence of performance. Equally, there may be an ability to "perform" after instruction, without sustained learning or the ability to transfer the learning to different contexts (Rovers et al., 2018; Zepeda et al., 2020). Bjork and Bjork (2011) proposed four conditions that increase the Desirable Difficulties associated with learning experiences:

1. Varying the conditions of learning (rather than maintaining consistency).
2. Interleaving instructions on separate content areas.
3. Spacing sessions on the same content area.

4. Using testing as part of the learning process (rather than just for a summative assessment).

The first and fourth of these conditions theoretically inform this paper and are elaborated on here. The first condition, varying the conditions of the learning, can increase the contexts in which students can apply their learning (Bjork and Bjork, 2011). Experiments reveal that the challenges invoked by unpredictability and variability in learning conditions enhance long-term performance, in particular, the ability to transfer the learning to novel contexts (Bjork, 1994) – a capability that is critical in the "one-size-does-not-fit-all" nature of project work.

Using testing as part of the learning process, the fourth condition proposed to increase the level of Desirable Difficulties, promotes the benefits of using testing to prompt learning, rather than extensive instruction, examples and illustrations (Bjork and Bjork, 2011). The Desirable Difficulties literature refers to the "generation effect" and "retrieval practice" to discuss the role of testing. Generation effect refers to the ways that experiences such as testing, which engage the mind and promote further thought and exploration, can embed learning more deeply than reading or listening to explanations. Retrieval practice is a related term and refers to the well-established ways that learning is boosted by conditions that promote learning through testing. Each time a learner has an opportunity to answer a question or execute a practice, their learning potential is increased. One benefit of retrieval practice (testing) is metacognition awareness, where students reflect on (and learn about) their learning. Such awareness prompts student engagement and directs their focus to areas where further development is required. Simply re-reading or listening to information (re-exposure) is not as effective as attempting to remember or apply presented information or skills (Bjork and Bjork, 2011).

Retrieval practice is well discussed in the literature. For example, Bertsch et al. (2007) meta-analytic review of the generation effect reveals a long history of research on retrieval practice, which is also represented in more recent publications, such as a case study on incorporating testing for learning in a law program (Schulze, 2020). The body of research on retrieval practice reveals the benefits of testing on learning; however, we note that these empirical studies are based on "declarative" testing, rather than testing for "procedural" skills, which are of importance in project management education.

Successful use of Desirable Difficulties to enhance learning requires students to be appropriately motivated to sustain effort and overcome challenges (Zepeda et al., 2020). Contrary to the proposition that embedding Desirable Difficulties in tasks enhances learning, by the age of seven, many learners report perceptions that an easy (as opposed to difficult) learning experience will enhance learning (Finn, 2020). Students willingness to engage with challenging educational environments is affected by their prior experience, that is, previous success can support enhanced learning but prior failure can limit their willingness to engage with a learning process in which they were previously unsuccessful (Finn, 2020). Motivational strategies to maintain student engagement when leveraging Desirable Difficulties include revealing the value of the Desirable Difficulties versus the costs; reframing setbacks when undertaking retrieval practice; chunking activities to ensure achievability; and providing choice (Zepeda et al., 2020).

2.4. Literature review summary and research questions

The literature consistently reports that students can benefit from project management education that enables the application of methodological and technical acumen in specific contexts while also building their human skills and encouraging reflective practice. Role-plays are an experiential approach that meets this need. However, despite the calls for ensuring authenticity in role-play settings and the increase in online project management education, evaluations of role-plays are usually limited to in-person formats. Given the importance of preparing project managers for the lived experience of practice (which increasingly

includes collaborating online) and the need to offer project management education virtually, we ask the following research questions:

RQ1: How do online role-plays affect student learning about project management methodologies?

RQ2: How does an online format affect student learning about project management practice?

3. The educational experience: an online role-play

This section overviews the design and context for the education experience evaluated during the study and the following section explains the ways we evaluated the experience. A major learning objective in our postgraduate course on project management approaches for innovation is to understand and apply agile project management practices. We first developed the agile role-play for in-person classes to provide students with an experience that would strengthen their understanding of agile project management and their capability and confidence in applying agile practices. Informal feedback and student results suggested that the agile role-play was successful, but we did not conduct a formal study on the in-person role-play. When the COVID-19 pandemic forced teaching to move online, we redeveloped the agile role-play to suit the online environment. At the same time, we decided to conduct the study reported in this paper to explore the influence on student learning of the online role-play and of the online format in general.

During the agile role-play, student groups developed a product they had previously defined in an earlier module of the subject. During the in-person version of the role-play, students developed physical prototypes out of craft materials, whereas during the online version, student groups developed prototypes for virtual products, such as websites or apps. Before the role-play, the students learned about agile practices through reading and an interactive lecture session. As there are many different approaches to agile project management, we explained that although the Scrum framework had been chosen as the basis for this role-play, the aim of their learning was to extend beyond a particular agile practice. Our primary learning objective in both the in-person and online role-play was to enhance student understanding of agile project management and build the students' capability and confidence in applying agile practices.

The role-play incorporated Scrum "ceremonies" such as sprint planning, stand-ups, sprint cycles, reviews and retrospectives. Student teams of five to six members adopted the roles of Product Owner, Scrum Master and Team Members, and they completed a full cycle of agile practices during the role-play followed by sprint planning for a further cycle. As with the in-person role-play, the timeframes for each stage of the agile process were compressed so students could experience several weeks of an agile process in a few hours. However, due to the anticipated challenges of collaborating online, we decided to increase slightly the length of the compressed stages ("ceremonies") for the online role-play. As with the in-person role-play, the online role-play was supported by two educators to keep time, provide direction to the entire cohort and to move between groups to facilitate and mentor each team. For the online role-play, Zoom breakout rooms provided groups with a "space" to work, and educators were able to move between the spaces.

The design of the online role-play aimed to recreate the energized and positive atmosphere of the in-person role-play and to stimulate equally innovative thinking and outcomes. We were unsure whether the transformation to an online version of the role-play would be successful, so we conducted a pilot test with a single group of volunteers as a trial (a combination of alumni and industry representatives). The trial enabled us to test assumptions regarding timings and the use of online collaboration tools such as Trello instead of whiteboards for tracking progress. Following the feedback and the promising results from the pilot, we refined the role-play design and prepared it for implementation in the online class.

4. Evaluation method

We explored our research questions by evaluating student learning as demonstrated through the marks awarded for their group assessments, and by evaluating the ways in which the students reflected on the online role-play and their learning in their individual written reflections. The assessments and evaluation methods are explained in more detail in this section, including the way we captured information about the knowledge gained and the ways that students learned, in particular, how the online role-play and the online experience affected the learning.

As Bjork and Bjork (2011) pointed out, short-term performance abilities do not necessarily equate with long-term transferrable learning. This insight prompted us to incorporate not only an assessment of the factual, conceptual and procedural knowledge gained as they relate to the agile methodology but also the more subtle metacognitive indicators of lasting and transferable learning. Bloom's Revised Taxonomy draws attention to the benefits of students cultivating metacognitive knowledge, which Anderson et al. (2001: 29) define as "knowledge of cognition in general as well as awareness and knowledge of one's own cognition". We argue that the cultivation of metacognition capabilities strongly aligns with the project management literature's call for reflective practice (see, e.g. Sage et al. (2010)). Factual, conceptual and procedural knowledge have a role in project management education, but they are not sufficient for preparing students for the context-specific situations they will encounter as part of the lived experience of project work.

The students' mastery of factual, conceptual and procedural knowledge was primarily assessed through a group assignment, which required the teams to explain their use of three ceremonies or artefacts associated with their role-play and to critique their use of the selected ceremonies and artefacts. The critique, which was approximately 1000 words in length and included screenshots and other supporting materials from the role-play, enabled the students to demonstrate their knowledge of the methodology even if their performance on that element was flawed during the role-play. While use of student work as a source of educational research has precedence (see, e.g. Scales (2013); Scott et al. (2019); Austen et al. (2020)), there is an inherent limitation in using a group assessment task as a research instrument; it is possible that "performance" in the task is reflective of only some members of the group rather than all, or is an average reflective on no single student's ability (Meijer et al., 2020). Therefore, although we used the group assessment as an indication of the overall level of learning, primacy was given to the students' individual reflections to answer our research questions.

The students' individual written reflections were designed to enable us to explore the "how" aspects of our research questions: How does an online role-play affect learning? How does an online format affect student learning? In the individual reflections, approximately 500 words each, students were required to outline their previous experience with agile practices and how their learning was shaped through the role-play. Students were also prompted to report any surprizing learnings from the role-play or any anticipated impacts on their workplace practice. The reflection instructions emphasized that marks were awarded for the quality of the reflective critique and "telling it as it is", rather than focusing on the positives of the experience. We informed the students that our evaluation of the online role-play would be based on their anonymized reflections and that any reported results would remain anonymous. Students were given the option for their reflection to be excluded from the study; however, no student took up that option. The students' reflections indicated honesty, with their writing highlighting the challenges and difficulties. However, we acknowledge that there is the potential for student feedback to be biased through attempts to provide positive feedback, especially when the cohort's educator is part of the research team. We mitigated this potential bias by celebrating failures as learning opportunities during the class; demonstrating that the students' marks were not affected by revealing mistakes or

difficulties during other assessments; and encouraging students to share and learn from each other (mistakes and all) – thus setting the scene for honest feedback without fear of negative consequences.

The student's reflections were thematically analysed using NVivo, adopting an abductive approach. The thematic analysis included a deeper exploration of the achievement of learning objectives established through the group assignment marks and indications on how the online role-play (RQ1) and the online format (RQ2) affected student learning. Extending indications from the group assignments, students' accounts of how their learning about agile practices would change their workplace practice in the future was used as a further proxy for learning. The abductive thematic analysis aligned with Braun and Clarke (2006) methodology, including familiarization with the data; generating initial codes; searching for themes; reviewing themes; defining and naming themes; and publication.

5. Findings

The evaluation in this article draws on a student cohort (n = 25) participating in the online role-play in mid-2020. There was an even balance of male (13) and female (12) students, and nearly half (12) of the students had three or more year's full-time work experience. The most common disciplines reported were construction, architecture, health and engineering, but the cohort also included those with information technology, business and other backgrounds. Pertinent to the role-play scenario, many students (15) indicated some pre-existing knowledge of agile practices prior to the class, with two students indicating they had significant applied experience using the methodology. Most students (21) reported they were comfortable using online collaboration technologies.

Before answering the research questions, we determined whether the students did achieve the learning objectives through evidence of their understanding of agile practices. The marks awarded for the group assignment in the online role-play (average mark 78%) aligned with the marks assigned during the in-person role-play (average mark 78% in 2017, 80% in 2018, 79% in 2019). This indicates that student learning was high and similar, regardless of whether the role-play was conducted online or in-person. The in-depth analysis of the students' reflections in the following sections provides further indication of learning while also providing information about "how" the online role-play affected their learning.

5.1. Student learning from the online role-play

Complementing the evidence from the marks awarded for the students' groupwork, which indicated that the students achieved a high level of learning, 22 of the 25 students' reflections explicitly emphasized that the online role-play *had increased their understanding* of agile practices. The other three reflections were neutral, inconclusive or did not mention whether the role-play affected their understanding.

Extracts from the students' reflections demonstrated *how* the online role-play influenced their learning, which addresses RQ1. Students commented that the role-play enabled them to better understand the methodology than through the lecture presentation alone:

"The lectures and readings given in this lecture were my first interaction [with] agile [practices] and [the] Scrum methodology. However, it wasn't until the [online role-play] took place during the second day of lectures that I appreciated and managed to get a realistic idea of what working agile implies." [Participant 3].

"[The online role-play] certainly improved my understanding of how agile works. Learning from the lecture session and readings, I could sense how the theories operate but not how to apply it. At first, I was confused about how agile could be used in a real-life situation, especially when the roles were explained in the lecture session … [The role-play] gave me a clear understanding of how agile practice works." [Participant 12].

These quotes show how the online role-play served to resolve confusion and clarify students' understanding of agile practices. Even students who had practical experience reported that the role-play was a valuable component of the learning. Furthermore, students indicated surprise at the effectiveness of the *online* role-play in cultivating their understanding of the methodology; for example, one student reported that "the simulation helped profoundly to appreciate the use of agile, *even though* it was conducted virtually" [Participant 14, emphasis added].

Specific aspects of learning were enhanced through the students' experiences during the online role-play. The students' reflections show how the experience with agile practices developed their ability to discuss accurately and with nuance the Scrum roles, ceremonies and artefacts. For example, Participant 24 demonstrated an understanding of the role profiles after experiencing how the roles interacted during the role-play: "the existence of Product Owner really helps in defining what I should be aiming for with a clear picture of the finished products". In terms of ceremonies, Participant 17 saw the effort required to keep stand-ups running as intended: "keeping a conversation short takes more extensive preparation". Participant 22 appreciated the regular visibility of progress that the stand-ups provided. Participant 11 acknowledged the iterative nature of sprints and how this supported an openness to change. Participant 18 reflected on the benefits of the User Stories to "chunk" user needs into achievable deliverables. Participant 15 demonstrated an understanding of the structure of User Stories: "The main 'aha' moment was when we were developing the User Stories' acceptance criteria [and] when I finally understood how to phrase a deliverable that was measurable rather than describe an action."

In addition to these reflections, which demonstrated how the role-play enhanced learning about agile practices, the students' awareness of the benefits and limitations of the methodology was also strengthened through the online role-play. For example, Participant 5 reflected that the role of the Product Owner was highly effective, assuming they have a well-developed knowledge of the end users' requirements. Participant 10 observed the potential for the team to feel pressure given the time-constraints associated with sprints.

Students also credited the online role-play with developing their awareness of how agile practices may be applied in different sectors. Multiple students [Participants 1, 14, 15, 23 and 24], from construction or architectural backgrounds, explained how they had previously assumed agile practices were not applicable to their sector, but the online role-play changed that perception. As an example, Participant 1 reported being able to see how agile practices could be applied to selected stages within their construction projects: "I was able to understand how the agile practices could be used and applied to my current work environment … for example, we could use the agile Scrum process in the designing stage with consultants, to develop and execute User Stories that could make up the project's architectural package."

Supporting the enhanced and nuanced understanding of the methodology, students also commented that the role-play had increased their confidence. For example, Participant 25, commented that "the insights that I have gleaned from the practical manifestation of my knowledge have gone a long way towards boosting my confidence". Participant 8 described this increase in confidence as an important complement to capability in being able to apply the methodology in the workplace: "reflecting on my learning [through the role-play] … I feel like I would be a lot more confident in doing stand-ups and running sprints in an agile environment".

The students' reflections revealed how the online role-play was initially challenging and demonstrated that some of the students struggled with the experience. Participant 2 reflected that to enhance their understanding of agile practices, they would need to be willing to "step out more from [their] comfort zone" and would need more training and exposure to "become an expert". Five students [Participants 12, 16, 17, 19 and 24] found their understanding of the agile practices was tested and commented that the pace of the role-play was, at least initially, quite

challenging: "the stand-up meeting was too quick as a first-timer" [Participant 12]. Although most students acknowledged some form of struggle or challenge during the initial stages of the role-play, the majority came to understand the agile methodology; there were only a few examples of misunderstandings in the students' reflections.

The students' reflections highlighted that the experience of being challenged was fundamental to the learning. Participant 1 commented that when applying the agile practices, they were provoked to "ask questions", which would clarify their understanding of the concepts. This learning through "trying" was also noted by Participant 2, while Participant 11 discussed the benefits of learning: "the ability to *practice* this content with the tasks throughout the block, …I found helped [me] make sense of the content and clarified my concerns" (emphasis added). Similarly, Participant 4 explained the value of learning by 'doing': "For someone who really learns by doing, the virtual agile simulation really fostered a deeper learning of the concept for me".

The majority of the students (21) explicitly commented that the learnings from the experience would affect their workplace practice. Six participants specifically reflected that the MoSCoW prioritization technique could be applied to their workplace practice (MoSCoW allocates the priority of tasks as Must, Should, Could or Won't). Other participants commented on aspects such as the benefits of the discipline and timeliness invoked by the stand-ups for their workplace; the potential for a product backlog to capture and record ideas; and the value of continually engaging closely with the end user or their representative.

These findings reveal how the online role-play enhanced the students' understanding and increased their confidence and capability to apply agile practices through "testing" out their learning during the role-play experience. Although many students acknowledged that the testing invoked through the role-play was difficult at first, they credited the role-play with creating an environment where their understanding was clarified and confusion resolved. After the role-play, students demonstrated nuanced understandings of agile practices and the ability to discern the strengths and weaknesses of applying agile practices in different contexts.

5.2. Student learning from the online format

In addition to demonstrating how the online role-play contributed to the achievement of the learning objectives, the students' reflections revealed unexpected learnings that had been achieved due to the online format. Although there were some challenges, the students reported that the online format provided important learnings about the realities of project work and working virtually. These findings suggested beneficial learning came from the experience of overcoming the challenges of collaboration in the online environment; an increased awareness of the available tools for online collaboration; and an appreciation of the strengths and weaknesses of each member of the team when collaborating.

While the online environment presented challenges, students acknowledged that it represented the future context of many workplaces. Participant 18 commented that the online role-play of the agile framework "enabled us to understand futuristic working conditions". Some of the difficulties students noted were related to technical issues. For example, Participant 25 noted that internet connectivity glitches always occurred at the most inopportune time. Participant 4 reflected on a limitation of the Zoom breakout rooms: "we couldn't quickly check-in with someone when someone else was already talking or the fact that some Team Members potentially felt it was intimidating to ask a question to the whole group rather than one person". As Participant 9 noted: "Microphone cracklings and other technical hiccups slowed down the team's communication and workflow"; a fact also noted by Participant 20. Other challenges arising from the online role-play setting were related to the limitations of technological mediation of the collaboration. Participant 17 recognized that "non-verbal communications [were] lost during the meetings, such as eye contact and gestures etc."

Participant 15 reported this challenge as "the lack of seeing a person's whole body and not being able to read energy in the room and instead [there was a need] to ascertain their disposition via a screen". Participant 19 noted that it was harder to maintain energy in the online environment.

However, the students also commented that such challenges resulted in learning that they would take into their workplaces and demonstrated that it was feasible to facilitate agile practices in an online environment. Participant 25 reflected on the need to have a "contingency plan [to enable] members to switch between the modes of communication (such as phone or internet) as one mode presents certain problems". Participant 4 reflected on the need to modify their behaviour to work in an online setting: "Each of us tried to put the fact that we were talking through a computer screen behind us and really tried to ensure we listened closely, spoke clearly and sought clarification when required." The online setting was credited for providing mechanisms to enhance collaboration; for example, "I felt as though it enhanced the experience as it encouraged immediate response and interaction, whereas in a group setting in a classroom, it would have been easy to hover around one computer as a group and potentially lose the interaction" [Participant 10] and "the stand-up and sprint sessions were effective and productive as there were no distractions unlike in a classroom scenario" [Participant 13]. Participant 17 reported that "I am convinced about Scrum's benefits to teamwork and innovation even in a virtual setting."

The online role-play also introduced the students to technology tools that can enable virtual collaboration. Five students commented on the benefits of learning about the Trello tool, which was used as a virtual "whiteboard" to track progress in the online role-play. The students understood how tools of this type could support online collaboration and in the case of Trello, support the application of agile practices online. Participant 20 appreciated that the role-play "introduced me to several important concepts, such as the highly intuitive, user-friendly platform Trello that efficiently helped us shift from our idea to action", and noted that they plan to "demonstrate to [their workplace] team how Trello works by using a current project so that they can experience a specific work example of how user-friendly and valuable the platform is". Participant 9 also relayed their appreciation of its potential use in the workplace, by commenting that Trello allows "managers and Team Members to visualise the journey in a simple and effective manner when virtually working".

In addition to these learnings regarding working virtually, the online role-play appears to have resulted in learning related to the benefits of diverse teams and the recognition of individuals' strengths and weaknesses. Participant 7 reported that the role-play "really opened my eyes, throughout the discussions I genuinely witnessed the value of the various perspectives, opinions. I felt the outcome was valuable". This sentiment was echoed by Participant 11: "the diversity within the groups allowed for a most valued collaboration of ideas and different mindset and input that helped strengthen group proposals and ideas". Participant 24 recognized that a diverse team can result in a better outcome than working alone. Aligned with this reflection, some students were faced with (and challenged) their own strengths and weaknesses through the role-play experience. Participant 15 commented that "I was surprised how difficult it was for me acting as a Scrum Master, to refrain from diving into the delivery of the work that the Team Members were undertaking." In contrast, Participant 17 found that the online role-play enabled them to move outside their comfort zone: "I found myself feeling comfortable to speak up compared to seated meetings." These examples highlight how the online delivery of the role-play was key to the learning; the online format was not only effective in delivering the intended learnings but also enabled students to achieve learning beyond the planned objectives in an authentic manner reflecting real-life contexts.

6. Discussion

Our analysis of the findings draws on the concept of role-play-as-rehearsal, Desirable Difficulties and authenticity to explore the research questions. Our study makes two key contributions. First, by aligning our findings with the concept of Desirable Difficulties, we explain *how* the online role-play enhanced learning and identify the potential for role-play-as-testing through the way it can deliver an authentic experience and facilitate a generation effect that enhances learning. Second, we reveal a surprising finding as to *how* the online format affected learning – we found that authenticity and learning were enhanced by avoiding the temptation to sanitize online project management education. We expand on these contributions in the following sections and then discuss the implications for practice and research.

6.1. The generation effect of role-play-as-testing: addressing RQ1

Analysing the findings through the lens of the Desirable Difficulties and role-play-as-rehearsal concepts, we answer the first research question as to *how* online role-plays can affect student learning about project management methodologies. We find that the role-play acted as a form of testing and suggest that it produced a generation effect that enhanced learning by actively engaging the students' minds and prompting them to ask for clarification when required.

The Desirable Difficulties concept proposes that implementing formative testing as part of the educational process can enhance learning outcomes, and that attempting tasks with Desirable Difficulties is particularly beneficial to learning (Bjork and Bjork, 2011). Analysing our findings using the Desirable Difficulties concept as a lens, we find evidence that the online role-play fulfilled a formative testing role and contributed to student learning. The students' reflections reported how the role-play "tested" whether they understood how to apply agile practices. The findings demonstrate how the testing provided an experience that increased the students' confidence in applying the methods but also revealed the deficits or limits of their understanding. The revelation of the gaps in their understanding served to prompt students' further learning through reflection on their practice, questioning the practice, discussing areas of confusion with peers, or receiving feedback on their performance from the educators. In this way, the testing through the role-play gave rise to a generation effect where students actively engaged their minds and thus enhanced their learning. We therefore propose the term "role-play-as-testing" to emphasize how role-plays can embed formative testing (aligned with the Desirable Difficulties concept) and provide an opportunity for deeper and more nuanced learning.

Our findings also support a central theme of the Desirable Difficulties literature by demonstrating how student learning can be enhanced by difficult or challenging tasks. Students repeatedly reflected that the online role-play was difficult, and at first they were confused or did not feel fully prepared for the task; however, they also relayed the ways the role-play helped to resolve the confusion, how they developed their understanding through the experience, and how they learned from their mistakes. The findings suggest that an easier task would not have achieved the same level of learning as it would not be as likely to spawn a generation effect by prompting students to stretch their abilities or improve their understanding.

We note that the students' actual performance during the role-play was not measured or marked; learning was the goal. In fact, our findings show that mistakes in the performance served to enhance student reflection and to embed the learning more deeply. This aligns with the Desirable Difficulties literature, which emphasizes learning as more important than performance. Our findings show that while student performance was often flawed during the role-play-as-rehearsal, this did not preclude learning; in fact, it seemed to enhance the learning through the generation effect.

Our findings extend the Desirable Difficulties literature by providing an example of testing procedural knowledge, whereas current literature focuses primarily on declarative knowledge. In our role-play-as-testing, we tested the students' ability to adopt agile practices in an authentic context, and our findings suggest that this testing served to enhance procedural knowledge.

6.2. Authenticity in online project management education: addressing RQ2

Our second research question as to how an online format can affect student learning about project management practice revealed surprising findings about the nature of authenticity and its relationship to student learning. We found that instead of serving to disrupt or hinder learning, the online format enhanced learning by providing an authentic and challenging context that reinforced the benefits of learning through Desirable Difficulties. We acknowledge that the online role-play cannot be fully authentic and cannot fully simulate workplace conditions; however, our findings demonstrate that a level of authenticity was achieved through testing procedural concepts in an integrated manner.

Contrary to our initial concerns regarding potential difficulties in learning interactively online, the students' reflections indicated that the online facilitation of the role-play increased the depth of their learning. The online format presented the students with a challenging condition that reflected real-world practice. The unpredictability and limitations of the technologies for interacting and collaborating online created challenges that are not encountered by teams in an in-person environment. However, the online format had many benefits we had not anticipated, that is, it introduced an extra layer of challenge and a source of unpredictability that provided an authentic experience by reflecting the reality of many workplaces, especially as online working has rapidly increased due to the COVID-19 pandemic. It reinforced the need to avoid sanitizing project management education; by allowing a level of unpredictability, the online role-play provided opportunities for the students to learn to adapt to imperfect and changeable conditions, which reflects the real-world experience.

The objective of the role-play was to enhance student understanding of agile practices and to build their capability and confidence to apply agile project management practices. In addition to achieving this objective, our findings demonstrate that the students derived additional learnings relating to the lived experience of managing project work and that this learning also influenced the ways they envisaged changes to their workplace practices. The students discussed the hindrances and subsequent accommodations that would need to be made when working online; the range of tools available for supporting virtual work; and how the online format helped them realize that individuals have diverse strengths and weaknesses, which need to be understood, leveraged and managed. These findings show how resisting the temptation to sanitize the learning environment enhanced and diversified the learning.

As argued in our literature review, research shows that successful project management requires more than technical acumen. The findings of our online role-play demonstrate that conditions that could be perceived as hindrances to learning (i.e. the *online* setting) can result in learnings that have strong workplace relevance. We argue that these learnings are necessary to build the competencies to mobilize the methodologies in complex, contemporary practice environments. The Desirable Difficulties concept proposes that students benefit from enhanced learning when they address the limits of their understanding through "tests". Our students experienced this benefit, coupled with an increased breadth of learning through testing their understanding in an authentic (in this case, online) context.

6.3. Implications for practice and research

Our first contribution on role-play-as-testing and the resulting generation effect is that project management educators should avoid seeking to cultivate a full understanding of procedural knowledge

through having learners re-read or re-listen to information (re-exposure). Instead, they should incorporate Desirable Difficulties into tasks that challenge the learners, such as exposing students to role-plays earlier to test and enhance their understanding. The need to practice the procedural knowledge will heighten the students' metacognition of deficits in their understanding, generate the context and desire to seek new knowledge, and enhance the potential for learning.

Drawing on our findings related to our second contribution on the benefits of authentic and "un-sanitized" experiences, we call for educators to avoid sanitizing project management education and retain a degree of Desirable Difficulties that will increase the authenticity of learning. As our study revealed, when the conditions of the educational experience reflect authentic workplace conditions, this can result in learning that is important for creating realistic understandings of the strengths and limitations of project management processes, tools and techniques in practice. In our educational experience, we were forced (due to the COVID-19 pandemic) to facilitate the role-play-as-testing in an online setting. Although our move to an online role-play was prompted by necessity, our findings have shown that the online setting provided valuable and authentic learning. This is important given the accelerated increase in online project management practice during the COVID-19 pandemic, and that this prevalence of online project work is likely to persist long after the pandemic has eased.

Despite our calls for educators to embrace role-play-as-testing, we caution that implementation is not necessarily easy. Drawing on the Desirable Difficulties literature, we recommend that educators monitor the level of challenge and the students' performance to ensure that the level of discomfort remains "desirable" and conducive to learning. It may also be of benefit to introduce students to the Desirable Difficulties concepts that underpin this approach to help them accept a level of "discomfort" when attempting the new and unfamiliar tasks. In our educational experience, we attempted to mitigate the level of discomfort by continually rotating through the breakout rooms to support the students in overcoming any difficulties and by explaining to the students that the role-play was, as the Desirable Difficulties literature encourages, designed to enhance long-term learning rather than short-term performance. This explanation of the role of Desirable Difficulties concepts assists students in constructively responding to the experience of "making things hard on yourself in a good way" (Bjork and Bjork, 2011: 56).

The limitations of our study indicate future research opportunities. We acknowledge that our data requires further validation in other settings to confirm generalizability of the findings to other project management education contexts. Our introduction of the role-play-as-testing concept also suggests potential for further research and theorizing that will contribute to the Desirable Difficulties literature. We have explored procedural knowledge development through such testing, whereas testing has formerly been focused on declarative knowledge. Future research could further explore the development of procedural knowledge or could extend the role-play-as-testing concept to see how it may apply to the development of declarative knowledge.

7. Final remarks

Our study contributes to the theory of Desirable Difficulties and the practice of project management education, particularly in the COVD-19 and post-COVID-19 era. There have been sustained calls for contextualized project management education that provides more than technical and methodological acumen and employs an experiential approach. However, as we note, there can be a temptation to try to avoid risk in our teaching (especially when moving online); giving in to this temptation can result in the sanitization of educational experiences that reduces real-world relevance.

During the COVID-19 pandemic, we recognized the temptation to play it safe and sanitize our online education, but we resisted; we thoughtfully and curiously facilitated an online role-play that included a key condition that project managers increasingly face in their workplace – collaborating online. We were curious as to how the online role-play would affect learning outcomes and developed a method to evaluate how the learning occurred in the online setting and whether the learning objectives had been achieved. We found that the online role-play increased student capability and confidence in using agile project management methods in practice and that a generation effect pushed students to realize where they needed to deepen their understanding. The students' reflections also revealed that the role-play resulted in additional and unplanned learning about contextual project management practice such as the challenges and strategies for working online and the benefits of diverse teams.

Theoretically, our online role-play contributes to the Desirable Difficulties literature by introducing the concept of role-play-as-testing and providing an example of how role-plays can be a form of authentic test. This finding has the potential to inform the practice of educators beyond project management who seek to use the Desirable Difficulties and generation effect concepts while preparing students for the lived experience of practice. Furthermore, from a project management education perspective, our online role-play demonstrates how leveraging authentic conditions (such as the need to collaborate online) provides students with insights into how tools and methodologies can operate, with all their strengths and weaknesses, in real-world contexts. We see this as a key strategy for project management educators in bridging the theory with the lived experience of project management. Rather than seeking to show tools and methodologies in sanitized, decontextualized settings where their limits and benefits are disguised, our results suggest that contextualized teaching will better prepare students to lead projects.

Declaration of competing interest

Acknowledgements

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