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Incremental Learning in a Capstone Project:
Not All Mature Students Are the Same

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ABSTRACT

Organizations are moving away from rigid planning to a more incremental style of planning and execution in projects. There is a growing acceptance of the effectiveness of incremental change, both in industry projects and in student projects, as a development method and as a learning approach. This, though, may not bring a universal benefit to all students. As enrolments in information systems degrees decrease, an increase in the number of mature students has the potential to counter this decrease in enrolments, but mature students need a different learning and teaching approach. This paper examines the impact of the adoption of an incremental, or iterative, approach in a capstone project for mature students. In the same way that there is not a single type of mature student, there also is no common set of impacts on mature students through the use of an incremental approach to learning and development.

KEYWORDS

Capstone Project, Incremental Learning, Mature Students, Self-Direction, Teacher-Dependent

INTRODUCTION

Short iterations, where a project is worked on incrementally, is referred to as emergent planning or rolling-wave planning. It starts with a high level plan, the details of which are filled in as learning increases in the project (Collyer, Warren, Hemsley, & Stevens, 2010). The learning process and knowledge creation is analogous to the software development process (Rajlich & Xu, 2007), where knowledge is built incrementally.Wynn and Eckert (2017) make the pertinent point that iterative projects allow continuous learning and prevent the problems seen in non-iterative projects, when it is too late to learn when the project is over.

In a university setting, the concept of iterations is also relevant when it comes to students' learning. Incremental learning involves creating new learning by building on existing learning (Nkhoma, Lam, Richardson, Kam, & Lau, 2016). This is also referred to as incremental gains in knowledge (Tao, Yeh, & Hung, 2015). While the benefits of building in increments in a learning context are now recognized, what is not clear is if these benefits apply to all types of students. In their review of research on generational learning, Oh, Ricciotti, and Cianciolo (2018, p.349) make the argument that differences between generations "necessitates continual reconsideration of educational practices." The purpose of this paper is to examine if the benefits of an iterative approach apply to mature students

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in the same way that existing research argues that it benefits traditional students. This is done by examining a final year development project which changed to an iterative approach.

BACKGROUND

Software development methods such as Agile evolved from the principles of Lean manufacturing which create an environment of continual improvement, adapting to change, and learning from mistakes (Mor, Singh, & A, 2016). These techniques are now taught to university students and its benefits to learning have been demonstrated. Harris (2016) used a simulation of manufacturing practices in a class of mature students, and this experiential learning was found to be effective. The concept of iterative software development evolved from manufacturing and promotes continuous learning through short iterations, feedback, and frequent change (Poppendieck & Cusumano, 2012). Projects using short iterations have benefits for student learning in technology-based university courses. There is an assumption, though, that all students doing projects will benefit from this iterative approach; this paper examines and challenges that assumption.

Mature Students

Current research into education in the information systems domain would typically be on traditional students [although this term is becoming more of a misnomer with Chung, Turnbull, and Chur-Hansen (2017) arguing that it is difficult to define exactly what non-traditional means]. What would be described as a "typical student" is a student who progressed from their second level education (high school or secondary school depending on the country) straight into an undergraduate degree. Non-traditional usually refers to mature students and are differentiated from traditional in that their path to university did not follow this traditional path of entering university (Cantwell, Archer, & Bourke, 2001; Cullity, 2006; Iloh, 2018). In this paper, we follow Heagney and Benson (2017) and Dawborn-Gundlach and Margetts (2018) definition of a mature student as a student over the age of 25.

Most developed countries are seeing a new grouping of students who, for a variety of social, economic, and cultural reasons, may not have previously applied for universities (Hassel & Ridout, 2018; Scheutze & Slowely, 2002). There have been huge increases in the number of mature students attending higher education (Forbus, Newbold, & Mehta, 2011; Hassel & Ridout, 2018; Justice & Dornan, 2001). This does not come without challenges. While mature student modes of entry to university give students a second chance (Cantwell et al., 2001), this is creating new difficulties for universities in how to meet their education needs (Scheutze & Slowely, 2002).

For example, some commonly agreed problems facing mature students include:

- Attrition rates in mature students are still higher (Hassel & Ridout, 2018), so teachers need to take into account that there will be differing learning styles between traditional and mature students (Faulkner, Fitzmaurice, & Hannigan, 2016; Kenner & Weinerman, 2011). It is worth noting that learning styles is under-researched in information systems education (Cegielski, Hazen, & Rainer, 2011) and there is even debate as to whether there is adequate evidence that learning styles can be applied in assessments (Pashler, McDaniel, Rohrer, & Bjork, 2008).
- An adult entering university usually constitutes a major life change. This, along with the additional stress of applying, enrolling, and attending classes, can lead to mature students feeling worried and unsure as they confront the new changes (Hardin, 2008).
- Mature students will often have a limited formal education and less opportunity to develop test-taking skills (Merriam, 2001) than traditional students who have taken tests for the majority of their life.
- Many mature students have existing responsibilities as parents and partners and the addition of their student responsibilities can be stressful. Additionally there may be an increase in financial

stress with student work reducing their ability to earn money to support themselves and their families (Dawborn-Gundlach & Margetts, 2018; Stone & O'Shea, 2013).

While there is general agreement on the problems above, there tends to be disagreement on how mature students learn and the ways they prefer to learn. For example, Papinczak, Young, Groves, and Haynes (2008) found mature students have greater self-efficacy and are better at self-regulation with their learning. This would appear to align well with an incremental approach, either for students learning about Information Systems (IS) development or working in their software development projects. Self-efficacy is regarded as important in software development (Chan & Thong, 2009; Hazzan & Seger, 2010; Seger, Hazzan, & Bar-Nahor, 2008), while self-regulation in software development aligns with the argument of Chun (2004) for giving student ownership of their learning process. There is not universal agreement, though, on whether mature students have these traits. It is a common finding in research that mature students are self-directed learners, but Boekaerts (1999) argues that this is actually a misconception. It is differences such as these that have the potential to impact the use of incremental development in a teaching environment with mature students and is now being examined. The two differing views on how mature students learn can be categorized as 1) mature students as self-directed learners and 2) mature students as teacher-dependent learners.

Mature Students as Self-Directed Learners

One stream of research has found mature students to be self-directed learners. Knowles, Holton, and Swanson (2015) wrote about how adults learn and argued that mature students are better at self-direction than traditional/younger students. Mature students also have a greater expectation of their learning by being self-directed (Ellis, 2007) (Henri, Morrell, & Scott, 2018). In fact, self-directed learning is used as a way of defining adult education and differentiating it from the more traditional learning by younger students (Merriam, 2001). Effective planning and time management are part of self-directed learning (Loyens, Magda, & Rikers, 2008), and mature students are better able to deal with ambiguity in what is required (Clark, 2010) and in managing their own time (Trueman & Hartley, 1996). With more life experience, mature students have been found to be more resilient than traditional students (Chung et al., 2017). Wong and Chiu (2018) found that lecturers often preferred mature students because they were better at self-direction.

Since mature students are seen as self-directed, the IS lecturer must take on a new role. In order for students to be self-directed, the lecturer needs to provide the right framework to allow self-direction to occur (Cercone, 2008). So rather than dictating to the students, the lecturer must become an enabler or facilitator. Similarly, mature students who are self-directed gain most from self-evaluation of their work (Hardin, 2008). This matches the incremental development concept (from both lean manufacturing and iterative software development) of self-evaluation where teams and individuals reflect on and evaluate their own work (Turk, France, & Rumpe, 2005). For self-evaluation to succeed, the student needs to be internally motivated to improve and have the confidence to do this. Research has shown that mature students have these qualities. Mature students seem to understand the course material rather than simply 'studying for the test' (Cantwell et al., 2001; Justice & Dornan, 2001; Pokorny & Pokorny, 2005). This would align with the findings by Bye, Pushkar, and Conway (2007) and Fazey and Fazey (2001) that mature students tend to have higher levels of intrinsic motivation than traditional students. Additionally, Vermeylen and McLean (2014) found mature students to have more confidence in their own ability and to be willing to challenge experts.

This stream of research into mature students, although not actually examining an incremental approach, does strongly suggest that an incremental approach would align well with the traits of mature students. As such, it suggests that an incremental approach to both student learning and student development projects would be beneficial to mature students.

Mature Students as Teacher-Dependent Learners

Conversely, even paradoxically, there is a second stream of research into mature students that directly contradict the research arguing that mature students are self-directed learners. Other research has found mature students to be the opposite, and this would change the implications for the use of incremental learning by mature students in IS development projects.

The most obvious problem for mature students in IS development projects is the use of technology. Traditional students, who progress straight from school to university, are more comfortable with using technology than mature students (Garcia & Aqin, 2007; McMulan, 2016; Pearce, 2017) and this might impact on the confidence of mature students (Chiu, Tasi, Yang, & Guo, 2019). It adds a further overhead in that mature students will have to be brought up to speed in technology more than traditional IS students. There isn't universal agreement on mature students' ability with technology though. Although there is an assumption that younger students would be more suited for technology in the classroom, Lai and Hong (2015) examined generational learning styles and found that this was not actually the case. Kirschner and De Bruyckere (2017) call it a digital myth that there are generational differences in being better with technology. This further highlights the different findings from research on mature students.

Further differences are seen with some researchers describe mature students as teacher-dependent. Dependent learners require explicit direction from the lecturer, who is seen as an authority figure (Black, 2018; Scheutze & Slowely, 2002). The view of the lecturer who is the "holder of the truth" can be seen in mature students' belief that there are "right answers" and these "truths" must be sought out by asking the expert (Anderson, Johnston, & McDonald, 2014). Compared to traditional students, mature students are more likely to ask the lecturer questions, something that has been found to isolate them from traditional students (Mallman & Lee, 2016). Mature students also seek recognition from their lecturer; they want to be assured that they are on the right track (Chapman, 2017) and are more demanding of feedback (O'Dwyer & Hamilton, 2018). If there is a mismatch between the stage a student should be at in their academic progression, then the student may become dependent on the lecturer (Scheutze & Slowely, 2002). As mature students are less prepared for study than traditional students (Faulkner et al., 2016), together with their disorientation on entering university (Hardin, 2008), this mismatch is more likely to occur. With the requirement for self-management and self-evaluation, a teacher-dependency would create problems for mature students undertaking an iterative software development project.

Mature students can struggle due to a variety of psychological barriers such as (Hardin, 2008; Kerka, 1989; Pozdnyakova & Pozdnyakov 2017):

- lack of confidence
- anxiety based on previous negative experiences in education
- negative expectations

In modern software development, the developer is relied upon to do their job (Augustine, 2005; Cockburn & Highsmith, 2001; Paasivaara & Lassenius, 2019) by giving them increased control of the project (Cao, Mohan, Xu, & Ramesh, 2004; Gutierrez, Garzas, de Lena, & Moguerza, 2019) to "do whatever it takes" to meet the iterations goal (Koch, 2004, p.113). Considering the negative traits described above, with mature students lacking confidence in their own abilities, they would appear to be unsuited to an incremental software development approach. Additionally, and contrary to the research that argues that mature students are self-directed, mature students have been found to be poor at self-regulation when they have to allocate their own time and concentrate on important tasks. This would further complicate and lessen the positive impacts of mature students using an incremental approach to both learning and development.

What is clear is that existing research on mature students is contradictory, and this contradiction will present problems when deciding whether to use an incremental approach in educating mature IS students. It is unclear why existing research has such different results, but some resolution is needed before it can be determined if incremental learning is suitable in educating mature IS students through development projects.

A possible explanation is offered by O'Dwyer and Hamilton (2018) and van Rijn, Lero, Bridge, and Fritz (2016) who warn against treating all mature students as one homogenous group. There are variations in how mature students learn (Marcaletti, Iñiguez Berrozpe, & Koutra, 2018). Holoyke and Larson (2009) make the pertinent point that current research on adult learners tends to put all adults into the same category". There are a wide variety of mature students and the differing types may be influencing the varying descriptions of their learning styles.

Studying part time, while still having the financial security of a job, could provide the mature student with a more positive attitude. A full-time mature student would have more financial insecurity and pressures. The differing stresses on a mature student between a full-time and part-time course could explain some of the discrepancies between the different research streams. Additionally, the level of the course the mature student takes could also have a great impact. There are large differences between an adult undertaking an information systems course in university and a continuing education course.

Rather than trying to investigate all types of mature students, this research will examine full-time university education to determine if an incremental approach can be of benefit to the mature students undertaking an IS university course. The research method is described below followed by a description of the case study.

RESEARCH METHOD

This research is a study of how an incremental approach to software development, and learning through development, can help or hinder full-time mature IS students. In this case study, in their final year, mature students undertake a software development capstone project and the impact of an iterative approach to software development on the students that is examined. This research investigates whether an incremental approach is beneficial or not to mature students.

The research philosophy followed was critical realism, as it was regarded as the best approach for examining underlying influences on the success or otherwise of the mature students. Critical realism is the philosophy that allows post-positivists to accept the limitations of positivism while still maintaining a degree of a positivist outlook (Robson, 2002); critical realism is also described as the middle ground between positivism and interpretivism (Outhwaite, 1983). Further, the aim of critical realism is explanation, determining what caused an event to occur (Easton, 2010)

Critical realism is becoming more widely used in information systems research (Wikgren, 2005) and has been proposed as the solution to the problems with positivist and interpretivist paradigms (Mingers, 2004b). Similarly in education research, it is argued that critical realism can overcome the problems inherent in positivist and relativist/constructivist research. The positivist approach to research on and in education can be problematic, Measuring the time taken with tasks by students or using data to identify 'good' or 'bad' schools often omits data that represents the real life of the classroom rather than a forced, closed experiment (Shipway, 2011). The relativist, or constructivist, approach to education research can also be problematic in that the attempt to construct an individual's experience internalizes the construction. This construction may not take into account the underlying structures and mechanisms at play (Shipway, 2011).

It has been noted that the majority of papers published on critical realism are predominantly theoretical (de Vaujany, 2008). There are, however, some examples of critical realist IS 'field work'. Carlsson (2009) used a critical realist approach to investigate the use of executive information systems, while Dobson and Love (2004) and McAvoy and Butler (2017) describe the benefits of a critical realist approach to research in IS development projects, including why they fail. This aligns

with the goal of this research to examine how incremental software development in a mature student capstone project could fail (or succeed). Longshore-Smith (2006) argues that the critical realism view of causality makes it appropriate for research into explaining why events occur (or do not occur); this includes why an initiative can potentially cause change (cf. Carlsson, 2003; Easton, 2010; Volkoff, Strong, & Elmes, 2007). The research herein is similar to this work, as potential changes brought by moving from rigid planning to an incremental approach are examined in a mature student capstone project. Further, critical realism's role in education research, is to uncover the underlying structures and mechanisms whose impacts on education need to be determined and explained (Shipway, 2011). The move to incremental learning through development gives rise to new structures and mechanisms which need to be identified and explained. The goal of the research is to identify the impact of a change to iterative approach to software development on mature students, and their capstone project provides the context for the change in approach.

The process followed will be that of retroduction. The goal of the critical realist method of retroduction is to discover the interacting mechanisms and structures which generate a phenomenon (Mingers, 2004a; Olsen, 2004), eliminating some while supporting others (Aaltonen & Tempini, 2014; Bygstad, 2010; Zachariadis, 2013). The phenomenon in this research is the success or failure of an incremental approach by mature IS students in their capstone project.

In this research, the different types of mature student will be examined through retroduction. This will identify the mechanisms at play in how incremental development and learning does (or does not) have an impact on the mature student's individual capstone projects. The findings from the retroduction of the mature student types are then used to better explain the impact by comparing similarities and differences over the duration of the case.

A CASE STUDY OF FULL-TIME MATURE STUDENTS USING AGILE IN A UNIVERSITY INFORMATION SYSTEMS COURSE

In 2000, the Diploma in Applied Business Computing was created in University College Cork. The course is open to individuals who are unemployed, with the goal that education will enable them to secure jobs in information technology. The success of the course is seen were students have gone to work in technology roles in organizations such as EMC, VMWare, Amazon, and Boston Scientific. Several students 'got the education bug' and went on to masters level, while others work for themselves. While the career prospects for the students have improved drastically, the academic level achieved is also positive. These successes are notable as all the students are mature students who were unemployed on entry to the course.

The students come from a variety of backgrounds. While all were unemployed, some had previously worked in different sectors and others had been long-term unemployed. It was hypothesized that, in general, those who had previously been in employment would display the learning characteristics described as self-directed learners while those who were long-term unemployed would display the learning characteristics described as teacher dependent. As such, this case study examined the effectiveness of an incremental approach for learning in both types of mature students.

The course is a full-time, two-year program where the students are taught modules in: databases, visual basic, web programming, IT architecture, multimedia, principles of information systems, economics, and accounting. In the final year of the program, the students complete an individual capstone software development project; this is where they design and build an information system for an organization of their choice. Students are expected to demonstrate their use of the technical topics they have studied in the course. It is this capstone project which provides the context to determine the effectiveness of an incremental development and learning approach for these mature IS students. Over the 16 years of the Diploma running (8 cohorts of students as it was a two-year cycle), approximately 165 students started each run of the course.

To undertake this study, the three researchers had access to all student emails, project documents, project journals, and formal student feedback. Additionally, two of the researchers were involved with supervision of the capstone projects and knew all of the students involved throughout the years. The third researcher did not teach on the Diploma and was used as an un-biased reviewer of student documentation and to resolve any potential differences of opinion between the two other researchers. The researchers separately categorized each student into one of the two groups: self-directed or teacher-dependent learners. The coded lists were then combined and examined. In coding the analysis, each researcher used examples from emails and documentation from the students regarding requirements for their projects.

There was similarity in the researchers' coded lists showing broad agreement on which students were self-directed and which were teacher-dependent. If there was disagreement categorizing the students, a combined examination of emails from the students was performed. This judgement was based on the type of requests the students made in emails to the lecturers. For example, if the majority of emails were judged to be seeking too much clarification (compared to others in the self-directed group) on assignments then they were judged to be teacher-dependent. Also, a student's work history and experience with technology was determined from analysis of the application forms submitted by the students when applying for the course.

The Impact of Moving from Rigid Planning to Incremental Development in a Mature Student Capstone Project

The first stage in the research was to categorize the students into two groups: self-directed students and teacher-dependent students. To categorize whether students were self-directed or not, the qualities of self-directed learners from Raemdonck (2014) was used: discover learning opportunities, take the initiative to learn, and will persevere in their attempts to learn, if they come up against obstacles.

Examples of the types of questions asked by students, and the categorization into teacher-dependent and self-directed, are shown below in Table 1.

As can be seen in the examples above, the teacher-dependent students were asking for confirmation on whether to do something, while the self-directed students were seeking answers on how to do something or trying something themselves.

There were two findings which initially stood out from this grouping. By examining the work history and prior technical knowledge (available from their application forms), it was found that students who had worked in the previous ten years fitted the description of self-directed mature students. They had more confidence in their own abilities and were more open to challenges and challenging themselves. Students who hadn't worked in the previous ten years (or who had never worked) matched the description of teacher-dependent mature students. The second finding of note was

Table 1. Student requirements questions

Teacher-dependent	Self-directed
"Would it be ok to add a carousel on the front page	"Are there API's that I could use to add a payment function"
"Do I need a login page"	"I can't connect to the database. Could you suggest some material I could read to learn about it"
"Should I use a card reader"	"What was the name of that function we covered in class? I want to use it in my project"
"Does this look ok to you"	"I want to keep at it – I think it might be better"
"How many links should I have"	"I am going to try it to see if it looks ok"
"Do I need referential integrity in something this size"	"It seems like it didn't work because of the block file. What did you say the work-around for that was?"

that the categories were not impacted by their prior IT knowledge. It was initially assumed that those who worked previously would have had contact with IT and that they would be more comfortable with programming. However, the ubiquity of IT minimized any benefit that contact with IT in a job would have had. As one student said "everyone has a computer and with your phone you always have access to the internet." Based on this, the influence (or the mechanism to use critical realist terminology) of prior IT usage had no impact on either category on the success or failure of the capstone project. Part of that is explained considering the capstone projects take place in the second year, by which time all the students have had intensive learning in technology and programming.

The change from a rigid planning approach to the capstone project was introduced in the fourth running of the diploma. Prior to that, students used a waterfall-based approach to planning and development. The waterfall model is a classical model used in system development life cycle to create a system with a linear and sequential approach; it is often considered to be a very structured (even rigid) approach to software development. In a waterfall approach, requirements are defined at the beginning of the project, and the requirements tend not to change throughout the project. The use of a waterfall approach showed differences between the categories of students. The self-directed students continued to be confident students that were self-managed and self-directed in their project. However, the more rigid process-based approach did not suit their learning style and traits as mature students.

Then in their fourth year, students present their final system, which includes the developed software, a user manual, and a journal describing the project as it happened. The authors and other lecturers then discuss the system to determine a mark. The two researchers who had worked on the Diploma examined the journals in addition to the third researcher (who had not worked on the Diploma or involved in the initial groupings). This was to ensure that there was no bias from knowing the students or knowledge of students being grouped into the self-directed and teacher-dependent categories. For the self-directed students, the details in the journal were obviously written after the software was developed instead of while the system was being developed. It was clear from seeing the final developed systems that the journal did not describe the many changes that had occurred throughout the project. Seemingly, the self-directed mature students had experimented with different solutions throughout the project, some of which worked and some of which failed, and this was not included in the final system. Reading the journals of the self-directed students gave the impression that everything had progressed according to a plan. Examples of how the journals were coded, and the categorization into teacher-dependent and self-directed, are shown below in Table 2.

The self-directed students disliked the journal; they felt it restricted their experimentation in development, ability to make changes to the system, and was trying to force them into a rigid-planned approach. Many of the self-directed students admitted that they wrote the journal after the development and pretended that there was a structure to what they did. The teacher-dependent students did not have these problems with the journal and would discuss progress with a lecturer before writing anything in the journal. Essentially, the journal was the capstone project's equivalent to a project plan. The

Table 2. Journal coding

Teacher-dependent	Self-directed
Talks about problems and how they could be solved	No discussion of problems, only outcomes
Written sequentially from project start to finish	Written about topics with no flow of time
Included a project plan that was followed and deviations to the plan identified	Included a basic plan which appeared as if it was successfully followed with no changes required
Risks identified in advance of development and failures described	No risks identified or failures described
A lot of the document described up-front planning	Very little up-front planning

self-directed students resented the imposition of a plan (the journal) while the teacher-dependent students embraced and used the plan (the journal) in a way similar to the initial waterfall approach.

When the capstone project changed to an incremental approach, it brought some benefits to both categories of students. Once the students had embraced the incremental approach, they were able to adapt their plan to deal with problems as they occurred. One major difference between traditional and mature students are the issues that can interfere with their education. Mature students have financial issues, family issues, and a variety of other reasons necessitating that they be off campus for differing periods of time. Planning and developing incrementally, in short iterations, allowed the students to adapt and change their work as required. For example, work could be moved to the next iteration to allow time to look after a sick child. By building the system incrementally, the students would always have a working piece of software to submit, even if they missed an iteration.

While this flexibility had benefits for both categories, there were differences between the two types of mature students. The self-directed students embraced the incremental development and it was clearly suited to their learning style. They set their own plans, adapted the plans, and engaged in self-reflection on how they were doing. They coped well with uncertainties and were able to adapt to any changes that were required in the system.

On the other hand, with the lack of rigid up-front planning, the teacher-dependent mature students struggled. This was seen through the experience of the two researchers involved in the Diploma and also through the analysis by the third researcher of anonymized student emails concerning their capstone project. These students started each project seeking reassurance from the lecturer, tried to plan everything in detail up-front, and were initially stressed when the development did not go as planned. To them, the "customers" for the project were the lecturers, and these teacher-dependent mature students continually looked for guidance from the customer. This is not a problem in modern IS development when the customer is more involved. The problem was that the teacher-dependent students were using the customer (the lecturers) not for guidance but for confirmation. The teacher-dependent students were very uncomfortable with vague guidance about requirements and the fact that they changed throughout the project. This is a concern as the reality of software development projects has customers who generally do not know what they need (Glass, 2001), until they see something (Sutherland, 2001). The concern of Glass (2001) is relevant as, similarly, the teacher-dependent students had great difficulty in dealing with vague requirements and continually tried to get confirmation of the exact details of what was required.

On every project, the teacher-dependent students over time became more accepting of the new approach. Usually the trigger to acceptance was when they had to deal with something outside of the course (such as a family emergency). It was then that they started to see value in an incremental approach, which allowed them to reschedule and reprioritize work. While this is positive, it usually occurred late in the project was stressful for the students. Ultimately this stress impacted had a negative impact on their overall grade for the capstone project. Over the years, it was initially assumed that the lower marks for teacher-dependent students was because they were not as good as the self-directed students or that self-direction leads to better results. But by using the critical realist method of retroduction and analyzing what other mechanisms could be at play, it became clear that the lower marks were a direct consequence of the stress caused by the teacher-dependent student struggling to deal with the lack of a rigid plan for their project. Further examination highlighted that they felt a lack of direction. The teacher-dependent students were comfortable with plans; plans provide guidance and a degree of comfort. It was the philosophy of acceptance of change to these plans, and being empowered to deal with these changes, that caused them stress.

CONCLUSION

A common method of teaching development to IS students is through a capstone project, and researchers have shown the benefits that this can bring to students. However, caution is needed in

assuming that incremental development in capstone projects will bring benefits to all students. There needs to be a recognition that mature students can have different learning styles than traditional students and, with the rise in the numbers of mature students, IS educators need to take these differing styles into account. Even the term 'mature student' is too broad; there are a variety of different types of mature students, from part-time to full time and attending differing levels of courses. Each of the different type of student may have differing styles which can be impacted by, and impact on, the approach used in how we teach IS and on IS capstone projects.

This research examined full-time mature students and identified two specific categories: self-directed mature students and teacher-dependent mature students. While both categories of students find benefits in an incremental approach to their capstone projects, there are differences between the two categories. Ultimately, while both categories of mature students accept, learn more, and find benefit through incremental development in their capstone project, it can create difficulties for teacher-dependent mature students. The time taken to accept the benefits of a new approach can be a period of stress, and this stress can negatively impact on the overall grade for the capstone project. It was found that this stress for teacher-dependent mature students was caused by dealing with change in the project. Acceptance of change and uncertainty, while self-managing and adapting your work and progress, is core to incremental software development, but this very philosophy is difficult for teacher-dependent mature students to fully accept and put into practice.

The findings of this research suggest that, for the information systems educator, it is vital that mature students are introduced to the reality of change in IS projects (specifically those showing signs of teacher-dependency) as early as possible. This research has shown that it is too late for the students to have to deal with it during their individual capstone project.

It should be acknowledged that there are limitations to this study. Only one specific type of mature student was examined and that was mature students who were unemployed before starting their studies. It is not possible to apply the findings to students starting a course who were already in employment. Additionally, the students in this study were all full-time students so part-time students may have different learning characteristics and needs. It is acknowledged that this research does not address every type of mature student and the authors agree with van Rijn et al. (2016, p.40) who argue that "institutions can include mature students by demonstrating awareness of their needs and moving away from a one-size-fits-all approach designed for traditional students."

Although not examined specifically in this research, the suggestions below may help to introduce change to mature students:

- For the first projects that mature students do in their first year, the projects could be made up of sections/iterations. New sections are introduced when the previous one is completed and builds towards a final solution.
- These sections should be of a short duration – an iteration of two to three weeks would be ideal as it allows for changes in direction.
- Changes to requirements should be deliberately introduced mid-way through the project.
- Students should be rewarded for adapting their projects to changing requirements.

If the skills needed to adapt to change are introduced early to mature students, they have the potential to avoid the problems they may encounter in their capstone project and in any future roles they may hold in industry.

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