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Improving Scrum Adoption Attitudes in Non-Traditional Industry Settings

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Abstract

The Scrum development method has proven useful in maintaining project flexibility, quality, and customer satisfaction. Many teams and companies are moving towards a more agile approach to project management. However, some team transitions to agile are easier than others. Previous research shows that many senior industry developers, especially in companies with a high Capability Maturity Model Integration (CMMI), are resistant to adopting Scrum, or other agile methods. This work shows that the adoption of Scrum and increased buy-in, even from resistant team members, is possible over the course of multiple years. This research was conducted in a university department with faculty service committees, which is a non-traditional group to transition to Scrum. University faculty tend to resist change, especially change that involves additional training or work for their limited bandwidth. However, it is found that the additional productivity of Scrum increases the faculty buy-in over time, indicating that even teams who are resistant to change can accept and adopt Scrum. These findings are especially useful given that many large industry companies with a high CMMI, who may be resistant to change, are transitioning to Scrum or other agile development methods. This paper analyzes faculty interviews and recorded committee meetings and compares the faculty perception of Scrum over the course of three years. The results show that there is an increase in faculty buy-in and perception of the use of Scrum for departmental operations due to the increased productivity of the department teams. These findings indicate that Scrum adoption attitudes can be improved among other teams who are resistant to change, which could help companies with a high CMMI transition to Scrum or another form of agile development.

Keywords: Scrum, Capability Maturity Model Integration (CMMI), faculty buy-in

Improving Scrum Adoption Attitudes in Non-Traditional Industry Settings

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1. INTRODUCTION

This research presents an experiment from the Department of Electrical Engineering and Computer Science at Embry-Riddle Aeronautical University where Scrum was introduced and used as the project management technique for faculty service committees. The goal of this paper is to connect the lessons learned from this experiment to help in transitioning industry teams to Scrum. The use of Scrum and other agile development methods has proven useful in maintaining project flexibility, quality, and customer satisfaction (Javdani Gandomani, et al., 2013). Additionally, Scrum has shown faster times to market for products (van Waardenburg & van Vliet, 2013). Therefore, agile's popularity is growing in industry (Javdani Gandomani, et al., 2013). However, previous research has shown that there are significant challenges involved in transitioning from a traditional development method to an agile one. Most notably, senior developers and employees of high Capability Maturity Model Integration (CMMI) companies are resistant to adopting Scrum, or other agile methods (Javdani Gandomani, et al., 2013; Selleri Silva, et al., 2015).

Similar to the issues of transitioning to Scrum in industry, research shows that faculty are also resistant to change (Tagg, 2012; Gratz & Looney, 2020). This is mainly caused by limited bandwidth, especially when considering tenure-track faculty (Tagg, 2012; Gratz & Looney, 2020; Pfeifer, 2017). Trends in the majority of universities have shifted to a more research focus when considering tenure-track faculty, often considering teaching, mentoring, and service as less important than research to obtaining tenure (Tagg, 2012; Gratz & Looney, 2020; Pfeifer, 2017). Therefore, changes or projects that increase faculty workload that are not related to their research will often be met with resistance as it is deemed a worse use of their limited time. Additionally, this research found that other faculty who had previously used Scrum in industry were resistant to its use in the department because they felt that the committees were a non-traditional setting for Scrum, or they felt that the modifications made to fit Scrum to an academic setting were too challenging. This work analyzes faculty's increased buy-in to Scrum over multiple years. The similar resistance to change between faculty and industry members indicates that the success and knowledge gained through this experiment can be transferred to industry as an aid to transitioning resistant teams to Scrum or other methods of agile development.

The data for this experiment was gathered over the course of three years via annual faculty interviews and recordings of the Scrum meetings. These meetings and interviews were used to analyze meeting efficiency, Scrum modifications, Scrum process and role understanding, as well as the faculty's general opinions and feelings about Scrum throughout the years. Over the course of the three years, the success of the Scrum teams in maintaining productivity throughout the semester and in achieving their goals increased the faculty buy-in and positive attitude in using Scrum.

2. BACKGROUND

To understand the significance of this research, it is important to discuss the benefits of Scrum and why its use in non-traditional settings has historically been difficult.

Scrum

Scrum is an agile development process traditionally used in software engineering. It outlines an organization for project management (Schwaber & Sutherland, 2020). Scrum teams work in short time frames called sprints, which can be one to four weeks long, but are generally two weeks (Schwaber & Sutherland, 2020). At the beginning of each sprint, the team chooses tasks from the full list of necessary tasks, known as the product backlog, to be completed within that sprint, thereby forming the sprint backlog. As tasks are completed throughout the sprint, this effort is shown in a burndown chart.

There are three roles on a Scrum team: Product owner, Scrum master, and team member (Schwaber & Sutherland, 2020; Hilburn & Towhidnejad, 2020). The product owner acts as

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the voice of the customer. They help to organize and prioritize tasks in the product backlog. The Scrum master runs the meetings and ensures that the team follows the Scrum process. The rest of the team consists of developers who complete project tasks.

Each sprint begins with a sprint planning meeting to choose tasks from the product backlog to place on the sprint backlog (Schwaber & Sutherland, 2020). It is important for the team to have as accurate of an effort estimate as possible to ensure the sprint's success. Throughout the sprint, the team holds daily stand-up meetings, which should not be longer than 15 minutes, to discuss the current sprint status and address any challenges preventing the sprint's success (Schwaber & Sutherland, 2020; Hilburn & Towhidnejad, 2020). At the end of each sprint, the team holds two meetings: the sprint review, and the sprint retrospective (Schwaber & Sutherland, 2020). The sprint review consists of a discussion on what was completed during the sprint and any changes in task priorities that should be addressed in the next sprint. The final meeting of the sprint is the sprint retrospective, which is a discussion of the sprint outside of the tasks themselves (Schwaber & Sutherland, 2020). This meeting's discussion topics may include, but are not limited to, productivity, team interactions, problem solving strategies, necessary tools for future work, and the accuracy of effort estimation. The full Scrum process is shown in Fig 1.

Fig 1. The Scrum process (Hilburn & Towhidnejad, 2020).

Non-Traditional Scrum Settings

This paper discusses implementing Scrum in non-traditional Scrum settings, but what is a traditional Scrum setting? Traditionally, Scrum has been used in industry for software development. Mostly, smaller companies, teams, and projects have used Scrum to maintain a faster development pace (Javdani Gandomani, et al., 2013). However, given the success of Scrum and other agile methods, even companies and teams that do not fit this traditional description are becoming interested in using agile development methods to improve their productivity, increase their flexibility on requirements, and have a faster time to market (Kasauli, et al., 2018). Unfortunately, this is often met with resistance from the team members in these non-traditional settings (Javdani Gandomani, et al., 2013; Selleri Silva, et al., 2015).

This application of Scrum in academia focuses on faculty service committees, which are also a non-traditional Scrum setting. Generally, Scrum teams are used in industry where team members are only working a few projects at a time, working hours are common to all team members, and company employees are required to implement the company's vision (Stein Smith, 2021). In contrast, at any given time, university faculty members must teach multiple classes, write research papers and grant proposals, mentor students, and contribute to their service projects, meaning that each of their projects get much less time than in industry (Griffith, 2020). Additionally, faculty members, especially those with tenure, have much more freedom to stray from the department vision without consequences. Therefore, this is a non-traditional Scrum environment. With this environment being so different from normal Scrum settings, findings in this environment can be transferred to non-traditional industry settings.

3. METHOD

The data for this research was gathered via recordings of the Scrum meetings, as well as a series of annual faculty interviews in 2020, 2021, and 2022. The data was then analyzed by the authors, a third party to the data collection, and recorded in codebooks.

Gathering Data

This research was conducted in the Department of Electrical Engineering and Computer Science at Embry-Riddle Aeronautical University in Daytona Beach, Florida, USA. The project applied Scrum to managing departmental service committees to improve their effectiveness, success, and member morale. Some faculty were previously familiar with the Scrum process either from teaching it in classes or from industry experience. However, many were unfamiliar with the process and only had knowledge from an online training course and textbooks in preparation for this project.

The projects were managed using Scrum for five years. Scrum meetings, e.g., sprint planning, daily stand-ups, and sprint retrospectives, were recorded and faculty interviews were conducted, transcribed, and anonymized. The first year involved a pilot program with few participants, and data for the final year is still being collected. Therefore, the research presented in this paper is based on the preliminary results of years two through four. The department projects and descriptions through these years are given in Table I.

Team	Description
Year 2 – 2020-2021	
Curriculum - Graduate	Updating the class listing, order, and content for the M.S. degree in Software Engineering (SE).
Curriculum - Undergraduate	Updating the class listing, order, and content for the B.S. degrees in Computer Science (CS), Computer Engineering (CEC), Electrical Engineering (EE), and Software Engineering (SE).
Recruitment	Marketing the department to increase student enrollment and improve retention.
ABET Adherence	Addressing the shortcomings identified during the most recent ABET visit.
Year 3 – 2021-2022	
Curriculum	Updating the class listing, order, and content for the B.S. degrees in CS, CEC, EE, and SE. This is a continuation of the work from the previous year.
Faculty Search	Searching for, interviewing, and hiring new faculty into the department.
Graduate Recruiting	Marketing the department to increase student enrollment in the department's graduate degrees.
Program Review	A university program review for B.S. degrees in CS, CEC, EE, and SE, and M.S. degrees in SE, Systems Engineering, Cybersecurity Engineering, Electrical and Computer Engineering (ECE), and Unmanned Systems.
Year 4 – 2022-2023	
Asset-Based Course Culture	Identifying ways to encourage students to use their unique talents to thrive at Embry-Riddle.
Rewards and Incentives	Identifying methods to encourage faculty to participate in departmental projects.

Table I. Department committees throughout the project.

Each committee had a designated product owner and Scrum master, with the rest of the committee consisting of team members. Committees initially used the online Scrumwise platform to house their product and sprint backlogs, but as the project progressed, some committees adopted a new platform for their backlogs (Scrumwise, 2024). Committees were encouraged to follow the traditional Scrum process as closely as possible. However, due to scheduling constraints and faculty bandwidth, they were allowed to modify the Scrum process as needed to fit the committee's needs, e.g., having stand-up meetings twice per week rather than daily. The use of these meetings was left to the discretion of the committees. Some used them as stand-ups, while others hosted longer meetings to combine stand-ups with sprint planning or sprint retrospectives.

The data collection consisted of two parts:

1. Recording the Scrum meetings to analyze their effectiveness and efficiency.

2. Recording annual faculty interviews to gather individual perspectives on the effectiveness of Scrum over a traditional committee management style.

Analyzing Data

Data analysis was completed using codebooks based on the faculty interviews and Scrum meeting recordings, following the guidelines of MacQueen, et al. (MacQueen, et al., 1998). The codebooks were separated by year. Faculty interviews were then separated by faculty member and Scrum meetings were separated by committee. However, the same codes were used for both faculty interviews and Scrum meetings. Table II shows the codes that were used in the analysis and a description of them and their significance. Each code was chosen to analyze:

- Were the committees following true Scrum?
- Did the committees understand Scrum? How was this understanding or misunderstanding affecting their usage of it?
- Was Scrum effective for each committee?
- How did the use of Scrum for the committees affect the department culture?

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Code	Description	Significance
Hierarchy	How Scrum can affect junior faculty. Any mention of faculty hierarchy.	Does the inherent non-hierarchical structure of Scrum encourage junior faculty to participate more?
Scrum considerations	Team member considerations of Scrum. Is it helpful?	Analyzing benefits, drawbacks, successes, and challenges.
Scrum process understanding	Team member understanding of Scrum processes (backlog, point delegation, sprints, standups etc.). Include references to them using Scrum processes.	How well did the faculty understand the Scrum process? How did this reflect in the effectiveness of Scrum for the project?
Scrum role understanding	Team member understanding of Scrum roles (Scrum Master, Product Owner, etc.)	How well did the faculty understand the Scrum roles? How did this reflect in the effectiveness of Scrum for the project?
Scrum meeting efficiency	Team members follow a structured meeting process. Team members prioritize meetings. Team members share concerns about meetings.	How well were the teams working together? Did they follow the rules of the stand-up meetings? Were they staying on track?
Scrum modification	Team members modify Scrum to better suit the needs of the team.	How did the team need to change Scrum to make it fit their project and team members?
Adapting to Scrum	Team members adapt their schedules/ workflows to fit in their team's work for the Sprint.	How well did Scrum work for the academia setting?

Table II. Codes used for data analysis.

The codebooks aligned with the faculty interview questions, thereby ensuring direct evidence for the trends analyzed in this work. Meanwhile the Scrum team meetings were a bit more complex to code but also provided a more direct view of the effectiveness of Scrum for the department. These codebooks still mostly consisted of direct quotes from the meetings, but some additional analysis about meeting efficiency could be gleaned from the meeting recordings.

4. RESULTS

The codebooks enabled analysis of faculty attitudes throughout the three-year experiment. The most helpful code for this was Scrum considerations. Both the faculty interviews and the Scrum meetings were used in this analysis. Table III provides example faculty quotes from each year of the experiment, along with observations about their attitude throughout the years, and the overall trend of their attitude towards Scrum. These quotes are meant to be a representation of how each faculty member felt about the Scrum process being used for the faculty service committee meetings each year. Although there may be additional quotes from faculty members, these are the best representative quotes. The full results table is in Appendix A.

The trends presented in Table III are summarized in Fig. 2, which shows that 63.16% of the faculty had an increasingly positive attitude towards Scrum throughout the three years while only 15.79% had a neutral attitude and 21.05% had an increasingly negative attitude towards Scrum. The purpose of identifying these trends was to determine if faculty adoption attitudes had changed towards Scrum as a project management method for the department. Although these trends were qualitative, analysis focused on isolating the approval or disapproval of Scrum itself, as opposed to the committees' successes or failures. For instance, faculty member three noted an increase in their project's success, but attributed it to the straightforward nature of their project, not the use of Scrum, and generally showed a negative attitude towards Scrum. Because the interview questions aligned well with the intended codes, many quotes directly answered the question of adoption attitude, thereby providing evidence for the analyzed trends.

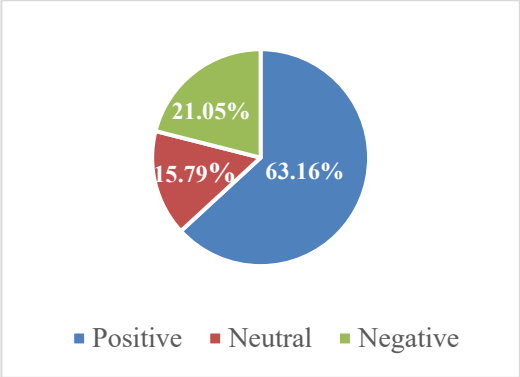

Figure 2. Percentage of Attitudes Towards Scrum.

Faculty Member	2020 Opinion	2021 Opinion	2022 Opinion	Observations	Overall Trend
1	- "I think it will positively impact some of the processes because some of the traditional processes are long and then cumbersome…there will be some…things that need to be blended using traditional techniques. But I would say overall, it's a benefit." - "…if you're not responsive on the market, you're probably getting behind. And…I don't see any reason for which this will not apply to education as well."	- "[Scrum] keeps people involved, so they have their own assignments and then they get the points…" - "…it helps in scheduling your tasks…and then it helps in tracking the department's needs." - "…people are involved and when you have your task and your name over there and you have to deliver, you are going to do it…And then if you don't do it, you're not doing your work and it doesn't look good."	- "…I was really surprised. I'd done those program reviews in the past…and then it was a before the deadline effort, on many times. But this one [was not]. We had the schedule, and we followed it with deliverables, and then the activities on the backlog, and everything that [was] completed. So, it really helped in doing the entire effort over the semester, rather than before the deadline."	A trend from belief that it is innovative and positive to being convinced that it helped the teams succeed	Positive
3	- "You have assistant professors that are trying to get tenure. We have other priorities, publish, funding, et cetera, et cetera. And you also have faculty that are full professors, been here for 20 plus years who might not care. They are set in their ways, so it can be hard for that [reason]."	- "[The success of the team was] actually finishing the work and accomplishing the goal. Not necessarily because agile was used, but because there was an external push that said 'RED is going to focus on curriculum'…[but the] search committee was not worth doing Scrum with because the backend work would have been way more overhead than the actual work."	- "I think it's because of the nature of the product. Look, when you know exactly what you need and you have to follow step one, step two, step three, step C, Scrum is not necessary…When you are trying to get feedback from the stakeholders and adjust short periods of time, i.e. from sprint to sprint, that's where Scrum shines through. So this doesn't work that well, and it's an overkill because we had or work well-defined..."	Noted the increase in success, but did not think that it was caused by using Scrum	Negative
12	- "I think the Scrum process will trigger more decisions, faster decisions, and also hopefully, make more meaningful decisions because the stakeholders are involved in the projects. That's what I envision. But also, I fear that the department will focus too much on the process, and not so much on the delivery. So, the amount of energy that we dedicate to the process should be minimized, and then it should be focused on the actually delivering under the Scrum framework."	- "...the product driven process is helping…Knowing that we need to deliver, and this is what we need to deliver, and this is when...That has helped to the success of the team."	- "Well, I think the big thing is the culture of delivery, so you have backlog items, and you need to deliver. I think that's mindset that helps as opposed to a committee that meets and you look at what you have to do and just figure it out and you arrange next meeting. There's no not a kind of time scale to things often, so I think the backlog and the delivery of the Scrum helps."	There was initial concern about focusing too much on the process, but they did believe in 2021 and 2022 that Scrum was helping the committees succeed	Positive

Table III. Example faculty opinions throughout the experiment.

It is important to note that there was some limited faculty turnover throughout the duration of this project, which could affect the results. Only faculty members who were interviewed for two or more years were analyzed. Any faculty member with only one interview was labeled as neutral because they did not indicate a change in adoption attitude.

Additionally, faculty members had varying levels of familiarity with Scrum prior to the project. Some faculty had previously taught Scrum or worked in industry where it was used. Although this may have affected initial attitudes for these faculty, this project focuses on the change in attitude over the course of multiple years, so variations in the initial attitude serve to diversify the case study and better tie this academic environment to industry environments where individuals may have preconceived notions of Scrum.

5. DISCUSSION

Based on the results, the experiment was clearly a success. 63.16% of the faculty had an increasingly positive attitude towards Scrum throughout the three years while only 15.79% had a neutral attitude and 21.05% had an increasingly negative attitude. These are especially important findings given how non-traditional this Scrum setting is.

When analyzing the quotes in Table III and Appendix A, there are some trends among the positive and negative statements that may explain both the resistance of faculty towards Scrum, and the increasing buy-in as the case study continued. Table IV summarizes common trends in statements and tallies how many faculty agreed with those statements over the course of the experiment. Table IV shows consensus on each of these statements. Overall, there were more positive statements and more faculty that agreed with the statements, suggesting that they increasingly bought into the idea of using Scrum throughout the experiment. Based on Tables III and IV, even faculty members who had a positive attitude at the beginning of the experiment, were concerned about their bandwidth or that Scrum might not be suited to academia. However, throughout the experiment, they became increasingly convinced that Scrum helped the committees accomplish their goals.

Statement	Number of Faculty that Agree
Positive Statements	
Easy to follow what needs to be done with the whole backlog available from the beginning of the project, good to break things down into smaller steps, helps with being goal-oriented	5
Keeps continual progress instead of waiting until the last minute	5
Holds the committee accountable for following through on ideas, and helps with making faster decisions	5
Holds committee members accountable for completing their work and in a timely manner	4
Scrum helped committees have results & hit deadlines	8
Negative Statements	
Not enough faculty bandwidth (too many meetings, takes too long to learn)	5
The projects are not suited to Scrum	3
There is too much overhead for small projects	2
Focusing too much on the process and not the work	2

Table IV. Positive and negative statement trends.

Based on these results, there are some key considerations for adopting Scrum into non-traditional settings.

1. The projects must be chosen carefully to ensure that the projects are not too small, that the tasks can be broken up into smaller tasks and among different members of the team, and that the overhead of Scrum does not exceed the time spent on the tasks.

2. Scrum must be modified to fit the limited bandwidth of faculty, e.g., only meet a couple of times per week instead of every day, assign fewer points each sprint.

With these considerations, Scrum can be successful in a non-traditional setting and team members can show increased buy-in over time.

It is important to note that there are some limitations to the connections that can be drawn between academia and industry. Faculty at a university may have more numerous projects than industry professionals at any given time. However, given the limited bandwidth of the

university faculty and their resistance to utilize that bandwidth for service requirements, these findings can be applied to other teams that may be resistant to adopt Scrum. These findings can also be applied to other departments that may have faculty with no Scrum experience, given that many of the faculty in this department had no experience prior to starting the project.

6. RELATED WORK

Other authors have noted the challenges that teams face when transitioning from plan-driven development to agile development (Javdani Gandomani, et al., 2013; Gregory, et al., 2015; Conboy, et al., 2011; Hanslo & Mnkandla, 2018). Many authors have even categorized the challenges that teams face during this transition in the hopes of preparing teams and reducing their struggle (Javdani Gandomani, et al., 2013; Gregory, et al., 2015; Conboy, et al., 2011). Javdani Gandomani et al. separate the challenges into four categories: organization and management related challenges, people related challenges, process related challenges, and technology and tool related challenges (Javdani Gandomani, et al., 2013). The authors' goal is to provide a reference to prepare teams for the challenges associated with transitioning to Scrum and make that transition smoother. Meanwhile Gregory et al. collected data at agile conferences and separated 193 challenges into the following seven themes: claims and limitations, organization, culture, teams, sustainability, scaling, and value (Gregory, et al., 2015). The goal of the authors was to summarize the academic knowledge in this area and note the need for this knowledge to be used in industry. Finally, Conboy et al. dove deeper into the challenges caused by people when transitioning industry teams from plan-driven development to agile development (Conboy, et al., 2011). The authors find nine specific problems during this transition, including fear that transparency will reveal developer skill deficiencies, lack of business knowledge and resistance to continual interaction with the customer. While these papers identify and categorize challenges that teams may face when transitioning to Scrum, none of them follow teams or individuals over the course of multiple years to analyze the difference in attitude and buy-in to Scrum over time, which this research does.

While team challenges have been analyzed, individual factors also make a difference in Scrum acceptance or rejection. Hanslo et al. develop a model to understand why individuals are resistant to adopting Scrum or why they might struggle once Scrum has been adopted by their team (Hanslo & Mnkandla, 2018). These criticisms or challenges include insufficient training and organizational culture, which align with trends found in this research. However, this paper does not follow individuals over the course of multiple years to analyze how their attitudes change regarding Scrum, which the research presented here does.

7. FUTURE WORK

This research has provided critical insight into the aspects of Scrum that cause team members to resist its use. With these areas of concern identified, future research should focus on avoiding these areas when transitioning to Scrum in academia. One such direction of future work is an exploration of different types of departmental projects, and which are best suited to Scrum. Such research could produce a detailed description of academic project characteristics that work for Scrum that other departments or companies can use as a guide.

Other concerns discussed by the faculty in this study include an increased workload on already limited bandwidth faculty members. Therefore, an exploratory study into training methods and Scrum modifications that reduce these concerns could also be a direction of future work.

Finally, faculty members described a concern that the department and the teams would focus too much on the process and not enough on the committees' goals. This can especially be an issue when faculty are still learning Scrum and therefore are highly focused on ensuring that they are applying it correctly. Therefore, research into Scrum training and transition speed to avoid over-focusing on the process would be beneficial to reducing time to faculty buy-in.

8. CONCLUSION

This research analyzed the adoption attitudes and buy-in of university faculty towards the use of Scrum in faculty service committees. The goal of this research was to connect the change in adoption attitudes to the larger category of non-traditional Scrum settings, allowing the lessons learned from this experiment to help in transitioning industry teams to Scrum. Based on the results of the experiment, faculty adoption attitudes improve over time because of the benefits of using Scrum and the increased success of the service committees. Analysis of the results shows that Scrum necessitates carefully

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chosen projects and may require small modifications in these resistant environments. Given the extreme non-traditionality of university department teams as Scrum settings, the authors conclude that the lessons learned through this experiment can be transferred to industry with few issues. Even the attitudes of highly resistant industry developers in high CMMI companies will likely become increasingly positive towards Scrum over the course of multiple years. Future work for this experiment could include developing a detailed guide towards introducing and transitioning from plan-driven development to agile development to manage individual and team adoption attitudes.

9. FUNDING DISCLOSURE

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10. ETHICAL STATEMENT

This work includes human participants who provided their informed consent (i.e., in compliance with the Declaration of Helsinki) before the experiment took place. The experiment was approved by the Embry-Riddle Aeronautical University IRB prior to taking place. To maintain the anonymity of the human participants, the data collected during this experiment is not publicly available.

11. REFERENCES

Conboy, K., Coyle, S., Wang, X., & Pikkarainen, M. (2011). People over process: key people challenges in agile development. *IEEE Software*. https://doi.org/10.1109/MS.2010.132.

Gratz, E., & Looney, L. (2020). Faculty Resistance to Change: An Examination of Motivators and Barriers to Teaching Online in Higher Education. *International Journal of Online Pedagogy and Course Design (IJOPCD), 10*(1). https://doi.org/10.4018/IJOPCD.20200.10101.

Gregory, P., Barroca, L., Taylor, K., Salah, D., & Sharp, H. (2015). Agile Challenges in Practice: A Thematic Analysis. *International Conference on Agile Software Development.* https://doi.org/10.1007/978-3-319-18612-2_6.

Griffith, A. S. (2020). A framework to assess higher education faculty workload in U.S. universities. *Innovations in Education and Teaching International, 57*(6), 691-00. https://doi.org/10.1080/14703297.2020.1786432.

Hanslo, R., & Mnkandla, E. (2018). Scrum Adoption Challenges Detection Model: SACDM. *2018 Federated Conference on Computer Science and Information Systems (FedCSIS).* Poznan, Poland. https://doi.org/10.15439/2018F270.

Hilburn, T. B., & Towhidnejad, M. (2020). Chapter 10: Using the Scrum Development Process. In *Software Engineering Practice: A Case Study Approach.* New York: Chapman & Hall. https://doi.org/10.1201/9780429168499.

Javdani Gandomani, T., Zulzalil, H., Azim Abdul Ghani, A., Baker Md. Sultan, A., & Ziaei Nafchi, M. (2013). Obstacles in Moving to Agile Software Development Methods; at a Glance. *Journal of Computer Science, 9*(5), 620-625. https://doi.org/10.3844/jcssp.2013.620.625.

Kasauli, R., Knauss, E., Kanagwa, B., Nilsson, A., & Calikli, G. (2018). Safety-Critical Systems and Agile Development: A Mapping Study. *2018 44th Euromicro Conference on Software Engineering and Advanced Applications (SEAA).* Prague, Czech Republic. https://doi.org/10.1109/SEAA.2018.00082.

MacQueen, K. M., McLellan, E., Kay, K., & Milstein, B. (1998). Codebook Development for Team-Based Qualitative Analsyis. *Field Methods, 10*(2). https://doi.org/10.1177/1525822X980100020301.

Pfeifer, H. L. (2017). How to be a Good Academic Citizen: The Role and Importance of Service in Academia. In *How to Find Success as a Criminal Justice Faculty Member* (pp. 90-106). Routledge. https://doi.org/10.1080/10511253.2015.1128706

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v11 n6366

Schwaber, K., & Sutherland, J. (2020). *The Scrum Guide.*

Scrumwise. (2024). (Scrumwise) Retrieved 2024, from https://www.Scrumwise.com/

Selleri Silva, F., Santana Furtado Soares, F., Lima Peres, A., Monteiro de Azevedo, I., L. F. Vasoncelos, A., Kenji Kamei, F., & Remero de Lemos Meira, S. (2015). Using CMMI together with agile software development: A systematic review. *Information and Software Technology, 58*, 20-43. https://doi.org/10.1016/j.infsof.2014.09.012

Stein Smith, S. (2021). The Academic Workload. In *Shifting from Accounting Practitioner to Academia* (pp. 87-145). https://doi.org/10.1007/978-3-030-67546-2_5.

Tagg, J. (2012). Why Does the Faculty Resist Change? *Change: The Magazine of Higher Learning, 44*(1), 6-15. https://doi.org/10.1080/00091383.2012.635987.

van Waardenburg, G., & van Vliet, H. (2013). When Agile Meets the Enterprise. *Information and Software Technology, 55*(12), 2154-2171. https://doi.org/10.1016/j.infsof.2013.07.012.

Appendix A – Full Results

Faculty Member	2020 Opinion	2021 Opinion	2022 Opinion	Observations	Overall Trend
1	- " I think it will positively impact some of the processes because some of the traditional processes are long and then cumbersome and also, I think. But as I said, it will possibly impact overall, there will be some of the things that need to be blended using traditional techniques. But I would say overall, it's a benefit. It's better to be responsive right now, if you're not responsive on the market, you're probably getting behind. And then I don't see any reason for which this will not apply to education as well so..."	- "…it works well, I would say it keeps people involved, so they have their own assignments and then they get the points and everything…it's different when you actually have to say, okay, what's the progress, right. I have it done. We're going to make it, check it, complete it and so on. So, it helps, it helps in scheduling your tasks, there could be many of them scheduling your tasks. And then it helps in tracking the department's needs and whatever, it depends on the team." - "I think so since people are involved and when you have your task and your name over there and you have to deliver, you are going to do it…And then if you don't do it, you're not doing your work and it doesn't look good."	- "…I was really surprised. I'd done those program reviews in the past…and then it was a before the deadline effort, on many times. But this one was… we had the schedule, and we followed it with deliverables, and then the activities on the backlog, and everything that [was] completed. So, it really helped in doing the entire effort over the semester, rather than before the deadline. So that's really something that we can report, actually, for this year." - "…I've seen the results of the teams. I've seen that the program review…we've seen that the faculty assigned to those teams have completed their tasks in time. And then the assessment office specifically thanked us for that…So I see the results of this, I see the results of the effective search, I see the results of recruiting..."	A trend from belief that it is innovative and positive to being convinced that it helped the teams succeed	Positive
2	- "…my main thing is…that it's very easy to feel you're doing a great job on the process and not actually accomplish the goal. And get too focused on making the process work and not keeping your eye, that we're actually trying to accomplish a goal. And I think that's our biggest risk, with the whole Agile approach, is that we're going to get so interested in backlogs and things like this, that we're not going to be making the progress toward the goal that we need."	- "My thing is, is that I think there's been a huge embrace of Scrum as a process, but there's been no demonstration that it's done anything to change or move us any faster or really do anything different than what we always do. So, it's hard to get excited about the latest new thing when it doesn't seem to have changed anything…The biggest difference I see is that in industry, we all wanted the same goal. In this department, we don't. And so, when you try to put all these teams together, they don't fit well in Scrum because everyone's not pulling	- "The thing is the sprints tended to be really short. They used to be ridiculously small topics that… What I'm going to do is I'm going to write on a Scrum process chart, and I'm going to create a bunch of tasks, and then I'm going to say, 'yay, you accomplished these tasks'. And that's basically what we did is instead of just doing something, we created lots of tasks, and we checked them all off…It's [terrible], it does not fit this application. Scrum works really well when everyone kind of has a coherent goal and we	A negative trend from thinking that it might not work, to being absolutely against it	Negative

		towards the same goal. And so it really kills the Scrum process when people don't want to achieve the same final result."	know what the goal is. This case, we don't know what the goal is."		
3	- "You have assistant professors that are trying to get tenure. We have other priorities, publish, funding, et cetera, et cetera. And you also have faculty that are full professors, been here for 20 plus years who might not care. They are set in their ways, so it can be hard for that and the reason why we do it in software engineering is because we can get rid of the process to speed up the response to change by leveraging the expertise. But in the department, that's not the same. We don't have requirements that change that fast…I struggle to see the full benefit of this as someone who's been doing it for many years."	- "[The success of the team was] actually finishing the work and accomplishing the goal. Not necessarily because agile was used, but because there was an external push that said 'RED is going to focus on curriculum'…[but the] search committee was not worth doing Scrum with because the backend work would have been way more overhead than the actual work."	- "I think it's because of the nature of the product. Look, when you know exactly what you need and you have to follow step one, step two, step three, step C, Scrum is not necessary. It's a network. When you are trying to get feedback from the stakeholders and adjust short periods of time, i.e. from sprint to sprint, that's where Scrum shines through. So this doesn't work that well, and it's an overkill because we had or work well-defined..."	Noted the increase in success, but did not think that it was caused by using Scrum	Negative
4	- "So, it went pretty well, pretty professional. We started... Because most of the faculty were in software engineering, computer science faculty. So, we started a backlog. Everybody was knowing who's doing what, who's finishing on time and things like that. So, it was very transparent, very, again, professional. I liked it."	- "I was mostly an outsider. However, from outside, it looked like they were very goal oriented. It was obvious from their updates during the department meetings. So, whenever they were giving updates on their progress, it was clear that they were working on very concrete tasks and giving updates on those tasks. So, I think it seemed to me like a positive impact."	No relevant quotes	No strong opinions but did state in 2021 that it seemed to be having a positive impact	Positive
5	- "So basically, I think about some of the metrics of the department looks like kind of a day-to-day operations. It's like a software engineer related, that kind of project. It makes perfect sense using Scrum. But some others, probably not that easy to put in that framework."	- "I think very effective. The reason is this. The reason is that whenever you have a huge project, sometimes we get a little bit, kind of fear. This is so typical, but when you're talking about the teamwork, if you can separate this big thing into smaller chunks and then everyone take one piece and then do it, and then the other person follows on, it's not so bad. I think that works	- "Yeah, again, the Scrum team works very well [to] keep the whole department moving forward. At least the routine work, so we are doing that fairly well. So that's why I'm saying that I don't see much change. So, it can be a good thing, it can be a bad thing but depending on how you evaluate that. But seem to me this is pretty good. Because we don't have	Went from being unsure about its utility in department projects to believing that it worked well	Positive

		pretty good."	chaos. We're still doing whatever we're supposed to be doing."		
6	- "The decision-making process is going to be easier and quick. And so, we can make a decision on certain things and we can implement. Like I said, implementing usually we're doing pretty good. But making a decision to implement that is something we're not doing well."	- "I think it's very effective. There's this approach because we've been talking about curriculum change for a very long time and…[but we] pretty much finished all the curriculum change proposal…I think probably [because of] the Scrum process, that kind of thing. I think that we follow that Scrum approach very effectively. Also, really, we have a regular weekly meeting, which push us to move forward and that's something...we have basically continuous meetings to push it forward."	- "The Scrum team is working on some curriculum change proposal that got it just approved. So that proposal, we discussed for many years and no, basically, final product. But because of the Scrum team, we actually have a final product, which is approved by the campus curriculum committee."	Anticipated that Scrum would be helpful, but then noted exactly how it was helpful	Positive
7	- "Here's the primary challenge. When I was in industry for 17 years, the tasks were well-defined and well-scoped because everything was under contract. In academia, I found that the university will swallow your entire life if you let it. It's always about trying to make sure that you can manage the workload that you're taking on which I haven't always done that well. There are always far more things that you might want to do than you can physically do."	- "…things got done, and that's what is different sometimes than non-Scrum, where you just say, 'Okay, here's our goal,' and we don't actually break down the steps to the goal."	- "I think the curriculum committee one could be counted as a pretty good success. Now, correlation, it's not causation. Right? So, we've been wanting to get these change proposals in for several years and it hasn't happened, so the fact that we got a committee together dedicated to do this, that was a positive thing. Now, whether that was specifically because of Scrum or because as part of the RED project, we dedicated a team to it. You know, we don't have the data to say either way. The Scrum process certainly worked in that environment."	Still saw bandwidth as a barrier after the year, but seemed convinced that breaking the tasks down into smaller tasks was beneficial	Positive
8	- "It might negatively impact the department culture, by the fact that faculty ward is very stable usually. Not a whole lot of mayhem, especially if you settle into your routines. You teach your classes, and you write one or two proposals, and everything else. In reality, when you're looking at Scrum, you're always looking for	- "The beginning was really good. As we got ... this kind of went over almost two semesters. As we got to the latter part, the attention was not there, the dedication was not there. You can sense burn up...the shorter timeframe for the project is better. I mean, if you look at it, in my opinion, you can see the burnout being on the rec project at this point."	- "So, to be honest, if I was doing this myself, December 9 would've been the deadline. Probably the weekend before December 9, I would sit down and actually sweat my butt to get this thing done. Would it have the same quality? I don't know. Because there was a stuff that it was revealed during the process..."	Although concerned about burnout by utilizing Scrum, they did acknowledge that Scrum helped spread the work out over the whole semester	Positive

	opportunity to do something more, something different, so that might cause a burnout that could potentially bad."				
9	No relevant information	No relevant quotes	- "I think what has been doing so far is pretty good. I think it's working out. So, because in the department meeting, people are talking what they are doing. I think it's very effective."	No indication of a change in perspective	Neutral
10	- "Sometimes we think it's too often probably better than the... I think the problem is probably we started to use the Scrum too late for this semester. So, we want to do something before the end of the semester. So, we meet twice per week, but if we do that twice per week sometimes, we think that we don't have too much activity to report to share something like that. I think that probably in the fall semester, if we have enough time probably, we don't need to meet twice per week. We can reduce the frequency of our meeting, once per week, or every two weeks it will be better. In that way we have more time we have enough time to prepare."	- "I think we could use Scrum more ambitiously."	- "Success, I think now we are clear about the similar programs offered by other universities. Before we started this project, we don't know what's going on in other universities. Now we are pretty clear about what they are doing. So, we know what's the difference between our program with others. So, I think this is the success. Without this project that we probably, we don't know, we just sitting in the dark."	No strong opinions present	Neutral
11	- "A month ago, we didn't have an IEB meeting really beyond a date, and we didn't have a town hall planned at all. We had our student awards, we've done... A bunch of stuff has happened. Some of them was going to happen anyway, but it was better because this team... I couldn't have thrown everything together. It facilitated getting my act together by having people I work with on a regular basis."	- "The meetings have been good, productive. I don't know that we've... Again, it was stood up late, it's the end of the term, we're already trying to deal with the transition to the Summer, and how do we do stuff in the Summer, and what do we do next, and the like? The other thing is it's good for me because it gives me accountability. [There are] people immediately... A small group of people waiting on me as opposed to a bigger group which is easier. The bigger the group, the easier it is to	No relevant quotes	No apparent change in opinion on Scrum	Neutral

		blow off."			
12	- "I think the Scrum process will trigger more decisions, faster decisions, and also hopefully, make more meaningful decisions because the stakeholders are involved in the projects. That's what I envision. But also, I fear that the department will focus too much on the process, and not so much on the delivery. So, the amount of energy that we dedicate to the process should be minimized, and then it should be focused on the actually delivering under the Scrum framework."	- "...the product driven process is helping as well. Knowing that we need to deliver, and this is what we need to deliver, and this is when. The spring's deadlines. That has helped to the success of the team."	- "Well, I think the big thing is the culture of delivery, so you have backlog items, and you need to deliver. I think that's mindset that helps as opposed to a committee that meets and you look at what you have to do and just figure it out and you arrange next meeting. There's no not a kind of time scale to things often, so I think the backlog and the delivery of the Scrum helps."	There was initial concern about focusing too much on the process, but they did believe in 2021 and 2022 that Scrum was helping the committees succeed	Positive
13	- "I would say it's a positive thing, because one of the main concerns I had was we had the problem for so many years and we have been talking about it for so many years, but no [substantive] action has been taken. I would say that the Scrum process seems to be conducive to taking more frequent actions that will result in more positive changes. That part I think it is opportunity..." - "…I would say certain aspects like promotion tenure [is not suited to Scrum], it's a structure that the university does have a set process. It's very hard to make any changes, because the process is pretty well defined and has a lot of different levels of variation. It's not really amenable to change."	- "…one advantage of the Scrum model is we do have this backlog of items to be accomplished. It's very obvious for everyone to see. So, we're clear that the set of tasks we need to accomplish at the end of the process. So, we are assigned a certain role, to attack sort of items on the backlog…It's not like a traditional committee, I would say most of committee members, they are just relatively passively responding to the chair's request. They're not taking the ownership of certain tasks to be addressed."	- "Well, I think the meetings, the weekly status meetings, are pretty useful in updating us the current status and what has been accomplished? So, we have a better sense of what to do next." - "Yeah, like I mentioned, I think the way the Scrum Team is structured, it has frequent status meeting, and we can move things along more consistently. It does improve efficiency of things."	Not fully certain of what its effects would be in the first year, but believed that Scrum had a positive effect on the department in the following two years	Positive
14	- "One thing that might be a little bit of causing friction right now is that and instead of Scrum being helpful or at least for the moment, is just creating additional work which could be because it's just the beginning and not everybody is familiar with it so	- "…we had a very effective [team]... As I mentioned, it's all about the team understanding and also holding themselves accountable. So, we had that culture. It was a very productive team."	- "I think what has been doing so far is pretty good. I think it's working out. So, because in the department meeting, people are talking what they are doing. I think it's very effective. I don't see any... yeah, I think it's going very well. People are doing a good	Some concern early on about the additional work of learning Scrum and the meeting frequency, but seemed to worry less about that in the later years	Positive

	hopefully as things roll down people will be more comfortable and less effort will be needed to get the Scrum process rolling and being effective. So, we shall see." - "In terms of delivering goals and being goal oriented, I think it's working much better than the non-Scrum traditional process. So, I'm happy with that aspect of it." - "One [negative] thing would be if the meetings and briefings are too frequent. So, at the beginning, as I mentioned, not everybody was that clear about what we're supposed to do, we were just meeting two or three times a week and just having nothing to talk about to be honest, because the timeframe was too short that nobody could achieve anything."		job."		
15	- "I like it. I think that we are not, as a department, all on the same page, I think, still, with what Scrum is. And I'm not quite sure what's the best way to get everybody on board. Partly because it's something that I think you have to get experienced with just practicing, and then learning and tailoring to yourself."	- "[Scrum] works well, I would say it keeps people involved, so they have their own assignments and then they get the points and everything…it's different when you actually have to say, okay, what's the progress, right. I have it done. We're going to make it, check it, complete it and so on. So, it helps, it helps in scheduling your tasks, there could be many of them scheduling your tasks." - "…since people are involved and when you have your task and your name over there and you have to deliver, you are going to do it. So, what can you doing? And then if you don't do it, you're not doing your work, and it doesn't look good…So it's like incentive to get those points or whatever that you have to perform the tasks and everything."	- "I would say that the final deliverable, the curriculum, was well received by the department, so that would be our big success." - "[I would] say that if this were a real Scrum in a real organization, having a process to fire or make corrective changes to your team, I think it would've been desirable and would've allowed us to at least have some better ways of talking about some of the issues that we've had."	Did not have a strong opinion on Scrum for the most part except that it helped to keep continual progress throughout the semester instead of all at the deadline	Positive

		- "[Scrum] will help in structuring the work over a larger period, rather than doing all of it towards the stated deadlines."			
16	- "I think it's a good practice. How well it works? I hope that it works. I think it will be good. It's a little different than the Scrum that I'm used to because the Scrum that I am familiar with and had very little practice was based on software processes period. This change of going to departmental processes, and doing this in Agile, and Scrum process for the department operations is a new thing. I hope that it works, and I think if you push it, eventually it's going to work." - "If you follow the actual Scrum processes, that means we have to basically do everything in a continuous motion rather than leave it alone for six months and come back to it."	- "The [morale] of the team is very high. Again, I think we are getting kind of to like it, granted the aspects of everyday meeting and every meeting, meeting, meeting, especially because it's all on Zoom. I'm a people person. I like to go to people's offices. I like to sit down and talk with them. So, this Zoom thing is really gotten into me, to be honest with you. But other than that, no, I think the morale is good."	- "Well, it worked well, I guess, because all of us contributed. All of us were okay doing this, I think. One factor was that we all bought into it. And then the deliverables that we had, if you were having it go one or two person not delivering on time, when we had our stand-up meeting and then the review meeting every two weeks, those people kind of sort of, not pressured, but felt like, hey, they got to do their stuff. And they did it and they did it fairly quickly. So, we pretty much didn't miss any deadline, very little deadline as far as a schedule was concerned. We missed internally, but we never missed a deadline for our team deliverable to the program review people."	Positive outlook throughout, but went from not being sure if it would actually work, to having concrete evidence that it did	Positive
17	No relevant quotes	- "…I think the concept of Scrum, I think it's [an] efficient way to get everybody involved. There is this hierarchical level. There is a program manager in the team that each one can contribute whatever they can, and that can be extended to the whole department also…people will feel that they are more involved, they are part of all this whole process. In that sense, I think this is a very positive effect on the whole department."	No relevant quotes	No evidence of a change in opinion	Neutral
18	No relevant quotes	- "I believe that it will affect the department and the culture in a positive way, because I think that when you...Actually, you are able to see the product right at the end of the process. And I think that's going to motivate you ... That will motivate	- "So, to compare the two [searches: traditional versus Scrum]... So here I feel like we are more targeted and more organized, and the retrospective and scheduling the small sprints is helping us in a way to be more effective	Gained concrete experience about the positive effects of Scrum	Positive

		you and I think that ... Yeah, it will motivate you to whatever you are trying to accomplish, you'll be able to accomplish. And it will give you the positive energy to move forward with any project."	and more targeted as compared to my experience with the last search."		
19	No relevant quotes	- "I'm sure that the idea is a good one because of the ability to cycle fast from one screen to the other so you could measure how things are going and adapt to change rapidly, but I'm not sure how that would apply to actually...I'm not sure how it would apply to academia completely." - "I think the best thing about Scrum is flexible scope. Because that way you can adapt to…things that change, rapidly…From that point of view, I think we could benefit. You'd have to wait two years to see what the result is which is hard to now fix because you have to go back and plan for another two years." - "You can't get a curriculum to change in a week. Things like catalogs have to be updated. That's not happening every month, so I think eventually it's going to have some kind of ... There's going to be a limit as to what you can do in terms of applying Scrum in an institution that does not have Scrum as its main methodology."	- "No, it's the ability to make everybody meet at certain times, and…to be able to have people have free time to be able to deliver monthly stuff regularly. We don't work like that. We don't go in, clock in at nine and leave at five and have fixed time to do certain things." - "This was definitely more organized [than previous recruitment experiences]. Before you met and you discussed things, and you wrote them down on a piece of paper and that kind of thing. But there was a plan and there was a structure. There was a structured date, so that was different." - "I think in some form it would work. I just don't know if it would work as planned. I'm not sure if it would work... Again, it's all about scheduling and getting people together and having everybody in lockstep, which is [difficult]... And they have lots of, everybody has lots of commitments."	Recognizes that there are benefits to using Scrum, but is not convinced that it is a good fit for academia	Negative

Table V. Faculty opinions throughout the experiment – Full Results.