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The Agile Academic Enterprise

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Currently appointed as the A. Dale Thompson Professor of Leadership at the University of Texas at Arlington, Dr. Erin Bowen is a scientist-practitioner with an interdisciplinary focus on the intersection of I/O Psychology and Aviation. With a research and practice career focused on applying psychological science to the aviation industry, Dr. Bowen's expertise is relied on by research and industry partners as well as numerous national and international news outlets. Recent media appearances include "Good Morning America", live in-studio on NBC's "Meet the Press", CNN's "The Lead" with Jake Tapper, CNN's "Tonight with Don Lemon", The Washington Post, BBC Radio, Bloomberg News, USA Today, Forbes, National Public Radio, a feature article in Flying Magazine, and many others.

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Prior to joining UTA, Erin was founding Chair and Professor in the Department of Behavioral & Social Sciences at Embry-Riddle Aeronautical University in Prescott, AZ. She holds a Ph.D. in Industrial/Organizational Psychology from Saint Louis University, with a graduate minor in Research Methodology.

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The Agile Academic Enterprise

Introduction

What might it mean to be an agile academic department?

"Agile", as used here, refers to practices and frameworks in software and system development and deployment, such as Scrum, Extreme Programming, and Crystal Clear. The Agile movement's founding documents, the Agile Manifesto and its accompanying Agile Principles [1], were published by leading software engineering researchers in February of 2001. The Manifesto staked out distinction with the prevailing software development approach at the time, called planned development and otherwise known as waterfall. The Agile Manifesto states,

> We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:
>
> Individuals and interactions **over** processes and tools
> Working software **over** comprehensive documentation
> Customer collaboration **over** contract negotiation
> Responding to change **over** following a plan
>
> That is, while there is value in the items on the right, we value the items on the left more.

Agile has been called everything from a mindset to a movement [2]. While it may be best known from its use in software development, Agile practices have been adopted in diverse enterprises such as as finance [3], learning [4], aerospace [5], and the military [6]. While the definition of Agile may vary with the domain in which it is applied, "Agile methodologies seek to rapidly *sense* environmental change, rapidly *adapt* to change, and rapidly *create* solutions." [7]

Academic enterprises have unique attributes: recurring, months long, instructional terms; "customers" (students) whose short-term dissatisfaction can be part of the path to long-term success; industrial stakeholders who influence program direction and focus to satisfy hiring needs; generation of new knowledge, often with financial support from government agencies and industry; service to the profession and to our institutions.

Our five-year project applies the Agile framework Scrum in operations of a medium-sized engineering department at a medium-sized university with an aerospace-aviation niche. Scrum is "a lightweight framework that helps people, teams and organizations generate value through adaptive solutions for complex problems" [8]. An overview of the Scrum framework is found in [9] and [10] and is illustrated in Figure 1. In Scrum, small teams create value by working in fixed, recurring intervals, or timeboxes, called "Sprints" of one to four weeks duration. Scrum Teams select and manage their own work from a Product Backlog, a list of prospective future work prioritized according to value by the Product Owner, who represents the enterprise's interests to the Scrum Team. The Scrum Master leads the Scrum Team in following Scrum guidelines and works within the enterprise to remove impediments. This work is distinct from use of Agile principles by individual faculty members in conduct of their professional activities [11] or in teaching and learning [4], [12].

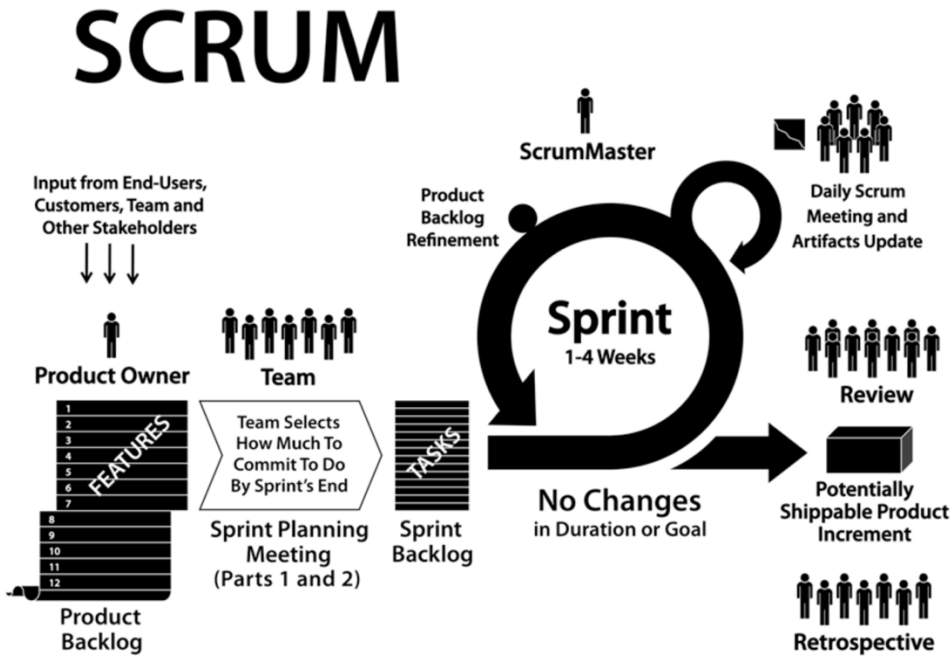


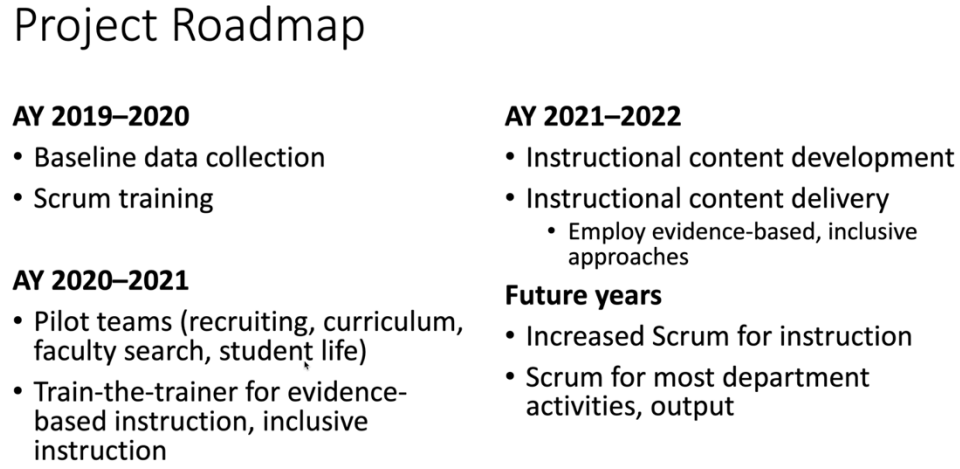
Figure 1. Scrum framework [13]

We conduct this research using Scrum, with two-week long Sprints featuring not-quite-daily Scrums three times a week. Table I shows the project roadmap. During the first year, we collected baseline data prior to use of Scrum for department activities. During this second year, selected faculty members in the department were organized into two teams to explore Scrum and build confidence about Scrum use. Demonstration projects, described in the following section, were selected in consultation with department faculty regarding relative value to department success. As the project matures, we will utilize Scrum in course development, incorporating inclusive and evidence-based instruction, and even in instructional delivery.

Demonstration Project Teams

The Curriculum team's goal is to revise and enhance the department's four undergraduate degrees (computer engineering, computer science, electrical engineering, software engineering) to better serve stakeholders (students and the industries that hire them). It is comprised of four members, one serving as both Scrum Master and Product Owner, with each member of the team representing one of the undergraduate degrees. As well as proposed curriculum revisions, work completed includes examining curricula of similar programs in other universities, reviewing ABET accreditation guidelines, and consulting bodies of knowledge for each domain. Following the Scrum framework, Sprints are defined to be two weeks and include Sprint Planning (one hour), Sprint Review (demonstrating the progress to the department chair, the Chief Product Owner) and Sprint Retrospective (one hour combined with Sprint Review), and includes twice weekly standup meetings (the not-quite-daily Scrum).

Table I. Project Roadmap



The Recruitment team's goal is to increase enrollment in the department's graduate programs: cybersecurity engineering, electrical and computer engineering, software engineering, systems engineering, unmanned and autonomous systems engineering, plus doctorate in electrical engineering and computer science. This team has five members: one faculty member serving as both Scrum Master and Product Owner, plus three other faculty members and one student. The team identified customers — the university's admission and marketing departments — that will use the team's products. Customers are updated frequently, providing suggestions and guidance on the team's products. The team also consulted with current graduate and undergraduate students to identify types of information valued when pursuing a graduate degree. The recruiting team delivered products in two-weeks Sprints, starting with a one-hour Sprint Planning, meeting twice weekly for 15–20 minutes for a not-quite-daily Scrum, and once every two weeks for an hour for its Sprint Review and Sprint Retrospective. The Product Backlog is well defined such that an Increment of Work is delivered at the end of each Sprint to the Chief Product Owner (department chair) and other stakeholders (if applicable).

Agile in Industry *vs.* Agile in Academia

Attempting to use an Agile framework for the academic enterprise encourages an examination of how we go about our business in the academy, and how that compares to industry practices. We limit what follows to comparing our understanding of Scrum both as idealized and as practiced in industry with matters identified in our use of Scrum for our RED team and in department demonstration project teams. Table II summarizes these comparisons.

Effort allocation. Scrum as idealized presumes each team member is working on a single project at a time, meaning only working on Sprint Backlog Items to complete the Sprint Goal. In industrial practice, a team member is often working only on one project, although it is occasionally the case that an individual is obligated to multiple projects. Researchers in this project and faculty members involved in demonstration teams have additional obligations — developing and delivering instruction content and activities, managing research, professional and university service — that historically are not conducted using Scrum or any other Agile approach. Among the faculty at any particular college or university, the situation ranges from instructional faculty with only teaching obligations to research-intensive faculty who may be

partially or wholly "bought out" of instructional obligations. The level of interest, energy, and time that an individual faculty member brings to a Scrum Team can be highly variable depending on other obligations.

Table II. Industry-Academia Scrum comparison

	Theoretical	Industry	Academia
Effort Allocation	Each member of the team is 100% committed to the project	In some cases, this is an unrealistic expectation.	Each team member is working on multiple "projects" (teaching, research, service) at the same time
Daily Scrum	Team meets daily to discuss project progress, reprioritize effort, and identify impediments and dependencies.	Team meets daily to discuss project progress, reprioritize effort, and identify impediments and dependencies.	Daily Scrum difficult to implement given varied schedules of team members
Engagement	Manager requires or team has chosen Scrum framework. Not following the framework could affect employee evaluation, lead to removal from team or enterprise.	Manager requires or team has chosen Scrum framework. Not following the framework could affect employee evaluation, lead to removal from team or enterprise.	Little penalty for not following the process.
Value Proposition	Items in the Product Backlog have associated financial value. Teams deliver product increment of value to customer each Sprint.	Items in the Product Backlog have associated financial value. Teams deliver product increment of value to customer each Sprint.	Value associated with projects/products often subjective instead of financial. Rank ordering difficult.
Expertise	Ideal team members are the T-shaped engineer.	Team members have a variety of expertise and can contribute to multiple project aspects.	Faculty team members tend to be expert in limited areas.

Daily Scrum. Because faculty members have multiple obligations, running the Sprint along industry lines with daily stand-up meetings is frequently seen by participants as more effort than appropriate for just one component of all their obligations, hence the not-quite-daily Scrum. The priority and the amount of time dedicated to each area/effort depends on many factors—e.g., stage in the profession, career growth, university guidelines (mission/vision), professional goals—and often change throughout the calendar year. At the beginning of a semester more time might be required to teaching, while during the summer a faculty member might devote more time to research. Individual deadlines such as publication deadlines, proposal submission deadlines, professional travel, and service obligations can influence prioritization of work. In industry, teams working under an Agile approach do not have as many competing individual factors. A team will have one simple goal, to deliver the Sprint Goal agreed to in the Sprint Planning Meeting. Everything that a team member does will be to add value to the product. This can bring a unique challenge to academia; some faculty might not be able to attend daily standup

meetings or might not be available to work for parts of a sprint. As agile approaches depend on small teams, missing team members can cripple the Scrum sprint.

Engagement. Scrum teams in industry largely either have chosen to use Scrum or have been directed to do so by management, leaving personnel on Scrum Teams to either use Scrum or change jobs. Academic leaders rarely have that degree of leverage over faculty, who are their colleagues. Evaluation of faculty is frequently if not usually based on performance in each of the three categories of instruction, research, and service—the "three-legged stool"—with each individual faculty member expected to demonstrate their individual performance in those areas. Credit for effort on a jointly developed research project is sometimes credited by negotiated proportion, but rarely is a faculty member evaluated for contribution toward team success in a general sense. Even effort on ubiquitous faculty committees is evaluated by the individual's contribution, not the success of the group. Under such a framework, there is little incentive or punishment for faculty to participate in team-based activities. Developing faculty engagement to Scrum Team membership and participation then requires other types of incentives and disincentives. Identifying such alternatives is a major goal of this project. Preliminary discussions with faculty members suggest wide-ranging motivations from student success and teaching excellence to successful research funding and hiring grad students.

Value proposition and the Product Owner Role. Other differences concern the notion of Product Owner and the value associated with Product Backlog Items. In industry, the Product Owner represents the enterprise and its customer to the Scrum Team, creating the Product Backlog Inventory and prioritizing it by value. This role provides a quick turn around on requirements validation and a rapid pathway to requirements change. This simplifies product creation, as the team can focus on implementing items in the Product Backlog. However, in an academic setting, identifying one person and empowering them to make decisions that impact an academic department is challenging. Furthermore, due to the nature of an academic department, the hierarchy above can overrule the Product Owner, thus weakening the benefit of using Scrum; *i.e.,* quick validation and rapid response to change. Product Owners will instead seek to get approval before themselves handing approval to the team, slowing the agile process.

Distribution of expertise. A related issue is role assignment and expertise in the distribution of tasks. In ideal Scrum teams, each person on the team has a specialty but each person on the team should be able to help with that person's task (the T-shaped engineer/Scrum cross-functional concept). In the RED project team, there have been instances where not everyone is familiar with the research skills, or knowledge of engineering practice, or engineering content, leaving many tasks to fall to a specific individual rather than having the team broadly contribute to task completion.

Summary

We are in the second year of a five-year project to use Scrum as the basis for operations in our department. As the project moves forward, we identified issues with using Scrum in an academic context and compared aspects of that with industry practices. As the project continues to evolve, we hope to better understand issues in bringing Agile practices into the academic enterprise.

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