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Agile Manifesto for Teaching and Learning

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Abstract

A group of faculty members representing six colleges at a public university formed a learning community to study the Agile Way of Working – a method of workplace collaboration widely used in software development – and to determine whether the concepts, practices, and benefits of Agile are applicable to higher education settings. After more than two years of study, experimentation, and reflection, this group found that its adaptations of Agile to higher education produced positive outcomes by increasing student engagement, encouraging students to take responsibility for their learning, enhancing the level and quality of collaboration, and producing higher quality deliverables. In this paper we propose an Agile Manifesto for Teaching and Learning that can be used to direct the work of higher education faculty in the classroom and beyond. Second, we describe our diverse experiences incorporating Agile tools and techniques into the classroom. Third, we present the results of a student survey concerning their experiences. Finally, we discuss our journey for adopting the Agile Way of Teaching and Learning.

Keywords: Agile, self-directed team projects, student-driven inquiry, collaboration.

The Agile Way of Working (or Agile) is a collection of principles and practices aimed at enhancing group collaboration that emerged in the software development field in the early 2000s. In an Agile environment, workplace teams place a heavy emphasis on collectively articulating their goals, frequently reflecting upon and adjusting work plans, facilitating authentic group interactions, improving team dynamics and encouraging experimentation and innovation (Smith & Sidky, 2009). Agile teams, by definition, do not follow a rigidly defined plan of action throughout a project; rather, they work in cycles, using frequent, time-boxed iterations that allow regular check-ins with and feedback from their colleagues and their end-product customers. Practitioners of Agile in the software industry have found that this way of incorporating real-time knowledge and feedback throughout the development process is quite conducive to mutual learning and innovation. Not coincidentally, they have also found that the end-products of this flexible de-

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velopment process are often better in quality and 'fit' to customer needs than are comparable products created by using more traditional linear working models.

Although envisioned initially for use in software development, the core principles and concepts of Agile are readily adaptable to group-based work in a wide range of professional fields as well. Building upon this basic insight, the co-authors of this article have been exploring together for over two years how the 'Agile Way' can be used to enhance teaching effectiveness and student learning in higher education. Our primary motivation in pursuing this work has been to create instructional environments where learning is *student-centered, self-authored* and *collaborative* (see Kegan, 1994; Baxter-Magolda, 2008). As such, we have developed and piloted a number of different collaborative Agile-based practices in classroom environments spanning across several academic disciplines. The results of these various classroom adaptations of Agile are reported below. Also proposed below is an "Agile Manifesto for Teaching and Learning," modeled after the 2001 document that launched Agile in the software world, that provides a conceptual framework upon which future innovations in higher education may be fruitfully considered.

This paper is organized as follows. First, for context and background, we provide a brief overview of Agile's emergence within the field of software development as an alternative to traditional approaches to group-based collaboration. Second, we discuss a proposed Agile Manifesto for Teaching and Learning that we have developed as a possible guide for future innovations in higher education. Third, we describe and evaluate our own experiences in adapting Agile methods and principles for use in our teaching of students in content courses spanning across several different academic disciplines. Fourth, we present the results of a survey concerning students' experiences using Agile teams and methods during class-related projects. Finally, we provide a brief overview of our journey in hope that it might provide guidance for other educators wishing to explore how this method of work may offer benefits to their own work as well.

Agile in Software Development

At a 2001 meeting in Snowbird, Utah, a group of software industry leaders developed an 'Agile Manifesto' of principles and practices aimed at improving both the quality of collaboration within software development teams and their ability to respond effectively to changing environmental and product requirements. (Beck, et al., 2001). This Agile Manifesto (see Figure 1) was embraced enthusiastically within the software development field and expanded rapidly in use; indeed, today, as Schur (2015) has found, well over 90% of the nation's software development firms use Agile for at least some of their collaborative development projects. And as Rigby, Sutherland & Takeuchi (2016) recently noted, Agile innovation methods "have greatly increased success rates in software development, improved quality and speed to market, and boosted the motivation and productivity of IT teams" (p. 31). Perhaps not surprisingly, organizational leaders in other fields, observing Agile's success in improving software development, have begun to adapt Agile for use in their own work environments as well (Gothelf, 2014; Krill, 2011; Rigby, Sutherland & Takeuchi, 2016; Scrum Alliance, 2012).

As Agile approaches have proliferated in use over time, practitioners have developed several widely-used collaborative Agile tools as well as a corresponding nomenclature. One major technique associated with Agile is the use of Scrum – an approach that utilizes cross-skilled, self-organizing teams to produce work products in small, successive iterations (Galloway, 2012; Schwaber & Sutherland, 2013). Other Agile techniques include the regular use of story card writing, estimation and sizing, product backlogging, iteration (sprint) planning, release planning, daily standups, show and tell, retrospectives, velocity, eXtreme Programming (XP), and Kanban (LeanDog, 2012). Within groups, 'social contracts' are often formed to reinforce positive behaviors and overcome dysfunctional ones (Riordan & O'Brien, 2012; Dando, 2013).

Manifesto for Agile Software Development

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

This is, while there is value in the items on the right, we value the items on the left more.

Kent Beck
Mike Beedle
Arie van Bennekum
Alistair Cockburn
Ward Cunningham
Martin Fowler
James Grenning
Jim Highsmith
Andrew Hunt
Ron Jeffries
Jon Kern
Brian Marick
Robert C. Martin
Steve Mellor
Ken Schwaber
Jeff Sutherland
Dave Thomas

Figure 1: The Agile Manifesto.

The Agile Way of Teaching and Learning

While Agile was initially conceived as a tool for software developers, its broadly applicable ideas about collaboration – as well as its essential similarities with other management approaches such as Total Quality Management (TQM) and Lean that have migrated beyond their originating environments (see Emiliani, 2015) – made Agile a likely candidate for adaptation by educational organizations. Such has been the case with the use of Agile Teaching, also referred to as Agile Instruction, which is a student-centered approach where learners work in teams and respond to rapid feedback. Instructors using this approach intentionally eschew adherence to rigid syllabi or lesson plans in favor of flexible classroom interactions and ongoing student/instructor collaboration (Briggs, 2014; Stewart, et al., 2009; Tan, 2012). As Royle and Nikolic (2016) have recently suggested, Agile has been found to be readily adaptable to educational settings despite the clear differences between profit-oriented organizations and those like schools that focus on the production of less tangible final products. Applied in any setting, they noted, "perhaps the most important facets of the [A]gile approach are ownership of the work and a collaborative supportive approach that builds in a reflective planning and review process" (p. 15).

Given Agile's specific disciplinary origins, it is hardly surprising that the majority of applications of Agile techniques in higher education to date have focused on computer science, engineering and similarly technical fields. A pioneer in this arena was Chun (2004), whose Agile-Teaching/Learning Methodology (ATLM) centered on three essential elements: agility (*i.e.*, instructors quickly adapting to students' abilities and needs), XP (meaning that if something is good for teaching/learning -- *e.g.*, giving feedback to students – then instructors should do it frequently), and independence (*i.e.*, students taking ownership of their own learning process). Indeed, ATLM frequently involves the extensive use of blogging, wikis, instant messaging and other technologies to support collaboration, knowledge sharing, and quick feedback. Chun, in the above-cited 2004 piece, reported considerable success in using this Agile-based methodology in several technical courses taught at the City University of Hong Kong – although the piece did not provide any formal assessment of outcomes. Other scholars have found similar success in adapting Agile to their teaching in computer science courses at other institutions as well (Anderson & Romney, 2014; Berry, 2012; Fox & Patterson, 2012, 2013; Guercio & Sharif, 2012; Mahnič & Časar, 2016).

Other scholars in science, technology, engineering, arts**,** and mathematics-oriented (*i.e.*, STEAM) fields have developed at least two additional education-focused adaptations of Agile ideas and methods. One is Agile Problem-Driven Teaching (APDT), which borrows from Problem-Based Learning (PBL) the use of iterative student work on complex problems while also calling for greater instructor flexibility and adaptation to different learning environments (see, *e.g.*, Dey, *et al*., 2009; Romney, 2009). A 2009 study by Dey, *et al*. provides several examples of the use of APDL in various STEAM-oriented (i.e., Science, Technology, Engineering, Arts, and Mathematics) curricula including mathematics, database development, information technology, and programming languages. The other is Extreme Pedagogy, recently introduced by D'Souza and Rodrigues

(2015), which adapts the principles of XP and the Agile mindset to teaching and learning in engineering. As D'Souza and Rodrigues see it, students should be viewed as the primary 'customers' of education, while other stakeholders – including parents, sponsors and the government – are best understood as secondary customers. As such, Extreme Pedagogy calls for educators to emphasize three elements of Agile in their teaching: (1) learning by continuous doing; (2) learning by continuous collaboration; and (3) and learning by continuous testing.

To date, educational applications of Agile beyond science and engineering are still uncommon. Still, a few pioneers have found success in this regard. Rebecca Pope-Ruark of Elon College, for instance, has used Scrum in her English courses to facilitate collaboration in student-group writing assignments, particularly large writing projects concerning complex real-world situations (Pope-Ruark, et al., 2011; Pope-Ruark, 2012). As Pope-Ruark explains: "In my experience, using Scrum to frame complex group projects encourages trust, engagement and accountability among students, while also promoting the learned behaviors of professionalism and reflective practice" (Pope-Ruark, 2012, p. 172). Similar examples of faculty use of Agile project management techniques for facilitating student teams can be found in chemistry (Piunno *et al*., 2014) and in digital media studies (Wilson, Brown, & Burke, 2013) as well.

Education Manifestos

In a relatively short time, Agile-based approaches to collaboration and innovation have migrated beyond industry and into education. Yet to date, almost all of the scholarly discussion of Agile in that latter arena has focused exclusively on the task of classroom instruction – even though Agile has much to contribute to educators' work outside of the classroom. Indeed, as Nikolic and Gledic (2013) have argued, institutions of higher education in general "must develop their capacity for change and transform their strategies, from constructed-beforehand to permanently-in-construction" (p. 119). And in that vein, Agile techniques of collaboration and idea-generation seem to be ideally suited for application beyond the classroom to other components of higher education work such as curricular development, administration, research collaboration and strategic planning. Yet our search of a broad variety of outlets uncovered only three instances – found in a blog, a conference proceeding, and a white paper posted on Research Gate – in which scholars had developed general Agile-based value statements applicable to education.

The first instance, by Peha (2011), responded to slowing growth in student achievement and lagging teacher morale in K-12 schools by seeking to help school principals become more effective organizational leaders. Specifically, Peha's proposed *Agile Schools Manifesto* called for the prioritization of:

- Individuals and interactions over processes and tools
- Meaningful learning over the measurement of things
- Stakeholder collaboration over complex negotiation
- Responding to change over following a plan

In arguing generally for an Agile approach to K-12 education in a variety of contexts, Peha especially emphasized its ready transferability to educational organizations and noted "how perfectly suited Agile is for running schools."

In the second instance, Kamat (2012), at the 2012 IEEE Fourth International Conference on Technology for Education, similarly called for changes in three core areas of educational work: teaching/learning, evaluation, and administration. Aiming primarily at schools of engineering, Kamat presented an *Agile Manifesto in Higher Education* that called for a new emphasis on:

- Teachers and students over administration and infrastructure
- Competence and collaboration over compliance and competition
- Employability and marketability over syllabus and marks, and
- Attitude and learning skills over aptitude and degree.

Kamat argued that in addition to increased learning, students will make a smoother transition to the workforce – particularly in industries such as engineering where job candidates already equipped with an 'Agile mindset' are especially valued in the market.

Most recently, Royle and Nikolic (2016) more generally called for an Agile-based collaborative approach to work in educational settings through the use of intentionally reflective planning and review processes. Central to Royle's and Nikolic's approach is a prioritization by teachers on the development of students' skills and understanding rather than on the *a priori* creation of detailed lesson plans. Their *Agile Pedagogy Manifesto* calls for an explicit value-ordering as follows:

- Practice preferred to theory
- Learner choice and agency preferred to learners being limited and controlled
- Learning and applying skills preferred to learning facts
- Collaboration preferred to competition
- Customized learning preferred to standardized one size fits all, and
- Co-constructed learning preferred to teacher-led learning

The authors suggested that for learners and teachers alike, this explicit ordering of values results in more fun for students, greater independence and choice and more support and collaboration in the learning environment.

Agile Manifesto for Teaching and Learning

Building upon this previous work, the authors of this paper –all faculty members at a mid-sized Midwestern public university -- have worked together for the last two years to study how Agile methods might be adapted and applied fruitfully to the day-to-day work of higher education faculty and staff. Working within an array of different disciplines,

we have used many of the specific tools and techniques used in Agile software development – such as Scrum, story card writing, social contracts, product backlogs, burn-down charts, daily stand-ups and retrospectives – in our own classrooms. More generally, we have each sought to understand the basic values and approaches that undergird 'the Agile mindset' and adapt those values to our work both inside and outside of formal instructional settings. In light of this collective experience, we now propose an Agile Manifesto for Teaching and Learning (see Figure 2) that we believe can usefully guide faculty, staff and administrators as they tackle a wide variety of the tasks that make up the work life of educators today.

This Agile Manifesto for Teaching and Learning is, above all else, a statement of core professional and personal values. More specifically, we believe that the key to successful application of Agile in higher education is an explicit prioritization upfront of the basic values that guide our day-to-day work as educators. To that end, we contend that faculty work, regardless of specific discipline, should value the following: (1) Adaptability over prescriptive teaching methods; (2) Collaboration over individual accomplishments; (3) Achievement of learning outcomes over student testing and assessment; (4) Student-driven inquiry over classroom lecturing; (5) Demonstration and application over

Manifesto for Teaching and Learning

We are uncovering better ways of teaching and learning by doing it and helping others do it. Through this work we have come to value:

Adaptability over prescriptive teaching methods
Collaboration over individual accomplishment
Achievement of learning outcomes over student testing and assessment
Student-driven inquiry over classroom lecturing
Demonstration and application over accumulation of information
Continuous improvement over the maintenance of current practices

While we believe there is value in the items on the right,
we value the items on the left more.

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The Manifesto may be freely copied in any form, but only in its entirety through this notice.

Figure 2. Agile Manifesto for Teaching and Learning.

accumulation of information; and, (6) Continuous improvement over the maintenance of current practices. Brief discussions of each of these six value statements immediately follows.

Adaptability Over Prescriptive Teaching Methods

As educators, we should value the ability of students to operate in an environment of uncertainty. Learning is a process of discovery that evolves as the participants are exposed to different contexts and experiences. Thus, if we are rigid in our expectations, then we lose the opportunity to create new knowledge. As such, we should ensure that we are flexible in meeting the needs of students rather than blindly enforcing a strict adherence to a syllabus. Likewise, we should aim to develop students that can navigate in the midst of ambiguity and thrive in a dynamic world.

Collaboration Over Individual Accomplishment

As educators, we should value a collaborative approach where all participants assist in a joint effort to accomplish an outcome. Collaboration requires transparent communication among all parties, including the ability to listen effectively and to provide positive feedback. As faculty, we should facilitate meaningful group interactions requiring engagement, cooperation, and contributions from all. We believe that a collaborative approach generally produces better results than any individual could have achieved alone. Experience with collaborative work also prepares students to work effectively in teams in their professional and personal lives.

Achievement of Learning Outcomes Over Student Testing and Assessment

Regular assessment is an essential element of instructional improvement and curricular development. Yet assessment is not an end in itself. Rather, as educators, we should strive to use assessment primarily as a tool to advance student learning and student mastery of disciplinary knowledge and skills. We should aim to move students from a short-term focus on doing what is needed to achieve a grade to a longer-term focus on how course material can be applied in each individual's future endeavors. As educators, we see great value in encouraging our students to be learning-driven rather than test-driven. We should strive to nurture self-motivated, lifelong learners.

Student-driven Inquiry Over Classroom Lecturing

Educators across the span of disciplines recognize that learning happens best when students are interested, engaged, and motivated to learn. We also understand that the motivation to learn often comes in response to questions and problems that students encounter along their journey and are inclined to explore. As teachers, we should cultivate student empowerment and individuality by assisting them with active-learning assignments and real-world experiential opportunities. Deep learning occurs when students consider contexts, develop new questions and utilize their own voices as they engage material and develop applicable skills.

Demonstration and Application Over Accumulation of Information

As disciplinary experts, we know that knowledge within our specific fields is constantly evolving and expanding. As educators, we want to create ongoing opportunities for students not only to master disciplinary content but also to demonstrate their knowledge and skills as they attain them. When students produce tangible evidence of their achievements, they build self-confidence, learn more deeply, retain that learning for a longer period and adapt more readily to changing needs and demands. We can celebrate our success when our methods have increased graduate recruitment, employment, and salaries, when faculty deploy our techniques, and when other institutions seek to replicate our results. Success is the joy of discovering that we have helped our students accomplish more than they had thought possible.

Continuous Improvement Over the Maintenance of Current Practices

As educators, we should strive to foster learning environments that encourage risk-taking, creativity and innovation. For faculty members, pursuit of this goal requires constant evaluation of current teaching practices and a willingness to try new things. For our students, this involves an environment in which students feel safe to try new things, fail, and keep on trying. Faculty and students alike can learn a great deal from their mistakes and from frequent assessment and formative feedback. We believe that a high-quality education makes meaningful connections from the present to the future and is based upon the trial and error skills that develop confidence and a willingness to innovate.

Examples of Agile Practices in the Classroom

As members of this learning community, faculty members from several disciplines have developed several distinct Agile-based instructional methods and assignments for use in their own classrooms. Adaptations to date have involved courses in computer science and software engineering, information systems, supply chain management, English, teacher education, civic studies, and political science. Those applications are described below.

Computer Science and Software Engineering

Members of this faculty learning community have used Agile techniques in at least three undergraduate courses in computer science and software engineering to date. One of those courses – Introduction to Agile – is aimed specifically at teaching students how to use Agile in managing software development projects. Two others – Introduction to Software Engineering and User Experience Design and Software Requirements – have been altered to incorporate numerous Agile concepts in lieu of the use of more traditional, faculty-focused teaching methods.

Tools and practices. In all three courses, a range of commonly employed Agile tools and practices have been adapted including chartering, physical and virtual 'Story/Kanban boards' and the frequent use of retrospectives. These Agile tools have allowed students and faculty alike to track ongoing progress toward class goals, enhance transparency and

mutual understanding about course topics, and promote ongoing reflection about the course and about students' own learning.

Successful application. Particularly useful has been the adaptation of a specific Agile technique called 'project and team chartering,' which is used in these courses at the outset in order to establish a classroom environment where students actively share, discuss ideas, and work collaboratively. In this chartering exercise, the Agile-based techniques and tools that are employed include:

- Ice Breakers – which prompt students to talk with one another and develop trust;
- Retrospectives -- which prompt students at the outset of a course to reflect on what they liked about their previous courses, what they would change in them and what they seek to gain from their coursework;
- Value sliders -- which are graphical representations that allow students to weigh the relative importance of their own subjective value choices in education (*e.g.*, the importance of learning v. high grades; collaboration v. individual work; flexibility over rigidity);
- Social contracts – which establish explicit rules for the class about how participants (both faculty and students) will relate to one another; and
- Course mission statements – which, in a single document, states the basic values and goals to be pursued collectively in the particular course at hand.

Information Systems Management

Agile techniques have likewise been employed by faculty teaching two courses in information systems management. One of these courses, aimed primarily at advanced undergraduates, focuses on the application of project management concepts and techniques to a specific real-world IT project commissioned by an actual client. The structure/schedule of that course is designed so that core content is covered via lecture or discussion in between two pre-scheduled two-week sprints focused solely on the commissioned project.

Agile has also been used in a junior-level elective class entitled Governance, Risk Management, Security & Audit. The main purpose of this class is to introduce students to information technology governance concepts and principles. The course includes a group project in which student teams (selected by the instructor to provide a balanced set of skills) perform a simulated IT audit of a fictitious company developed by alumni who work at a CPA firm in IT assurance and risk management services. Selected Agile tools are used for this simulated IT audit.

Tools and practices. During project-focused sprints, various Agile techniques are used including 'daily standups' – which call on group members to provide updates on progress and challenges; frequent discussion of 'user stories' – which prompt group members to imagine how their collective work product will be used; 'product backlogs' and 'sprint backlogs' – which take stock of collective progress on shared goals; and 'showcases' and 'retrospectives' – which highlight tasks accomplished and evaluate lessons learned along

the way.

Successful application. In order to raise awareness of peculiar issues that may arise when applying Agile techniques in specific course settings, one instructor introduces basic Agile objectives and methods in a class module on systems development; in addition, key IT governance issues, such as the possible lack of documentation are discussed with students. Following this introduction, student teams are guided through Agile processes that challenge traditional group project models. Students are introduced to the process of creating a team charter/social contract, carrying out a small number of 5-10 minute daily standups in class, as well as writing a retrospective that provides feedback at about the mid-point of the project. These adaptations of Agile techniques have been observed to improve the efficiency and interpersonal dynamics of the class's project-based groups.

Supply Chain Management

Agile has similarly been used to teach a senior-level course entitled Quality Management Systems, which is taken primarily by students earning a major or minor in the business school's supply chain management program. In this course, students learn a variety of quality management perspectives, including TQM, Six Sigma, and Lean.

Tools and practices. Students are assigned to five-person teams which solve authentic problems and which allows them to explore quality as a management framework. Before the first project, students are introduced to basic Agile concepts and specific Agile topics including planning meetings, Scrum, sprint reviews, and retrospectives. Tools such as Kanban boards and team charters are also introduced in order to provide techniques for effective teams. One student from each team is then selected as the 'Scrum master' and is made responsible for facilitating team meetings, reporting key information back to the class during daily standups, and the like. At the end of each project, retrospectives were conducted and teams changed their work agreements included in their team charters based on problems they have observed with their teamwork and how they were completing work.

Successful application. Because three separate projects were sequentially completed using Agile, several groups of students commented that by the end of the third project they understood how beneficial Agile truly was despite being originally resistant to it on the first project. Practically all teams had modified how they had conducted work to complete the projects and altered expectations for team member behavior from the first to last project. Specific comments were that Agile helped them complete their projects in a timely manner. They also noted that Agile reduced the free-rider effect more so than they had experienced in their other classes which had not utilized Agile. Most importantly, a few specific students commented that they would, on their own, attempt to utilize Agile methods on future team projects in other classes because they felt it was so valuable even if Agile is not used or taught in that class.

Technical Writing

Extending the use of Agile to an on-line instructional environment, a faculty member in English similarly used various Agile techniques in a course on technical writing. In the on-line section of the course, which is taken by students across diverse majors and disciplines, students are ultimately evaluated on a number of measures. A major component of the course, however, is a final group assignment that is managed in its entirety as a virtual Agile project.

Tools and practices. To facilitate student work on this project, Agile principles and practices were first introduced via a custom-developed video that reviews Agile, discusses key Agile principles and practices – such as 'backlog,' 'planning sprints,' 'standups' and 'retrospectives' -- and details how the approach was to be used for the final project. Students were then placed into virtual groups, and each group given access to a Trello board (Trello is an online site where individuals can create Kanban boards – called Trello boards – free of charge) that had been previously set up by the professor with different swim lanes for different sprint cycles. They then created virtual cards for each task they needed to accomplish for the last project and moved the cards they accomplished in each sprint into the appropriate swim lanes. The virtual Trello board significantly helped the groups visualize and manage their work.

Successful application. The weekly standups proved to be a highly effective instructional tool by allowing the faculty member to gauge in an ongoing manner both the students' levels of mastery of project learning outcomes and the quality of the class groups' interactions and collaborations. What's more, the transparency provided by the standups enabled the instructor to make mid-project corrections or changes as the need arose. Further, since each group's stand-ups and retrospective discussions were open to the entire class, students could also see how other groups were working together; consequently, they were given the opportunity to gain insight on others' approaches and points of view to usefully inform the work that they were doing as well.

Early Childhood Education

Within teacher education, another faculty colleague has used Agile in teaching Phonics and Word Study, a junior-level course required for all early childhood education majors. The key learning objectives for this course are to familiarize prospective teachers with historical and research perspectives on phonics, word analysis concepts and terminology, concepts regarding nature of the English language and its orthography, and instructional methods of phonics and word recognition used to instruct early childhood students. The specific content of this course is mandated both by national and state licensure standards developed collaboratively with the National Association for the Education of Young Children for early childhood teachers, as well as by the International Society for Technology in Education technology standards for educators.

Tools and practices. In this course, Agile practices are used to a significant degree; indeed, an Agile 'mindset' is infused throughout all course learning activities. Key Agile practices that are integrated into this course include:

- the creation by students of a 'social contract' at the beginning of the course;
- the use of a Trello board to organize and validate one of the required group projects;
- the use of a "fail fast" approach with each assignment, which allows quick turnaround time for grading and transparency about who might need additional support;
- weekly participation by students in stand-ups to report progress; and
- regular participation in retrospectives aimed at providing constructive feedback.

Successful application. During an end-of-course retrospective, students provided positive feedback on the use of Agile practices in this course. The most positive feedback reported was in support of 'showcases' and for validating the work of peers. 'Showcases' usually occur in the middle of a project as a means of facilitating feedback and timely revisions. During a 'showcase,' students are put on the spot to share their contribution to the project thus far. This Agile technique is helpful in decreasing the likelihood of students that often do not pull their own wait. From the instructor's perspective, it takes much of the authoritative role away from the instructor and puts it into the students' hands. Students often feel more comfortable taking constructive criticism from their peers.

Civic Studies

A faculty member recently debuted the use of Agile in Theories of Civic Leadership and Democracy, an introductory-level survey course designed to provide a critical introduction to democratic theory and to leading scholarly conceptualizations of community and civic leadership. Aimed largely at majors in the University's civic and regional development program, the course includes a semester-long group project in which students work in small teams to conduct an in-depth examination of a specific practitioner of community-based work at the local, state, national or international levels.

Tools and practices. Given the student audience for this course – mostly undergraduates in the social sciences with no formal background in software development, business practices or manufacturing methods – the instructor's use of Agile methods in this course studiously avoids the use of Agile terminology – such as 'Scrum,' 'retrospectives,' and 'Kanban' – which might be confusing or off-putting for student novices. Yet several basic Agile methods and techniques – including the use of frequent iterations, self-organizing and self-governing small groups, time-blocking, frequent check-ins with the 'customer' and repeated revisiting of user stories – are all used to spur group creativity and to foster intra-group accountability for product completion.

Successful application. By design, the group project assignment leaves considerable discretion and creative choice to students regarding the specific practitioner that they will

study, the research questions that they will ask and the methods that they will use to explore those questions. No rigid length requirements, presentation designs or modes of analysis are prescribed up front; rather, consistent with Agile principles, groups are instructed to view the instructor as the primary 'customer' for their final 'product' – which, according to the assignment 'contract,' is to be an "interesting, thorough and critical examination of the chosen organization/practitioner's structure, goals, activities and challenges." Groups must produce two deliverables – a written group report and an in-class presentation – by the last week of the semester. To this point, the instructor has found that the use of these techniques has resulted in consistently high-quality 'final products' from enrolled students. Two positive outcomes are especially noteworthy. For one, the use of Agile techniques quite quickly exposes 'free riders' in groups who can then be coached accordingly to modify their behavior. For another, the high levels of authentic collaboration that Agile techniques produce in small student groups leads to well-integrated final 'products' that compare quite favorably to comparable group papers that consist largely of loosely compiled pieces of individual work.

Political Science

Similarly, Agile has informed the instruction of several regional campus sections of the University's introductory course on American politics and government (American Political System). Within the curriculum, that course is designed to advance two primary goals. First, it provides a baseline of content knowledge about American political processes and institutions that political science majors and minors can build upon in subsequent coursework in the field. More broadly, the course is also part of the university's general education 'core;' as such, it aims to develop in students the ability to think critically, to work collaboratively, to communicate effectively and to act ethically in the world.

Tools and practices. A variety of Agile-inspired tools – including time-blocking, standups, client check-ins, discussions of user stories and the development of group 'community standards' – are used to structure and facilitate all group-based work in the course. As with the civic studies course described above, the instructor intentionally avoids the use of Agile-specific jargon in the classroom; still, the 'Agile mindset' guides every major element of group activity throughout the semester. Indeed, even the initial decision of how students are assigned to groups – whether by student choice, by lots, by alphabetical order or by some other means – is made not by the instructor alone but rather by the collaborative development in small groups of competing proposals through several iterations constrained by short time-boxes.

Successful Application. The primary group-based activity in the course is a semester-long research project in which students work collaboratively (in groups of 4-5) to design and complete an assessment of a local community's 'civic health.' On the course syllabus, students are instructed only to produce a 'substantial written report' that presents their groups' research findings; consequently, groups are left largely free to determine (a) their own operating 'ground rules;' (b) their particular divisions of labor; (c) which communities they will study; (d) how they will study those communities (*i.e.*, which research

methods they will use); and (e) the specific length, format and content of their final 'products.' Students in end-of-course evaluations have responded quite positively both to the level of autonomy provided to groups in the class and to their own experiences in working as parts of teams. The instructor, moreover, has found that the use of an Agile approach has produced research products that are significantly higher in quality and in originality than were comparable projects produced by more tightly scripted group assignments in the past. What's more, the instructor has encountered a strikingly lower number of instances than is typical of significant student-to-student conflicts within groups and of complaints about unequal distribution of work.

Student and Faculty Perceptions of Agile Teaching and Learning

How have students generally responded to the use of Agile in the classroom? To find at least a partial answer to this question, the authors of this study conducted a survey of students who have enrolled in six of the Agile-infused courses described above. Altogether, 109 students participated; their responses are summarized in Tables 1 and 2 below. The survey questions were crafted both to elicit students' general views about the utility of an Agile approach to instruction and, more specifically, to assess the usefulness of particular Agile 'tools' in facilitating student group work. A standard five-point Likert scale was used for each question, with a "1" signifying strong disagreement with a given statement and a "5" signifying strong agreement. Some faculty members who administered the survey to students did not utilize or teach all aspects of Agile to their students; thus, for those instances, the data reported in Tables 1 and 2 below include numerous entries of "N/A."

Table 1 displays the survey's results for items pertaining to students' perceptions of Agile's utility in advancing a range of learning outcomes. As the data indicate, a significant number of students found great value in their exposure to Agile techniques in the classroom. Most students agreed that the use of Agile contributed to "a more effective learning experience" and supported a "more efficient use" of their time. A clear majority likewise found that Agile techniques enhanced the quality of their class project deliverables. Most offered high praise for Agile's use in enhancing teamwork on group projects and in simulating real-world conditions for team-based work. Perhaps most important, students consistently expressed strong support for the view that the use of Agile "was a beneficial learning experience" for them.

The data reported in Table 2 reflect similarly high levels of student satisfaction with the use of specific Agile techniques by their professors across a range of academic disciplines. By large majorities, students expressed a greater understanding both of how to conduct Agile-inspired retrospectives and how they contribute to effective group collaboration. They reported similarly high levels of understanding and appreciation for the use of sprint planning meetings and daily stand-ups as useful means of collaborating with others. Most students likewise understood and supported the use of project charters as a mechanism by which collaborative groups can reach agreements about shared goals and desired outcomes. In the same vein, most students expressed the view that their use of Agile in class helped them to understand the value of having a task facilitator (or

'Scrum master' in the lexicon of Agile) to lead certain kinds of group work. Perhaps interesting to note here is the fact that, as a general matter, the survey statements pertaining to how and why specific Agile practices are used (Table 2) elicited slightly higher levels of agreement overall from students than did the questions that connected more generally to the learning outcomes associated with the Agile projects (Table 1). Such differences in response, however, were quite small overall; indeed, students generally offered strong support for both the use of specific Agile techniques and for their utility as effective tools for advancing teaching and learning.

How about faculty perceptions of Agile? Alongside student surveys, the authors of this study also gathered feedback from participating classroom instructors in a series of small group discussions. In those fora, faculty colleagues expressed high levels of support for the use of Agile and high levels of satisfaction with student performance in Agile groups. And in perhaps the best indicator of satisfaction, each person in the working group indicated their intent to use Agile in their teaching again in the future. At the same time, some faculty members also reported that Agile methods seemed to work best with more mature students and those who had been exposed to Agile in their previous courses. What's more, a few stressed the importance, particularly in courses outside of engineering and computer science, of avoiding excessive attention to the specific nomenclature associated with Agile while introducing students to its ideas and methods of collaboration. (Indeed, several faculty urged that their colleagues *not* focus not on Agile terminology *per se* but rather on the fostering in their classrooms of a broader Agile 'mindset' that can usefully guide students' collaborative efforts in a wide variety of disciplinary settings.)

Faculty members provided several additional tips about the practical uses of Agile in classroom settings. For one, several suggested that making the Agile project(s) in a course a significant part of the grade helped considerably in gaining student 'buy-in' and ensuring student commitment to the often time-consuming task of participating in Agile teams. Several also suggested that, even with Agile, faculty would likely encounter an ongoing need to monitor student groups so as to avoid problems created by student free-riders. One faculty member urged that, when using Agile, it would be wise to remind students to focus their collective efforts on the needs of the 'customer' or end user.' Finally, one faculty member believed Agile was best taught and accepted when students were assigned multiple, short, unrelated Agile projects. In this way, the students could perform multiple retrospectives throughout the semester, giving them an opportunity to improve, without being hindered by mistakes made in earlier projects.

Faculty Spotlight

An Agile approach to teaching and learning is by nature student-centered. It is meant to focus on engagement, collaboration, and adaptability. In being collaborative and student-centered, we are helping to students to learn to work together successfully, which is a goal of collaborative learning (Bruffee, 1995). In collaborative learning pedagogy, it is suggested that the instructor not intervene in working groups so students can learn to self-govern (Bruffee, 1995). In this regard, the instructor becomes a coach and facilitator. In

Table 1: Student perception of Agile outcomes.

		Overall *n=109*	Agile Software Eng. *n=7*	IT Project Mgmt. *n=7*	Information Risk Mgmt. *n=36*	Quality Mgmt. *n=36*	Technical Writing *n=16*	Phonics & Word Study *n=7*
Realistic context	Mean	4.0	5.0	3.6	3.8	4.2	3.8	4.1
	Std. Dev.	0.6	0.0	0.8	0.7	0.5	1.0	0.7
Effective learning experience	Mean	3.8	5.0	3.6	3.6	3.9	3.8	3.6
	Std. Dev.	0.7	0.0	1.0	0.7	0.8	0.8	0.8
Efficient use of time	Mean	3.9	5.0	3.7	3.6	3.9	3.8	4.0
	Std. Dev.	0.8	0.0	0.5	0.8	0.9	0.9	0.6
Teamwork	Mean	3.9	5.0	3.7	3.8	4.0	3.8	3.4
	Std. Dev.	0.8	0.0	0.8	0.8	0.9	1.0	1.3
Deliverable quality	Mean	3.7	4.7	3.4	3.5	3.8	3.8	3.4
	Std. Dev.	0.8	0.5	0.8	0.8	0.8	1.0	1.0
Overall learning experience	Mean	4.0	5.0	3.9	3.8	4.1	4.2	3.9
	Std. Dev.	0.7	0.0	1.1	0.9	0.6	0.9	0.7

Table 2: Student perception of Agile techniques.

		Overall *n=109*	Agile Software Eng. *n=7*	IT Project Mgmt. *n=7*	Information Risk Mgmt. *n=36*	Quality Mgmt. *n=36*	Technical Writing *n=16*	Phonics & Word Study *n=7*
How to retrospectives	Mean	4.2	5.0	4.2	4.0	4.3	4.1	4.0
	Std. Dev.	0.8	0.0	1.2	0.9	0.7	0.9	1.0
Value of retrospectives	Mean	4.1	4.9	3.8	3.9	4.3	4.2	4.0
	Std. Dev.	0.7	0.4	1.2	0.7	0.7	0.7	1.0
How to planning meetings	Mean	3.9	4.6	4.0	3.3	4.3	*N/A*	3.3
	Std. Dev.	0.7	0.5	1.1	0.9	0.6	*N/A*	0.6
Value of planning meetings	Mean	3.8	4.7	4.0	3.2	4.3	*N/A*	3.3
	Std. Dev.	0.8	0.5	1.1	1.0	0.6	*N/A*	0.6
How to daily stand-up	Mean	4.2	5.0	4.0	3.9	4.4	4.1	4.2
	Std. Dev.	0.6	0.0	0.6	0.8	0.5	0.8	0.4
Value of daily stand-up	Mean	4.0	4.9	4.0	3.7	4.2	4.1	4.0
	Std. Dev.	0.8	0.4	0.9	1.0	0.7	0.5	0.7
How to project charter	Mean	4.1	4.6	4.3	4.2	4.0	*N/A*	3.0
	Std. Dev.	0.7	0.5	0.5	0.6	0.9	*N/A*	0.0
Value of project charter	Mean	4.0	4.6	3.5	4.0	4.0	*N/A*	3.0
	Std. Dev.	0.8	0.5	1.4	0.7	1.0	*N/A*	0.0
Value of scrum master	Mean	3.9	4.8	3.2	3.5	4.3	*N/A*	*N/A*
	Std. Dev.	0.9	0.5	1.3	1.0	0.8	*N/A*	*N/A*

an industrial context, there is no "manager" who instructs the Agile team on how to function or conduct their work—teams are self-organizing. In our collective experience, an Agile instructor's place in the classroom is to provide tools (Agile tools) so students can learn to work successfully together, including how to self-organize. Agile instructors provide guidance on Agile practices and tools so students become fluent in talking about Agile and practicing Agile. In our experience, being an instructor who practices Agile does not mean that we take a disconnected distance from our students. We simply use a set of Agile practices and tools to help foster collaboration and group success.

From one instructor's view, the Agile approach has worked at least as well as the traditional waterfall approach (e.g., sequential or linear completion of well-known tasks) in

producing both high-quality end products for course clients and high-impact learning experiences for students. Still, students new to Agile-based approaches have at times struggled in courses in at least four ways. First, some students experience considerable difficulty in converting their 'user stories' into discrete tasks that can be accomplished within the available time. Second, some students struggle to break free from the divisions of labor that traditionally define IT workgroups; that is, some groups, despite instruction to the contrary, tend to fall back reflexively into traditional group roles such as 'designer,' 'coder,' 'tester,' and the like. Third, students sometimes approach the discrete 'sprints' involved in a project as traditional phases of a linear assignment rather than, as Agile suggests, as separate units of work each with defined objectives. And finally, students in the course are often inexperienced in working under conditions that require significant self-direction. Indeed, for nearly all of the students in this course, this project is the first of its type that they have worked on. Especially in the absence of experienced peers, the ongoing need to 'self-start' in Agile projects is a challenge for many novice students to fully grasp.

Agile Teaching and Learning has created other challenges as well. For instance, the combination within a single course of significant new Agile content (in addition to the course content) along with the application of that content can prove to be confusing and difficult for even the most engaged and motivated students. What's more, the need for dedicated physical space for the posting of Agile project notes, story boards and the like – or in the alternative, at least the availability of virtual on-line spaces on online sites such as Trello – can prove to be an obstacle depending upon the particular classroom space that is assigned for an Agile-infused course. Still, most of these challenges can be managed well enough to make the benefits of using Agile significantly greater than the costs associated with implementing and using these techniques.

Adopting Agile Teaching and Learning

Adoption of the Agile Way of Teaching and Learning is predicated on a desire to become more student-centered with a focus on collaboration. By adopting an Agile Mindset, a mindset where engagement of stakeholders is coupled with reflection inspection and adaptive action, the potential to enable a greater sense of ownership and an improved experience (among other things) increases.

Our own journey towards adoption of Agile occurred through faculty participation in an Agile Faculty Learning Community (FLC). The FLC was organized and led by one faculty member with experience in teaching Agile and another with both teaching and practical experience applying Agile in the workplace. Both were (and are) ICAgile Certified Professionals, while one is also certified for Agile Coaching.
The process of adoption used the following steps:

1. Training
2. Identification of Goals
3. Modeling and Piloting
4. Retrospective Evaluation

5. Modification

Training. In the software industry, adoption of Agile practices without an introduction to the motivation and mindset will typically degrade the benefits of Agile over time. We found it important to receive training from a certified Agile trainer and have since developed our own training materials for faculty. In addition, we supplement the training with participation in an Agile FLC.

Identification of Goals. We developed the manifesto with the goals of adaptability and continuous improvement (among others) with the intent of focusing on why Agile should be used. Based on our experiences, the Agile Way of Teaching and Learning is applicable to most disciplines. We suggest selecting Agile practices that are most relevant to the values and goals you want to achieve. For example, if your course includes a group project (and thus you wish to stress *collaboration*) we suggest having each group create a *social contract* or *team charter*. This is a simple method that can be used to hold group members accountable for their behavior.

Modeling and Piloting. While the faculty that participated in our FLC received training, in many instances, the students in the courses where the approaches were being used did not. As such, the importance of modeling and piloting cannot be understated. To address this, modeling of the approaches in the small provided a means for piloting the techniques. For instance, in courses where *social contracts* are being used for establishing group collaboration norms, the same method can be used at the course level through establishing a course-level social contract.

Retrospective Evaluation. Retrospectives are the backbone for Agile organizations. Without some form of reflective inspection and adaptive action, organizations cannot easily identify stakeholder concerns and cannot improve how they work together to achieve some desired goal. When adopting Agile for teaching and learning, it is important to frequently perform retrospectives rather than rely on either teaching evaluations or a single midterm evaluation such as +/Δ (pronounced "plus-delta") (Helminski & Koberna, 1995) and Small Group Instructional Diagnosis (SGID) (Clark & Bekey, 1979). Retrospectives can take many forms; Derby, Larsen, and Schwaber (2006). provide the best instructional treatment of retrospectives for teams.

Modification. The counterpart to *retrospective evaluation* is *adaptive action*. One of the greatest benefits of applying an Agile approach is "*being Agile*". That is, adopting an Agile Mindset provides the ability to focus on adaptability and continuous improvement through collaboration with others. As such, the focus is not on rigidity of the approaches but rather the adaptability to different contexts to meet the needs of each learner or cohort of learners.

Conclusion

Faculty in a wide variety of instructional contexts express frustration at times with the quality of collaboration in group-based class projects, their students' levels of engagement with group work and their students' often low levels of inclination to take owner-

ship of their own learning. Seeing the parallels that exist between creative collaboration in industry and similar group-based work in higher education, an interdisciplinary group of faculty at a mid-sized public university formed a learning community to study the Agile way of working and to determine whether and how the concepts, practices, and benefits of Agile are applicable to a higher education setting. After extensive discussion and study – as well as significant 'field testing' of Agile methods and techniques in a variety of classroom settings – we now believe that our Agile Manifesto for Teaching and Learning - which places high value on the principles of adaptability, collaboration, achievement of learning outcomes, student-driven inquiry, demonstration and application and continuous improvement - leads to better learning outcomes for students, greater student buy-in for group-based projects, more authentic forms of group collaboration and greater opportunities for creativity and leadership by members of student groups. To be sure, the experiences and impressions that are reported in this article are still preliminary at best; indeed, most of the participating faculty in this learning community will continue to experiment with Agile in their teaching and in their other faculty work experiences in the months and years ahead. Still, at this point, enough evidence now exists to suggest that Agile provides a way of collaborating and creating that offers much of value to faculty members and others in the higher education community. With the above-reported Manifesto, we hope that our colleagues in other fields and in other institutional settings will be encouraged to explore how this method of work may offer benefits to their own work as well.

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