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Scrum as a Change Strategy

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Scrum as a Change Strategy

While engineering programs are expected to graduate engineers who can work in teams, many, if not most, engineering faculty members have little practical experience with teamwork as practiced in industry [1]. Eschenbach et al. [2] note that like IT and software development industries, work in academia tends to be a collection of projects including teaching, conducting research, publishing, and providing service to the institution and field. However, faculty culture remains individualistic within engineering departments and across the university: performance evaluations rarely evaluate teaming effectiveness and collaboration within or across departments is not rewarded [3, 4]. Research suggests that scientists and engineers are highly individualistic, self-directed, with a strong desire to share their knowledge and the need for approval from their peers [5, 6]. Adapting agile techniques, specifically Scrum, can be used as a comprehensive change strategy to enhance the quality of engineering education and support faculty collaboration.

Scrum [7-9] is a framework to facilitate productivity by prioritizing tasks with highest value and by working in short time increments within an "inspect and adapt" framework. Project requirements can be adjusted during the development process, incorporating results from regularly occurring reviews by customers and other stakeholders. Scrum is frequently applied in software development and is well known in that field, with key industry leaders utilizing Scrum in software design, development, and deployment. As with other agile techniques, Scrum is recognized for its ability to drive innovation and create institutional change.

Scrum Overview

Scrum employs key roles, ceremonies, and artifacts to support development in iterative episodes called Sprints of duration no longer than one month, with one or two weeks being common. Key roles include the Scrum Team Members, the Product Owner, and the Scrum Master (Figure 1).

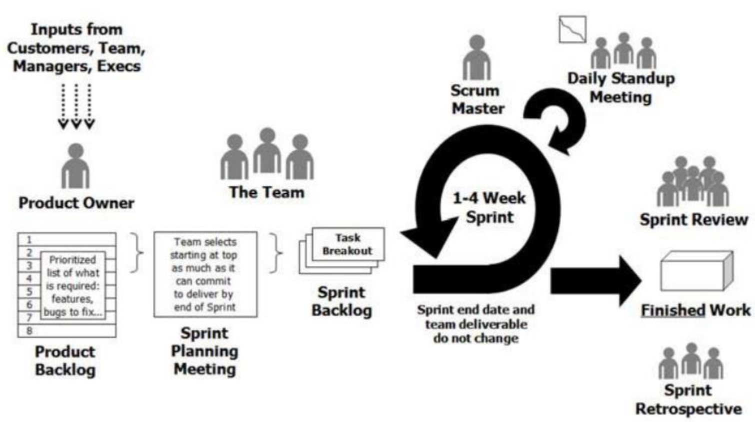

Figure 1. Scrum Process (Sutherland and Schwaber, 2007)

"The [Scrum] Team consists of professionals who do the work of delivering a potentially realizable increment of 'Done' product at the end of each Sprint." [8] "The Product Owner is responsible for maximizing the value of the product resulting from work of the Development Team. [8]. The Product Owner is the interface among the developing organization, the customer, and the Scrum Team regarding what is to be built and when it is to be released. "The Scrum Master is responsible for promoting and supporting Scrum by helping everyone understand Scrum theory, practice, rules, and values. The Scrum Master is a servant-leader for the Scrum Team." [8]. The Scrum Master is the interface among the Product Owner, the Scrum Team, and the organization and the Scrum Team regarding how what is being built is built, whether it is ready for release, and how to release it. The Scrum Master acts as a Scrum advocate of the Scrum Team and guides them in proper use of Scrum, particularly helping the Team identify impediments to Team success. The Scrum Master works with organization management to removed identified impediments.

Scrum has three pillars: transparency, inspection, and adaptation. These are supported by the Scrum values of commitment, courage, focus, openness, and respect. Transparency is a key element: planning and development artifacts are always available to Scrum Team members, and Scrum ceremonies are open to all, including customers and internal stakeholders. Scrum ceremonies (the Sprint, Sprint Planning, Daily Scrum, Sprint Review, and Sprint Retrospective) implement the pillars of transparency, inspection, and adaptation as recurring, time-boxed (finite-duration) events. In particular, during the Daily Scrum, a fifteen-minute stand-up meeting, Team Members answer three questions:

- What did I do yesterday that helped the Development Team meet the Sprint Goal?
- What will I do today to help the Development Team meet the Sprint Goal?
- Do I see any impediment that prevents me or the Development Team from meeting the Sprint Goal?

Scrum Artifacts include the Project Backlog (work necessary to complete the project), the Sprint Backlog (work to be completed by the Scrum Team during the current Sprint), the results of work during the Sprint, results of the Sprint Review (what usable value was added during the Sprint), and the Sprint outcome. The Sprint Retrospective assesses the overall process of the just completed sprint and identifies opportunities for improvement. One process improvement from the Sprint Retrospective, the kaizen, is incorporated into the next Sprint Backlog, facilitating continuous improvement. Scrum is empirical, and all work done under the Scrum framework has associated metrics including value to the customer and effort required to complete the work element [8].

Scrum in its original form was designed for small team (3-8 people) working on one product. As products become more complex, there is a need for more than one team to collaborate in its production. Scrum at Scale (Scrum@Scale) helps to organize multiple scrum teams collaboratively while delivering value for the organization (i.e., product) [10]. Scrum@Scale organizes multiple Scrum teams through parallel hierarchies of Scrums: Scrum of Scrums (SoS), and the MetaScrum. The Scrum of Scrums is the collection of Scrum Masters, and the Meta Scrum is the collection of the Product Owners. As the organization become larger, then number of SoSs and MetaScrums increases and additional layers are included in the heirarchy. The goal is to keep the SoS membership to 3–5 Scrum Master, and similarly for MetaScrums.

Scrum in Departmental Operation

Effective approaches to institutional change in higher education should apply a balanced approach between emergent and prescribed approaches across both individual and group aspects [11]. These intended outcomes and environmental structures lead to four categories of change: dissemination, reflective, policy and shared vision [12]. The implementation of Scrum into departmental operations, encourages engineering department to engage in each of these change strategies (Table 1)

Table 1. Elements of Scrum associated with change strategies (adapted from Henderson, Beach, & Finkelstein, [11])

I. Dissemination Tactic: • Scrum training • Instructional training • Internal dissemination of knowledge • Scrum artifacts data share	*II. Reflective Tactic:* • Daily Scrum • Sprint planning • Sprint review • Sprint retrospective
III. Policy Tactic: • Recognize Scrum as a component of workload responsibility • Recognize Scrum activities in promotion& tenure • Modify curriculum change policies	*IV. Shared Vision Tactic:* • Scrum of Scrums • MetaScrum

Dissemination tactics within Scrum can include training on what is Scrum and how to implement it for all faculty, training for all faculty on the implementation of critical instructional techniques (i.e. evidence-based instructional practices and inclusive teaching), enacting change on campuses, and the dynamics of working in teams. Through the Scrum artifacts data share, we allow department faculty and students to be part of the project, by sharing knowledge (as much as possible) about department operations, decision-making, and empowering them to participate in many of these activities.

Policy tactics include formally establishing policies that recognize and integrate Scrum-required team activities into workload policy, recognition of activities and success in Scrum operations for evaluation in promotion and tenure. In addition, due to the adaptive nature of Scrum, which incorporates rapid feedback from stakeholders at each sprint, departmental and institutional policies and structures can be modified to allow for changes that advance the highest value and priority of courses.

Reflective tactics include as key components of the Scrum process. The Daily Standup Meeting, Sprint Review, and Sprint Retrospective require faculty to reflect on their work in the Scrum team, their teaching, and beliefs about the change the department seeks. The transparency intrinsic to the Scrum framework can be utilized to encourage reflection across the department.

Shared vision tactics can be utilized from Scrum at Scale and include the Scrum of Scrums cycle in which Scrum Masters elevate identified impediments from their teams to department leadership and the MetaScrum cycle in which Product Owners take articulated department visions for programs and curricula to their individual teams.

Conclusion

Scrum methodology can be used as the change strategy in engineering departments. Departments can identify Product Owners who will identify products to be developed (i.e., new curriculum, new course content, marketing strategy, etc.), create the Product Backlog Items for each product, leading to achievement of departmental vision and objectives.

While some of these products will result in physical artifacts or software, others will include policies and practices supporting faculty and curricular aspects specifically facilitating use of critical instructional and curricular techniques used to advance student learning, and enhance departmental culture.

Critical to the process of Scrum is the participation of key stakeholders (i.e. industry representatives, faculty, students, administration, etc.) in Scrum planning and Sprint Reviews to provide iterative feedback throughout the creation of products that achieve project objectives. This involvement will ensure support applicability of academia to industry. To form cross-functional Scrum teams, faculty will need to develop their own professional skills through focused professional development on evidence-based teaching, institutional change, and effective teaming strategies.

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