# PRODUCT INNOVATION USING AGILE PRACTICES IN SUPPLY CHAIN MANAGEMENT CURRICULUM

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## Abstract

The dynamic business landscape demands supply chain professionals with Agile project management skills. This study introduces a novel course project simulating a new product launch for a Fortune 500 company. We designed a theoretical multi-phase student team-based Agile project as part of an undergraduate Supply Chain Management course. This article describes implementing a project where teams are guided through the "Agile Way" using scaffolding of the Scrum framework. The project is designed using team-based learning of Agile methodologies. Agile methodologies often emphasize collaboration and open communication, which can foster psychological safety in teams. Using Agile frameworks and the designed templates, student teams work through theoretical Agile product innovation phases for a Fortune 500 company throughout the semester. Students simulate a product launch and apply Agile practices.

A validated Agile survey assessed student learning outcomes across two semesters. Statistical analysis revealed a significant positive impact of using Agile templates on student understanding of Agile practices, team collaboration, and continuous improvement. This project offers a practical and adaptable framework and provides insights into using Agile management in the classroom. This study contributes to understanding student learning processes and outcomes using Agile project management and outlines teaching methods for a Supply Chain Management class that successfully implements Agile management projects.

## Keywords

Agile, Project Management, Scrum, Team-Based Learning, Product Launch, Supply Chain Management

## Introduction

The Age of Agile is spreading quickly as organizations today use Agile methods to connect and collaborate with employees, departments, customers, and suppliers worldwide (Denning, 2018). A global survey by Harvard Business Review reports that 82% of Production and Operations departments in 1300 companies are embracing Agile ways of working (Panditi, 2018). Alternately, college students are going to Career Fairs, and the interviewers ask, "What do you know about Agile?" As educators in Supply Chain Management courses, we must lead students to learn about Agile. Working in small groups, students need to learn how to take risks and experience the consequences, also called psychological safety, when adopting Agile practices. Research indicates that psychological safety improves team performance by increasing "team learning, experimentation, risk-taking, new practice production, and divergent thinking " (Marder et al., 2021, p. 3)". This method perfectly aligns with how Agile changes business processes, practices, company mindset, and company culture and promotes product innovation.

Seminal research studies of Agile approaches to product innovation were initiated in Operations and Supply Chain Management as early as 2001 (Power et al., 2001; van Hoek et al., 2001). An audit was conducted of Agile experiences in the supply chain in Europe. They found customer satisfaction was the primary driver for adopting Agile practices to meet just-in-time manufacturing. In today's complex, increasingly competitive, global marketplace, attraction to Agile is evident – "the market has shifted to a marketplace driven by the customer" (Denning, 2018, p. 1).

Today, organizations face a fast-paced and relentless shift with the internet-based global economy. Change happens quickly; corporations must catch up and stay caught up. Agile management empowers grassroots innovation that adds substantial value to the customer and the organization. Getting to Agile requires a significant change in its culture, mindset, goals, processes, and team engagement. Agile methods create new values and follow new principles and practices while they establish better benefits for the employees and the organization (Denning, 2018).

Although Agile is not a "silver bullet or a quick fix" (Shrivastava, 2018, p. 2), it changes how work is done and the organization's culture and mindset today. In this new Agile world, the Board of Directors of Multinational Companies (MNCs) embrace new Agile approaches to corporate governance. These directors interact with short, just-in-time interactions with company leadership to define and own the "why" (customer satisfaction). They have pivoted from measuring net income, revenue, cash flow, earnings per share, and Earnings before Interest and Taxes (EBIT) to empowering leaders and employees to direct their productivity and efficiency to focus on delighting the customer. When the board changes to the Agile way, employees must adapt to collaborate, communicate, share, and move quickly to solve problems and innovate new products (Koerwer & Perfetti, 2020).

This research study teaches students in Supply Chain Management classes how to use Agile practices to launch a new product. Students collaborate in small teams using Agile methodology to plan for product innovation for Fortune 500 companies. Students are engaged in groups, learning together, and working on completing Agile templates (product vision, user stories, product backlog, Kanban board, test plans, scope statements, and retrospectives) to launch new product features for one of the assigned Fortune 500 companies. This project is split into six parts, with assignments due weekly for the entire semester.

The instructor guides the students through the Agile process one week at a time. The instructor facilitates positive group working practices and builds psychological safety into group learning (Marder et al., 2021). Feedback is continuous and measures the level of group learning and acquisition of Agile knowledge.

This project is designed using scaffolding, team-based learning, and the Scrum framework for implementing an Agile product innovation project.

## Scaffolding

Research by psychologists in the cognitive sciences has contributed to a fundamental understanding of how learners can solve problems and learn with tutors who scaffold the process (Wood et al., 1976). Necessary scaffolds include clarifying practical skills, providing students with procedural guidelines, explaining and graphically representing metacognitive strategies, and training students to monitor the learning process. During this era of upheaval and change, educators in science, technology, and medicine have been at the forefront of using computerized scaffolds to improve instruction quality and assist students in complex thinking tasks. The rigid scaffolds designed for this study used metacognitive prompts and cues to assist students in planning, monitoring, and evaluating Agile management processes (Saye & Brush, 2002). Learning Agile by connecting it to practical application in a team environment leads to deepening learning and developing strong work habits for a successful career after graduation (Marder et al., 2021).

Adopting team-based learning, students collaborate, share Agile knowledge, and develop skills in Agile practices.

## Team-based Learning

In management education, business schools have embraced projects using team-based learning to develop group processes and leadership skills (Larson & Drexler, 2010). Larry Michaelsen developed Team-Based Learning (TBL) for instructing business students in 1970. TBL is an active learning process with group members focused on the project, but the teacher leads the process. Team-based learning is a productive method that requires the students to work together to solve real-world issues by engaging with one another and the material in solving the problem (Hrynchak & Batty, 2012)

Team-Based learning usually starts with a small group of students or employees with the same desire and interest to work on a project (Brown, 1989; Gavelek, 1996; Langer, 1986; Palinscar, 1984; Vygotsky, 1980; Wood et al., 1976). Group members improve their ability to apply the academic concept to the project. The students' purpose shifts from being passive recipients to active participants who take responsibility to start the project and apply the knowledge to engage the team. Four essential practices needed for success are:

- The group needs to be formed and managed appropriately.
- The accountability and responsibility of the group members are critical to the quality of the group work.
- The teacher needs to provide constant and valuable feedback.
- Group assignments promote the learning and development of the team.
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After implementing these elements, teachers and students are ready to develop into cohesive learning teams (Michaelsen & Sweet, 2008).

Team-based learning starts with social networking, and this helps students gather the necessary information for their project. As the team develops a knowledge-sharing climate, networking depends on the motivation of each member's communication and collaboration skills. With the TBL implementation, students work hard for the group and individual payoff (Parmelee & Michaelsen, 2010). Most of the innovative projects result from the successful implementation of TBL.

The team's perception of the organizational knowledge-sharing climate, the team's networking preference, and the team's perceived importance of networking for project success positively affect individuals' network building. The climate of organizational knowledge-sharing elevates the importance of networking with teams across the organization for project success (Hoegl et al., 2003). According to Denning (2018), Agile teams collaborate across the organization and with the customer in small teams to share knowledge as they accomplish Agile projects.

## Agile Management

Agile management is described as small teams' ability to respond to change in short cycles, based on frequent customer feedback, in an environment of complexity and uncertainty (Shrivastava, 2018); (Agile Alliance & Project Management Institute, 2017). Agile intends to provide more value to the customer. Agile emphasizes stakeholder engagement to establish a shared vision, collaboration, and communication with the Agile team (Griffiths, 2017). The entire organization embraces an Agile mindset that emphasizes employee's attention on customer wants and needs rather than just on profit. In the past, organizations' motto was the customer: "You take what we make; that is the way it is" (Denning, 2018, p. 13). Agile management focuses on dividing the project into smaller parts so teams can do excellent work in less time while meeting customer requirements (Denning, 2018).

The Agile value proposition adds to business value, risk reduction, adaptability, and visibility (Griffiths, 2017). Agile methodologies emphasize "flexibility, close collaboration with customers, and self-organized teams" (Larson & Drexler, 2010, p. 551). The customer becomes part of the team, and there is frequent interaction with the team every week. The team does weekly demos of features the customer wants to keep visibility high and gain customer acceptance (Griffiths, 2017). Organizations that embrace the change to Agile adopt three core characteristics of Agile:

(1) The Law of the Small Team
(2) The Law of the Customer
(3) The Law of the Network (Denning, 2018).

The Law of the Small Team creates small autonomous teams that are self-organizing and tasked with making their own decisions. The Agile team manager is a coach who listens and removes obstacles that would negatively impact the project or product. The units are cross-functional – bringing together employees from multiple departments such as Finance, Marketing, Sales, Purchasing, Engineering, and Supply Chain Management. The team size (like TBL) is usually five to seven members. Teams make decisions and are dedicated to short cycles (called iterations) without interruption. The product developed during each short iteration is presented and receives immediate feedback from the customer. Changes are incorporated into the product or service and demonstrated to the customer to gain customer acceptance in each short cycle.

The Law of the Customer has turned from customer satisfaction to customer delight (Denning, 2018). Agile organizations focus on improving products and services to solve customer problems. The goal is to mobilize employees to deliver extra value sooner to the customers. Agile teams are empowered by top management to have a clear line to the customer by making them a member of the Agile team. Communication changes to establish interactive, horizontal, and vertical relationships between customers and employees. One message is communicated to the customer daily that they are the company's number one priority (Denning, 2018).

The Law of the Network Agile teams interact and collaborate across the organization with transparency, connectivity, and passion. The goal is to enable trust between groups with a common purpose to provide excellent products and services to the customers (Denning, 2018). Agile is embraced within the headquarters of large corporations, and later, it expands to overseas locations to interconnect and collaborate globally.

## Teaching Agile Roles and Practices

The advent of Agile began in software development when seventeen people from the Information Technology industry met in 2001 at The Lodge at Snowbird Ski Resort in the Wasatch mountains of Utah. The purpose of the meeting was to discuss finding common ground on how software development projects were done. The group's consensus was to eliminate excessive documentation and provide more focus on the customer's wants and needs.

These 17 people called themselves "The Agile Alliance" and published the *Manifesto for Agile Software Development on February 11-13, 2001* (Agile Alliance & Project Management Institute, 2017).

The Agile Manifesto is a set of principles for Agile software development. Manufacturing companies often are tasked with developing innovative products to create a competitive advantage in their marketplace. Agile creates an environment with small self-organizing teams that encourage working in short iterative cycles on a specific product while making frequent changes based on customer feedback. Agile focuses on creating less documentation by using templates to capture and report progress on developing the new product (Denning, 2018).

The principles of the Agile Manifesto for this class project replace the term "software" with "product," as manufacturing and other industries have adopted these principles (Conforto et al., 2014, p. 34). Table 1 includes the Agile templates from the Project Management Institute (PMI) that are used to plan for the product launch by mapping to each practice and principle of the Agile Manifesto.

| Principles of Agile Manifesto | Agile Practices | Agile Templates |
|---|---|---|
| 1. *Our highest priority is to satisfy the customer through early and continuous delivery of valuable software (products). | Project Life Cycle Practices for Teams to Deliver Value | Product Vision User Story Cards |
| 2. *Welcome changing requirements, even late in development (product design). Agile processes harness change for competitive customer advantage. | Backlog preparation and refinement | Product Backlog |
| 3. *Deliver working software (product) frequently, from a few weeks or months, with a shorter timescale preference. | Standard Agile Practices (short, iterative, and just-in-time) | Kanban Board |
| 4. *Businesspeople (customers) and developers (designers) must work together daily throughout the project. | Servant Leadership to empower the team | Team Composition – Scrum Master, Product Owner, Team Members |
| 5. Build projects around motivated individuals. Please give them the environment and support they need and trust them to do the job. | Executive Leadership to support and sponsor funding for the team. | Agile Manager Project Sponsor |
| 6. Face-to-face communication is the most efficient and effective method of conveying information to and within a development team. | Team Structure Daily Communication of Project Status | Stand Up Meetings |
| 7. *Working software (product) is the primary measure of progress. | Iterations and Increments focused on delivering a working product. | Kanban Board Sprints |
| 8. *Agile processes promote sustainable (product) development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely. | Agile practices of the small team, sprints, rewards, and management of risks to manage delays and create corrective action. | Kanban Board Sprints Scope Statement |
| 9. Continuous attention to technical excellence and good design enhances agility. | Continuous testing to achieve the goal of zero defects. | Test Plan Release Plan |
| 10. Simplicity – maximizing the amount of work not done is essential. | Managing the workflow | Retrospective Summary |
| 11. The best architectures, requirements, and designs emerge from self-organizing teams. | Encourage active Leadership within teams. | Retrospective Summary |
| 12. The team regularly reflects on becoming more effective and then tunes and adjusts its behavior accordingly. | Agile team collaborative meetings | Retrospective Summary |

**Table 1. Agile Manifesto, Practices, and Templates (Agile Alliance & Project Management Institute, 2017)**
*Note: The word product, design, and customer has been added to the Agile Manifesto for the launch of a new product.

The project structure aligns with the Student Learning Outcomes (SLOs) of the Supply Chain Management course.

## Methodology

In Supply Chain Management classes, this project aims to help students learn how to use the designed Agile templates to plan for the product launch of their designated company's new product using Scrum. The framework of Scrum fits the agile method as it follows the Agile Manifesto values, including "focus, courage, openness, commitment, and respect" (Griffiths, 2017, p. 195). Scrum is the predominant approach adopted by companies to manage their Agile projects. Scrum practices guide the small team in formation, establishing roles and rules for governing an Agile project.

The entire group project is completed within 12 weeks and concludes with a final presentation for the students. In week three of the semester, students are introduced to ten major manufacturing companies from various industries. Each team chooses one manufacturer from a selected industry chooses one new product from the Company website. Then, they analyze the top five features of the product to complete their product launch. We raised the following research question for this study: Does using Agile templates to plan a product launch for a company influence student learning?

This study included 202 students from the Fall 2019 semester: two first-year students, 15 sophomores, 108 juniors, and 77 seniors. The participants' genders included 158 males and 44 females across the five sections of 300-level Operations and Supply Chain Management courses. Of the 202 students, 156 students participated in the survey: a 77% response rate. In the Spring 2020 semester, out of 122 students, 95 participated, a 78% response rate. The students were three sophomores, 78 juniors, and 41 seniors. Student genders were 90 males and 31 females from three sections of the same course.

Depending on the course's size, ten teams are created with four to five members on a team. Each team is assigned a Team Letter, for example, teams A – J. Their Team Letter is their designation for the entire semester. They self-enroll into a company group by its name in the Learning Management System. The students come from the following majors: Accounting, Finance, Information Systems (including Supply Chain Management), Marketing, Management, Construction, and Engineering. To make sure students come from different majors, students from Accounting, Finance, and Information Systems come to the front of the room, and then each group selects one of the students to join their group.

As instructors, students need to experience student learning outcomes to "cutting-edge best practices" in Operations Management (Dean & Forray, 2019, p. 326). To provide an in-depth learning experience, students study operations management with "time on task" to reinforce student learning retention (Netland et al., 2020, p. 329). Aligning a project with student learning outcomes gives students real-world experience with concepts covered in the course. Student Learning Outcomes (SLOs) align with the Agile templates and learning outcomes of the Supply Chain Management course. This project is divided into six parts, with two PMI Agile Templates due every two weeks. The Student Learning Outcomes are listed in Table 2.

| SLO # | Student Learning Outcome | Templates |
|---|---|---|
| 1 | Identify the strategic and operational issues in supply chain management for a new product launch. | Company Information Consulting Company Information |
| 2 | Understand and practice Agile methods for implementing a new product launch. | Product Vision User Story Cards |
| 3 | Record status and track the progress of the new product's five user stories (features). | Product Backlog Kanban |
| 4 | Assess risks to determine the chance of an impact on time, cost, or quality of producing the new product. | Risk Assessment Scope Statement |
| 5 | Manage quality control and scheduling for manufacturing the new product. | Test Plan Release Plan |
| 6 | Create a Retrospective Summary and a Final Kanban of the project. | Retrospective Summary Final Kanban Board |

**Table 2. Student Learning Outcomes (SLOs)**

Students learn the Agile terminology for each Agile template. They discuss the goals of the new product in the Product Vision template. User story cards describe five important features (requirements) that the customer values. Students learn about the Product Backlog, which categorizes the work to be done on the user stories. Progress is recorded on a Kanban board, a visible chart of the work's status to do, progress, and completion. They learn the value of testing by completing a test plan to validate the new product's five features before producing it. Ultimately, they do a retrospective summary to identify areas where improvements or changes could be incorporated into future product launches.

Finally, each team is an Agile consulting company hired by the manufacturer to assist in launching their new product using Agile methods. The consulting company employs experts in Agile implementations. There are two companies in specific industries. The consulting teams work in competition, for instance, General Motors vs.

Ford group consultants. Each group will present the project to peers to determine the best presentation. Companies assigned are from the Fortune 500 Companies list.

This Agile Project uses the Scrum framework to manage collaboration and interaction between team members. Scrum is a framework designed for team members to address complex problems creatively to deliver high-value products (Schwaber & Sutherland, 2017). As students learn to use Scrum techniques, research studies imply an increase in "psychological safety through fostering better interpersonal knowledge of each other's strengths and weaknesses" to improve team communication and collaboration (Marder et al., 2001, p. 3).

Students form a group of four members. Table 3 displays student Agile roles. The roles are Scrum Master, Product Owner, and Team Member. The Scrum Master leads the team and facilitates the meetings. One student represents the customer as the Product Owner from the company selected for the project. Team members work on tasks (user story cards) to complete the project.

| Role | Purpose | Definition |
|---|---|---|
| Product Owner | It is the customer who represents the company. | Defines the business value of a feature within an Agile Project. |
| Scrum Master | Leads the Team | The Scrum Master is a servant-leader who supports the team to maximize the Scrum Team's value |
| Scrum Delivery Team | Team members collaborate to solve issues and move the project forward. | Scrum Teams are structured as self-directed teams that manage their work as they improve the Agile project's efficiency and effectiveness. |

**Table 3. Scrum Team Roles (Schwaber & Sutherland, 2017).**

Each group is provided with shareable PMI Agile templates and a Google slide deck for collaboration and presentation. When due, the templates and slides are formatted as a PDF and submitted to the Learning Management System (LMS).

## Assessment of the project

A pilot study was conducted to validate the Agile Survey for this study. An IRB-approved Agile Survey was conducted during Week 14 of a 16-week semester in each section to assess students' perceptions of applying Agile practices. The survey was adopted from Yodiz.com, a company specializing in Agile software, and consisted of 19 questions measuring team management and Agile practices (Yodiz, 2019). The scale for evaluation of each question is listed below:

1. strongly disagree
2. disagree
3. neither agree nor disagree
4. agree
5. strongly agree

The results were collected using Google Forms. Using SPSS 25 and MS Excel, the questions and the results in Table 4 summarize each survey question's means and standard deviation between Fall 2019 and Spring 2020.

| Q# | QUESTION | FALL 2019 MEAN | SPRING 2020 MEAN | Standard Deviation |
|---|---|---|---|---|
| **TEAM** | | | | |
| Q1 | The team worked well together. | 4.58 | 4.49 | 0.04 |
| Q2 | The team was self-organized and self-managed. | 4.53 | 4.42 | 0.06 |
| Q3 | The members of the team were dedicated to the product launch | 4.45 | 4.23 | 0.22 |
| **BACKLOG** | | | | |
| Q4 | The product vision created by the team was evident. | 4.54 | 4.41 | 0.06 |
| Q5 | The requirements were identified clearly in the User Stories. | 4.36 | 4.27 | 0.05 |
| Q6 | The User Stories were created and prioritized before Sprint Planning. | 4.37 | 4.33 | 0.02 |

| SPRINTS | | | | |
|---|---|---|---|---|
| Q7 | The sprints in your product launch were the same length. | 4.39 | 3.97 | 0.21 |
| Q8 | The sprints in your product launch were different lengths | 4.42 | 3.98 | 0.22 |
| Q9 | The group participated in estimating and planning Sprint User Stories. | 4.53 | 4.18 | 0.18 |
| **TESTING** | | | | |
| Q10 | The product launch tests were clearly defined in the test plan. | 4.53 | 4.28 | 0.13 |
| Q11 | The group and customer were satisfied with the quality of the product. | 4.54 | 4.28 | 0.13 |
| Q12 | The group tested the product until zero defects were reached with product assembly. | 4.39 | 4.18 | 0.11 |
| **BUSINESS** | | | | |
| Q13 | The Product Owner (Customer) understands the business value and participated in prioritizing user stories. | 4.46 | 4.22 | 0.12 |
| Q14 | The Product Owner participated in sprint demos to give feedback. | 4.46 | 4.17 | 0.15 |
| Q15 | The Product Owner and Agile team have aligned the product vision. | 4.49 | 4.20 | 0.15 |
| Q16 | The Scrum Master facilitated the resolution of issues between team members. | 4.45 | 4.25 | 0.10 |
| **RETROSPECTIVE** | | | | |
| Q17 | The whole team participated in the retrospective. | 4.53 | 4.34 | 0.10 |
| Q18 | The problems were identified in the Retrospective sessions. | 4.49 | 4.16 | 0.17 |
| Q19 | The group identified some improvements for the next Agile product launch. | 4.49 | 4.12 | 0.19 |

**Table 4. Agile Survey Results (Yodiz, 2019)**

The survey responses were also analyzed with an Independent Samples Test based on two groups: (1) Fall 2019 and (2) Spring 2020. Both Levine's F-test and T-test for equality of means are reported in Table 5. The two-tailed tests of statistical significance are measured at $p < .05$.

| Ques No | Survey Question | | F | Sig. | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| **Team survey questions** | | | | | | | |
| 1 | The team worked well together. | Equal variances assumed | 0.62 | 0.43 | 0.811 | 249 | 0.418 |
| | | Equal variances are not assumed. | | | 0.817 | 203.52 | 0.415 |
| 2 | The team was self-organized and self-managed. | Equal variances assumed | 0.75 | 0.39 | 0.942 | 249 | 0.347 |
| | | Equal variances are not assumed. | | | 0.942 | 198.43 | 0.347 |
| 3 | The members of the team were dedicated to the product launch. | Equal variances assumed | 1.17 | 0.28 | 1.641 | 249 | 0.102 |
| | | Equal variances are not assumed. | | | 1.622 | 191.49 | 0.106 |
| **Backlog survey questions** | | | | | | | |
| 4 | The product vision created by the team was clear. | Equal variances assumed | 1.77 | 0.19 | 1.266 | 249 | 0.207 |
| | | Equal variances are not assumed. | | | 1.241 | 186.23 | 0.216 |
| 5 | The requirements were identified clearly in the User Stories. | Equal variances assumed | 0.18 | 0.67 | 0.65 | 249 | 0.516 |
| | | Equal variances are not assumed. | | | 0.662 | 209.99 | 0.509 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6 | The User Stories were created and prioritized before Sprint Planning. | Equal variances assumed | 0.04 | 0.85 | 0.372 | 249 | 0.71 |
| | | Equal variances are not assumed. | | | 0.376 | 204.6 | 0.707 |
| **Sprint Survey Questions** | | | | | | | |
| 7 | The sprints in your product launch were of different lengths. | Equal variances assumed | 8.69 | 0 | 3.502 | 249 | 0.001 |
| | | Equal variances are not assumed. | | | 3.286 | 160.6 | 0.001 |
| 8 | The group participated in estimating and planning Sprint User Stories. | Equal variances assumed | 0.38 | 0.54 | 3.47 | 249 | 0.001 |
| | | Equal variances are not assumed. | | | 3.356 | 177.82 | 0.001 |
| 9 | The Story points were identified and recorded on the Kanban board. | Equal variances assumed | 7.53 | 0.01 | 3.161 | 249 | 0.002 |
| | | Equal variances are not assumed. | | | 3.029 | 172.46 | 0.003 |
| **Testing Survey Questions** | | | | | | | |
| 10 | The product launch tests were clearly defined in the test plan. | Equal variances assumed | 0.76 | 0.38 | 1.493 | 249 | 0.137 |
| | | Equal variances are not assumed. | | | 1.49 | 197.52 | 0.138 |
| 11 | The group and customer were satisfied with the quality of the product. | Equal variances assumed | 1.57 | 0.21 | 2.297 | 249 | 0.022 |
| | | Equal variances are not assumed. | | | 2.263 | 189.12 | 0.025 |
| 12 | The group tested the product until zero defects were reached with the product assembly. | Equal variances assumed | 0 | 0.95 | 0.91 | 249 | 0.364 |
| | | Equal variances are not assumed. | | | 0.922 | 207.09 | 0.357 |
| **Business survey questions** | | | | | | | |
| 13 | The Product Owner (Customer) understands the business value and participated in prioritizing user stories. | Equal variances assumed | 2.92 | 0.09 | 2.254 | 249 | 0.025 |
| | | Equal variances are not assumed. | | | 2.2 | 183.35 | 0.029 |
| 14 | The Product Owner participated in Sprint demos to give feedback. | Equal variances assumed | 1.1 | 0.3 | 1.9 | 249 | 0.059 |
| | | Equal variances are not assumed. | | | 1.891 | 195.5 | 0.06 |
| 15 | The Product Owner and Agile team have aligned the product vision. | Equal variances assumed | 5.5 | 0.02 | 2.681 | 249 | 0.008 |
| | | Equal variances are not assumed. | | | 2.609 | 181.69 | 0.01 |
| 16 | The Scrum Master facilitated the resolution of issues between team members. | Equal variances assumed | 1 | 0.32 | 2.007 | 249 | 0.046 |
| | | Equal variances are not assumed. | | | 1.998 | 195.82 | 0.047 |
| **Retrospective survey questions** | | | | | | | |
| 17 | The whole team participated in the retrospective. | Equal variances assumed | 0.84 | 0.36 | 2.218 | 249 | 0.027 |
| | | Equal variances are not assumed. | | | 2.219 | 198.94 | 0.028 |

| 18 | The problems were identified in the retrospective sessions. | Equal variances assumed | 0.13 | 0.72 | 1.35 | 249 | 0.178 |
|----|----|----|----|----|----|----|----|
|  |  | Equal variances are not assumed. |  |  | 1.363 | 204.73 | 0.174 |
| 19 | The group identified some improvements for the next Agile product launch. | Equal variances assumed | 1.24 | 0.27 | 2.719 | 249 | 0.007 |
|  |  | Equal variances are not assumed. |  |  | 2.673 | 187.89 | 0.008 |

**Table 5. Independent Samples Test**

Table 5 shows the comparison of means between the two groups. The groups are not random but different in sample size and composition of students between the semesters. There are significant positive results between the two groups for several survey questions. Students clearly understood Agile sprints with significant results for question 7 - sprints of different lengths at .001, question 8 - estimating User Stories at .001, and question 9 - story points on the Kanban board at .002. Also, students are confident that testing leads to satisfied customers with question 11 – the customer is satisfied with product quality at .022. For the business value of adopting Agile, students realized for question 13 – product owner understands the business value in prioritizing user stories at .025, for question 15 - alignment with product vision at .008. For question 16 – at .046. Finally, students recognized the benefit of teamwork in doing a retrospective with question 17 – the whole team participated in the retrospective at .027. Question 19 – the group identified improvements for the following product launch at .007. Therefore, the answer to the research question is significantly positive: Agile templates to plan a product launch for a company influence student learning.

## Summary and Conclusion

This study's results indicate that the answer to the research question (Does using Agile templates to plan a product launch for a company influence student learning?) is positive. Azevedo and Cromley (2004) identified that learners often must use their prior knowledge and metacognitive monitoring processes. Students need help handling tasks and demands and often use ineffective strategies when learning in complex environments (Azevedo & Cromley, 2004). "Complex concepts are difficult to learn in the rarefied atmosphere of the university lecture hall" (Witt et al., 2018, p. #). Another (Witt et al., 2019) study investigating professional problems of practice found that students positively identified that the scaffolding they received while working on the project kept them on track with project completion. Also, it enabled the students to focus on the problematic aspects of the project (Witt et al., 2019) better. Similar results were found in this study, where scaffolded project submissions positively affected student learning. The teams participating in this study could better regulate their learning of the complex concepts of Agile management by using the designed templates for the Agile management project.

We found that implementing scaffolding to a TBL project on Agile management offers many benefits. First, the findings indicate that Agile lends itself to scaffolding and TBL. Saye and Brush (2002) also focused on improving group performance with hard and soft scaffolds. The results of this study confirm Saye and Brush's findings that rigid scaffolds provided teams with the proper direction to make more effective decisions (Saye & Brush, 2002).

Second, this project provides a mechanism for other instructors to use when implementing Agile methodology in the classroom. The student learning outcomes are clearly defined with templates designed using scaffolding (Appendices A - F).

A third use of the project is for guiding design. Other instructors can review these existing project guidelines through the construction of an Agile management project. However, the instructor must make specific design decisions when determining the aspects of Agile management and the scope of the student project.

This study surveyed eight sections of Supply Chain Management courses taught by two different instructors at Pacific Northwestern University. The two instructors varied when they started and ended the project within the 16-week semester. However, all five sections completed the project in a 12-week timeframe. In future studies, parallel course design should be implemented between instructors and class sections.

Future research could investigate this project using a quasi-experimental design with a defined treatment and control group. A control group was impossible for the current study because the instructors used the assignment in all the courses studied. Additional future studies should employ a mixed-methods approach. Qualitative research methods may reveal additional insight into the quantitative results. Objective measures should be used to determine if the scaffolding assignments effectively supported students' conceptual understanding of Agile management.

In her recent article on Agile project-based learning and teaching, Monett calls for more Agile research in the classroom that uses Agile-specific techniques such as Scrum (Monett, 2013). Undergraduate business students need to be aware of Agile project management and methodologies. Agile project management using Scrum is

relevant in supply chain management and likely will be used in their future business careers. Using the project outlined in this article has assisted us in teaching and reinforcing Agile project management concepts.

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