

Agile methodology-Scrum better approach than Linear Sequential Development Model for Computer Science and Engineering student's software project management

Md Rakibul Islam(1603078)¹ and Protiva Ahammed(1603079)²

¹Department of Computer Science and Engineering, Rajshahi University of Engineering and Technology

²Department of Computer Science and Engineering, Rajshahi University of Engineering and Technology

Email: protivaahammed7137@gmail.com

Abstract—Scrum is one of the many agile approaches to software development that have been widely adopted. Agile process allows students to learn new skills, to embrace under defined problems in complex environments where changes in requirements are inevitable [1]. Learning industry relevant skills and knowledge for the graduating students in the field of Software Engineering is essential to make the students employable and productive right from the time of joining on the job. Agile project management using the Scrum methodology as a method for more effectively managing and completing projects. Agile project management frameworks, Scrum can be taught and used to complete software project in graduation courses rather than using Linear sequential process model[2]. This article provides overview, benefits of Agile project management and particularly Scrum methodology comparing with Linear Sequential Development Model(Known as Water fall model)for CSE students during their academic years.

I. INTRODUCTION

A software process (software methodology) is a set of related activities that leads to the production of the software. These activities may involve the development of the software from the scratch or modifying an existing system. Any software process must include the following four activities[3]:

- **Software specification (or requirements engineering):** Define the main functionalities of the software and the constraints around them.
- **Software design and implementation:** The software is to be designed and programmed.
- **Software verification and validation:** The software must conform to its specification and meets the customer needs.
- **Software evolution (software maintenance):** The software is being modified to meet customer and market requirements changes.

A software process model is a simplified representation of a software process. Each model represents a process from a specific perspective. Agile is a software development methodology based on iterative and incremental approach [4]. Scrum is one

of the implementations of agile methodology. Scrum is an agile process framework for managing complex knowledge work, with an initial emphasis on software development, although it has been used in other fields and is slowly starting to be explored for other complex work, research and advanced technologies. Scrum is a lightweight, iterative and incremental framework for managing complex work. The stated, accepted philosophy for systems development is that the development process is a well understood approach that can be planned, estimated, and successfully completed. This has proven incorrect in practice[5]. Agile development breaks with a 40-year tradition of applying ever more structured and formalization design and development of software by achieving the basic principles of satisfied customers, working software, and the willingness to accept and respond to changes[6]. The waterfall model is a sequential approach, where each fundamental activity of a process represented as a separate phase, arranged in linear order.

II. LITERATURE REVIEW

A. Agile

Agile Software development is one of the methodologies in the development of a software. The word Agile means to be fast, lightweight, free-moving, alert. Agile is a word used to describe a process model concept which is different from the existing process model concepts. Agile software development concepts coined by Kent Beck and his 16 colleagues by stating that the Agile Software Development is a way to build software by doing it and helping others to build it all at once[7]. In Agile Software Development the interactions and personnel is more important than the process and the tools, a working software is more important than a complete documentation, collaboration with the clients is more important than the contract negotiation, and being responsive to changes is more important than following the plan. However, just as other process models, Agile Software Development has its own advantages and is not suitable for all types of projects,

products, people and situations. Agile Software Development enables process model which is tolerant of the requirement changes so the response to the changes can be done faster.

B. SDLC

SDLC(Software Development Life Cycle) is the stages of work performed by system analysts and programmers in building an information system.

C. Software

Software is a computer program that serves as a means of interaction between the user and the hardware. The software can also be regarded as a "translator" of commands that is run by the computer users to be forwarded or processed by the hardware.[8]

D. Scrum

Scrum was developed by Jeff Sutherland in 1993 and its goal is to become a development and management methodology that follows the principles of Agile methodology [pham2011scrum]. Scrum is an additional responsive framework of software development for software projects and manage products or application development. The focus is on "strategy, a flexible holistic product development where the development team worked as a unit to achieve common goals" as opposed to "traditional approaches, a sequence" [9]. Scrum has a complex process in which many factors that affect the final result

E. Linear sequential development Model

The Waterfall Model was the first Process Model to be introduced. It is very simple to understand and use. In a Waterfall model, each phase must be completed before the next phase can begin and there is no overlapping in the phases. Waterfall model is the earliest SDLC approach that was used for software development.

III. METHODOLOGY

Agile has 12 principles[10].They are:

- 1) Highest priority is to satisfy the customer.
- 2) Welcome changing requirements
- 3) Deliver working version of software frequently
- 4) Business people and developers must work together. (Frequent status meeting)
- 5) Build project around motivated individuals. (Happy Developers)
- 6) Emphasize face to face conversation (Frequent status meeting)
- 7) Working software is the primary measure of progress.
- 8) Promote sustainable development (reusable/renewable resources)
- 9) Pays continuous attention to technical excellence and good design.
- 10) Maximize the amount of unnecessary work not done by defining value of each work.
- 11) The best architectures, requirements, and designs emerge from self-organizing teams.

- 12) At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

Following figure describe the agile mode

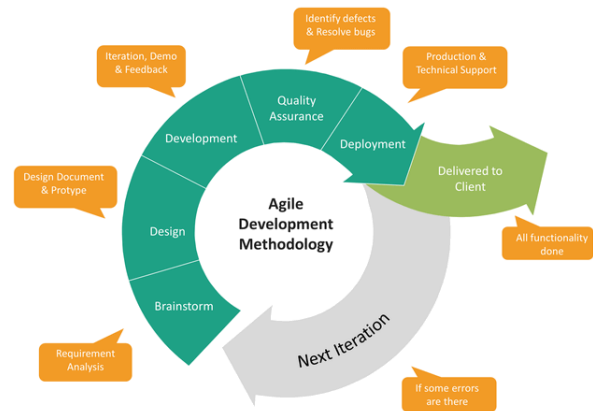


Fig. 1. Agile methodology

Scrum designed for teams of ten or fewer members, who break their work into goals that can be completed within time-boxed iterations, called sprints, no longer than one month and most commonly two weeks, then track progress and re-plan in 15-minute time-boxed stand-up meetings, called daily scrums. Process flow of scrum[11]:

- Each iteration of a scrum is known as Sprint Product backlog is a list where all details are entered to get the end-product.
- During each Sprint, top user stories of Product backlog are selected and turned into Sprint backlog.
- Team works on the defined sprint backlog.
- Team checks for the daily work.
- At the end of the sprint, team delivers product functionality.

Following is the of scrum process method:

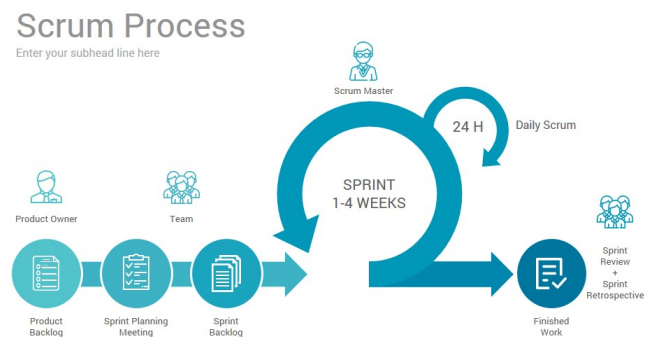


Fig. 2. Scrum

On the contrary, from various software process model if students perform linear sequential model for there project they must plan and schedule all of the activities before starting

working on them (plan-driven process). Plan-driven process is a process where all the activities are planned first, and the progress is measured against the plan. While the agile process, planning is incremental and it's easier to change the process to reflect requirement changes. The phases of the waterfall model are: Requirements, Design, Implementation, Testing, and Maintenance. Following is the figure describing Linear Sequential Model:

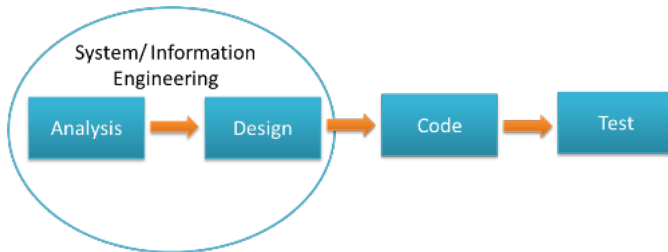


Fig. 3. Linear Sequential Model

IV. BACKGROUND

Agile methodology - scrum works better when student first time learn new skills to develop any software or app requirements changes due to teacher's requirement, own ideas, to solve specific problems. In agile student must work on their skill development to pace with requirements. Agile methods are adaptive rather than predictive. With traditional methods, most of the software process is planned in detail for a large time frame. This works well if not much is changing. In agile process model the application domain and software technologies are well understood by the development team. Agile methods were developed to adapt and thrive on frequent changes. Agile methods are people-oriented rather than process-oriented. They rely on people's expertise, competency and direct collaboration rather than on rigorous, document-centric processes to produce high-quality software. In this section, the most common agile methods are briefly discussed.[12] In principle, the waterfall model should only be applied when requirements are well understood and unlikely to change radically during development as this model has a relatively rigid structure which makes it relatively hard to accommodate change when the process is underway.

V. IMPLEMENTATION AND COMPARISON

Waterfall Model methodology which is also known as Liner Sequential Life Cycle Model. Waterfall Model followed in the sequential order, and so project development team only moves to next phase of development or testing if the previous step completed successfully. **Agile methodology** is a practice that helps continuous iteration of development and testing in the software development process. In this model, development and testing activities are concurrent, unlike the Waterfall model. This process allows more communication between customers, developers, managers and testers.

Linear Sequential Model is not an ideal model for a large size project. If the requirement is not clear at the beginning,

it is a less effective method. It is hard to move back to makes changes in the previous phases. The testing process starts once development is over. Hence, it has high chances of bugs to be found later in development where they are expensive to fix.

Agile is not useful method for small development projects though requirement can change anytime during development. It requires an expert for student teacher can perform this role to take important decisions in the meeting weekly. It helps the teacher to evaluate mark on performances and attendance. Cost of implementing an agile method in graduation level is little to other development methodologies because students are seeking to learn new things. The project will not be go off track as the project manager (as teacher) observe students' work or progress in daily basis. It is focused teacher's requirement (client) process. So, it makes sure that the teacher (client) and group member of team is continuously involved during every stage. Student project group (Agile teams) are extremely motivated and self-organized so it likely to provide a better result from the development projects. Agile software development method assures that quality of the development is maintained. The process is completely based on the incremental progress. Therefore, the teacher (client or team manager) and team know exactly what is complete and what is not. This reduces risk in the development process. Rather than traditional software development like the Waterfall method, where students might spend several months on a project without showing it to the teacher (client/project manager) Agile is all about moving fast, releasing often, and reacting to the real needs.

VI. RESULT ANALYSIS AND DISCUSSION

According to research from the Project Management Institute, agile organizations finished projects on time 65% of the time, versus 40% for non-agile companies. They also completed 75% of their goals, versus 56% for non-agile and even grew their revenue 37% faster.[13] These data and graph indicate the benefits of using agile method scrum is superior to water-fall model.

TABLE I
SPEARMAN'S RANK ORDER CORRELATION RESULTS

Software Development Practices	Correlational Coefficient($r(184)$)
Simple Design	0.37
TDD	0.45
Planning Game	0.3
Coding Standards	0.38
Refactoring	0.36
Continuous Integration	0.41
Collective Code	0.33
Integration Planning	0.41
Iteration	0.4
Iteration backlog	0.48
Iteration Retrospective	0.45
Daily Meeting	0.43
Product Backlogs	0.55

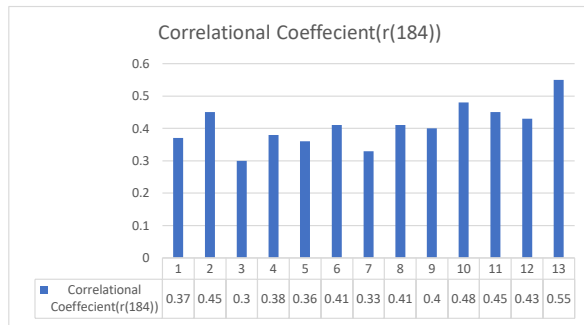


Fig. 4. Methods' and Practices' Characteristics

Practices shows that Scrum was most often utilized by respondents (71.2%), with Kanban (49.9%), Lean (39.7%) and Waterfall (35.3%) following in that order. It is important to note that practitioners were not restricted from selecting multiple methods, as assumed it was possible for their teams to employ one or more of these approaches, or a hybrid approach, to various degrees of strictness.[14]

VII. FUTURE PROPOSAL

In software engineering many process model is used. There are many implementation of process model in business areas on a wide range. As a to be software engineers CSE students must learn or practice the methodology. From various process model as incremental, spiral, RAD, prototype model, linear sequential model, agile model students can choose their project management model. But it is a better option to choose any of them according to future privileges. So Agile methodology-Scrum would help students to practice future IT work experience implementing them in graduation level. Agile is very flexible and it is possible to make changes in any phase. Scrum helps them to work as a team. It gives the platform to create something new in a shared, friendly environment. It helps students to connect with other students as group-mate, to lead a team, to share knowledge, experience, to get direction from teacher. Sharing experience and knowledge inspire other student to do, learn more, to work hard to meet the challenge. On the other hand linear sequential model is old structured without any mutual connection of students, teacher or any group. It takes long time to build the project. The waterfall is easy to manage, sequential, and rigid method. There is no feedback from the teacher or students. Therefore, it can be stated that agile methodology can be used as a development process model. It can be used in overall academic education process to get high response of students and teachers in a friendly, knowledge sharing environment obtaining new challenges.

VIII. CONCLUSION

Agile and Water-fall model are very different software development methodologies and are good in their respective way. Water-fall model is ideal for projects which have defined requirements, and no changes are expected. On the other hand, Agile is best suited where there is a higher chance of frequent requirement changes, new learning. In this article used data are collected from (indirectly collected) survey result. Agile methodology Scrum can successfully adopted to fulfil the specific need of academic project where team member would show more responsibility closely follow their plan.

REFERENCES

- [1] R. Wagh, "Using scrum for software engineering class projects," in *2012 Agile India*, IEEE, 2012, pp. 68–71.
- [2] M. Umbreen, J. Abbas, and S. M. Shaheed, "A comparative approach for scrum and fdd in agile," *International Journal of Computer Science and Innovation*, vol. 2, pp. 79–87, 2015.
- [3] S. B. Kaleel and S. Harishankar, "Applying agile methodology in mobile software engineering: Android application development and its challenges," *Computer Science Technical Reports*, pp. 1–11, 2013.
- [4] K. Schwaber and M. Beedle, *Agile software development with Scrum*. Prentice Hall Upper Saddle River, 2002, vol. 1.
- [5] K. Schwaber, "Scrum development process," in *Business object design and implementation*, Springer, 1997, pp. 117–134.
- [6] P. Schuh, *Integrating agile development in the real world*. Charles River Media, Inc., 2004.
- [7] T. Dingsøyr, T. Dybå, and N. B. Moe, *Agile software development: current research and future directions*. Springer Science & Business Media, 2010.
- [8] S. L. Pfleeger and J. M. Atlee, *Software engineering: theory and practice*. Pearson Education India, 1998.
- [9] J. Greenwood, *Inside the EU business associations*. Springer, 2002.
- [10] R. C. Martin, *Agile software development: principles, patterns, and practices*. Prentice Hall, 2002.
- [11] S. R. Palmer and M. Felsing, *A practical guide to feature-driven development*. Pearson Education, 2001.
- [12] F. Paetsch, A. Eberlein, and F. Maurer, "Requirements engineering and agile software development," in *WET ICE 2003. Proceedings. Twelfth IEEE International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises*, 2003., 2003, pp. 308–313. DOI: 10.1109/ENABL.2003.1231428.
- [13] S. A. Licorish, J. Holvitie, S. Hyrynsalmi, V. Leppänen, R. O. Spínola, T. S. Mendes, S. G. MacDonell, and J. Buchan, "Adoption and suitability of software development methods and practices," in *2016 23rd Asia-Pacific Software Engineering Conference (APSEC)*, IEEE, 2016, pp. 369–372.

- [14] P. A. G. Permana, "Scrum method implementation in a software development project management," *International Journal of Advanced Computer Science and Applications*, vol. 6, no. 9, pp. 198–204, 2015.