

## User stories as a tool for the specification of requirements: institutional projects and skills development

### Historias de usuario como herramienta para la especificación de requisitos: proyectos educativos y desarrollo de competencias

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DOI: 10.35429/JEHW.2023.12.7.23.30

Received January 20, 2023; Accepted June 30, 2023

#### Abstract

This article presents a study that aims to promote the success of software development projects using the agile approach efficiently in the requirements specification stage. The objective of the research is to implement as a strategy the definition of User Stories proposed by the agile approach. The case study presents the academic project "Acanmul", a comprehensive solution developed with emerging technological tools that lead to easy access and availability of tourist information from the state of Campeche, Mexico. During the development of the Acanmul software product, the implementation and start-up of the roles, artifacts, events, tools and techniques provided by the Scrum framework that ensure the agile management of the project during its execution and, in addition, favor the development of generic and disciplinary competencies in the area of project management. In this way, it is ensured that the development of the Acanmul software can collect and determine the specific requirements of the own needs for the reactivation of social, economic and commercial processes in the state and, therefore, in the country.

#### Resumen

El presente artículo exhibe un estudio que pretende favorecer el éxito de proyectos de desarrollo de software utilizando eficientemente el enfoque ágil en la etapa de la especificación de los requisitos. El objetivo de la investigación es implementar como estrategia la definición de Historias de Usuario propuestas por el enfoque ágil. El caso de estudio presenta el proyecto educativo "Acanmul", una solución integral desarrollada con herramientas tecnológicas emergentes que conlleven al fácil acceso y disponibilidad de la información turística del estado de Campeche, México. Durante el desarrollo del producto de software Acanmul se destaca la implementación y puesta en marcha de los roles, artefactos, eventos, herramientas y técnicas dispuestos por el marco de trabajo Scrum que aseguran la gestión ágil del proyecto durante su ejecución y, además, favorecen el desarrollo de competencias genéricas y disciplinares en el área de la dirección de proyectos. De esta forma, se asegura que, el desarrollo del software Acanmul, puede recabar y determinar los requisitos específicos de las necesidades propias para la reactivación de procesos sociales, económicos y comerciales en el estado y, por ende, en el país.

#### Requirements, Methodology, Tourism software

#### Requisitos, Metodología, Software turístico

**Citation:** HERNÁNDEZ-CRUZ, Luz María, CHUC-CAAMAL, Nardin Alexander, LLANES-CHIQUINI, Charlotte Monserrat and MEX-ALVAREZ, Diana Concepción. User stories as a tool for the specification of requirements: institutional projects and skills development. Journal-Health Education and Welfare. 2023. 7-12:23-30.

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## Introduction

Nowadays, we hear the word "project" on a daily basis.

ISO 25000 (2012) states:

"A project is a single set of processes consisting of coordinated and controlled activities with start and end dates, carried out to achieve an objective. The achievement of project objectives requires deliverables according to specific requirements, including multiple constraints such as time, cost and resources.

Each project is unique and differences can occur in:

- The deliverables.
- The stakeholders.
- The resources used.
- The constraints.
- The way the processes are adapted to provide the deliverables.

For its part, the PMBOK Project Management Fundamentals Guide defines [3]:

- A project is a temporary effort undertaken to create a unique product, service or result.

Software is the set of computer programmes, instructions and rules for executing certain tasks on a computer [5]. Unlike other products, a software application is developed with a process. It is not something that is manufactured from raw materials, nor is it assembled from small parts. Software has this special characteristic compared to other types of products, i.e. it is not manufactured in the classical sense, but developed through an engineering process [2].

Software development is the process of creating computer programs by writing code and performing related activities to develop, as every program to be developed implements the life cycle, which consists of several steps that are completed throughout the development process of this.

It depends directly on the methodology used, skills, techniques and a clear understanding of the customer's requirements and needs.

Software project management includes several aspects: governance, scope, stakeholders, risks, planning and control activities, project requirements, and business objectives. It refers to the project manager's abilities to manage management and technology issues [7].

Software development requires special project management practices, as its production has a different nature, this is the first step of an important path that will define the success or failure of a project. Software has no intermediate steps that can be verified as valid during its life cycle [1] [4]. Software production is different, the complex nature and innovative approach to technology related projects requires tools that provide efficient and quality development in the area of project management. In the technology area, project management must consider that software development is an essentially creative process that brings together talented professionals with differentiated knowledge with the objective of building a valuable product [6].

In recent times, agile methodologies have emerged as an alternative, a reaction to traditional methodologies and mainly to their bureaucracy. Brooks, in his mythical book *The Mythical Man Month*, sets out the first ideas put forward in agile methodologies, many of which are common sense [8].

A methodology is a set of procedures, techniques or systematic steps that are used to carry out a certain process or achieve a specific objective. It is a structured guide that provides a series of steps to follow in order to achieve the desired results efficiently and effectively. It aims to clearly define the purpose or desired result to be achieved by the application of the methodology.

A framework is a set of programming tools on which to build well-structured and reliable software and systems [9].

For software construction, a framework is a set of tools, libraries, standards and instructions that provide a basic structure and functionality for building applications. These frameworks are used by developers to streamline and standardise the development process, allowing applications to be built more efficiently and with less effort.

Therefore, this article externalises the User Stories of the Scrum framework as a strategy for the definition of the general requirements that constitute the initial Product Backlog of the Acanmul educational project. It should be noted that, as educational projects, it is necessary to promote, mainly, the development of generic and disciplinary competences in students of educational programmes in computer science.

### Theoretical contextualization

The study proposal arises from identifying the opportunity to enrich professional skills and competences in one of the main areas of software engineering, specifically project management, in requirements analysis.

The focus or character of the study envisages the commitment to carry out the requirements analysis phase of agile project management as a transversal and disciplinary competence, which in turn allows effective and fruitful links with the industrial, commercial and service sectors in the state of Campeche, through educational software projects developed by students of the educational programmes in computer science of the Faculty of Engineering of the Autonomous University of Campeche. From the above, the opportunity arises to apply tools and/or instruments that allow a frame of reference as a model, instrument, mechanism and/or tool, which takes as a guide the integration of internationally accepted standards for the agile management of software development projects as part of high-level academic training and promotes the vocation in relation to the Software Industry in the State of Campeche. Therefore, a correct identification of needs is required as a starting point for the definition of a software development project.

The study proposes the analysis of the study in educational projects. Table 1 shows the generic and specific competences of the Software Project Management learning unit of the Computer Systems Engineer educational programme of the aforementioned institution [11] [12].

Generic competences	Specific competences
Entrepreneurial, organisational and leadership skills. Cognitive skills. The use of ICTs in the professional field.	Develop, deploy and manage information systems using software engineering to support the productivity and competitiveness of organisations..

**Table 1** Generic and specific competences of the learning unit Software Project Management of the bachelor's degree in computer systems engineering

Source: Own elaboration

Likewise, Table 2 shows the competences and sub-competences of the learning unit Software project management [11].

Competences of the learning unit	Sub-competences
Manage software development projects to meet the specifications required by a company or organisation by applying internationally recognised and accepted standards, methodologies and/or frameworks.	<i>Sub-competences1:</i> Understand the basic concepts, available approaches, international associations and standards, methodologies and/or frameworks for project management.
	<i>Sub-competences2:</i> Apply a methodology for the agile management of software development projects following the stages of the process and employing specific software

**Table 2** Competences and sub-competences of the learning unit Software Project Management of the bachelor's degree in computer systems engineering

Source: Own elaboration

Consequently, Table 3 shows the direct competences and indirect competences related to project management and requirements specification [12].

Direct competences	Indirect competences
Design, develop and manage internet-based applications, as well as participate in the integration of websites supported by the use of emerging technologies. Design and build software systems and components applying intelligent systems techniques in any field of application. Ability to model, implement and administer relational and non-relational databases using database managers. Design, implement and operate technological solutions controlled by means of computer systems.	The approach links knowledge, values, aptitudes and skills to the context in which they will be used and considers combinations that may occur between them. Design, implement and manage communications networks applying current norms and standards. Critical and creative thinking skills. Leadership skills. Skills for the use of information technologies.

**Table 3** Direct competences and indirect competences related to project management and requirements specification

Source: Own elaboration

At this point, we cannot omit the importance of the aspects directly or indirectly related to the achievement of the competences of the Software Project Management learning unit. Table 4 shows the direct and indirect benefits of good software project management in institutional projects.

Direct benefits	Indirect benefits
Serves for the development of generic and disciplinary competences. Mastery of tools specifically used for project management. Knowledge and application of standards around project management.	Increase in the number of students participating in external or internal research and/or networking projects. Easy insertion into the labor market Forge a competitive advantage for graduates in the labor market. Encourage entrepreneurship around the software industry. Decrease in the student achievement rate. Decrease in the drop-out rate of students.

**Table 4** Direct and indirect benefits of Software Project Management.

Source: Own elaboration

### Methodology

Agile methodologies are a set of approaches and practices used in software development and other projects to manage work in a flexible and adaptive way. These methodologies are characterised by their collaborative, iterative and incremental approach, prioritising the delivery of value to the customer in a rapid and continuous manner.

Traditional software development methodologies are planning-driven. They start the development of a project with a rigorous requirements bidding process, prior to analysis and design stages. In doing so, they try to ensure high quality results within a timeframe [13].

Agile methodologies are flexible, they can be modified to fit the reality of each team and project [13].

An agile methodology is an approach used in project management and software development that is based on principles of flexibility, collaboration, iterative and incremental approach, self-organisation, adaptability and continuous improvement.

In this sense, Scrum is a structured framework for project development. It is frequently used by software development teams following an agile methodology [14].

It starts with the overall vision of the desired outcome, and from there specifies and details the functionality that is desired in the first place. Each development cycle or iteration (Sprint) ends with the delivery of an operational part of the product (Increment). The duration of each sprint can be from one to six weeks, although it is recommended that it does not exceed one month [15].

During each Sprint, the Scrum Team selects a set of elements from the Product Backlog and works on them to deliver a potentially deliverable Increment. At the end of each Sprint, a review of the work performed is conducted and the Product Backlog is adjusted based on the feedback received. The process continues with new Sprints until the project objectives are achieved.

All team members collaborate openly with each other, according to their capabilities and not according to their role or position. Through self-management and collaboration, the work that would otherwise be done by a project manager can be handled with ease [15].

**Sprint Planning:** In this meeting, the entire development team plans the work to be done (scope) during the current Sprint. In this meeting the team decides the goal of the Sprint [14]. Where the Scrum Master, at the beginning of the project, organises the first meeting for the organisation of the deliverables. The Product Owner ensures that the Product Backlog is updated and prioritised correctly. Similarly, the Scrum Master collaborates with the Product Owner and the Development Team to ensure that everyone is prepared and has the necessary information for the planning meeting. It is important to note that active collaboration between the Product Owner, Scrum Master and Developers is essential in the Planning stage. Transparency and effective communication is encouraged to ensure that everyone has a clear understanding of what is expected and how the work will be carried out during the Sprint.

Scrum is effective for educational projects because of its flexibility, transparency and ability to deliver early value. By adopting the methodology, teams can develop competencies in teamwork, adaptability, self-management and problem solving, which contributes to the success of the project and the growth of its members.

The Scrum framework establishes the following main components for agile project management:

- **Product Owner:** They know the product best. They are focused on understanding the business, customer and market requirements, and then prioritising the work that the engineering team must do to meet them [14].
- **Scrum Master:** The Scrum Master is responsible for enforcing the rules of the Scrum framework. Ensures that these are understood by the organisation and that work is done in accordance with them. He/she advises and trains the product owner and developers, and continuously configures, designs and improves the organisation's agile practices [15].

- **Developers:** Collaborate autonomously and in teams to deliver increments of value at the end of each Sprint. They may have roles as programmers, designers, or test engineers, as required by the product development.

The main events defined in the Scrum Methodology for agile project management, which will be immersed in the implementation in the case study, are listed below:

- **Sprint Planning:** This is a meeting held at the beginning of each Sprint where the entire Scrum Team participates; it is used to inspect the Product Backlog [16].
- **Daily Scrum:** A short, mostly 15-minute, focused meeting that takes place every day during the Sprint, with the objective of synchronising the team and ensuring transparency in the progress of the work.
- **Sprint Review:** One or two hour meeting at the end of the sprint to show the increment and collect suggestions. In the case of more relevant or complex increments it can last up to four hours. It is attended by the entire scrum team and all the people interested in the project who wish to attend [15].
- **Sprint Retrospective:** This is where the team meets to document and analyse what has worked and what has not worked in a sprint, a project, in people or relationships, tools or even for certain protocols. The idea is to create a place where the team can focus primarily on what went right and what needs to be improved for next time, and less on what went wrong [14].
- **Sprint Grooming or Refinement:** Product Backlog refinement is a best practice to ensure that the product backlog is always ready. This ceremony follows a similar pattern to the rest and has a specific fixed agenda in each Sprint. It is estimated to last 2 hours maximum per Sprint week. It is the responsibility of the product owner to schedule, manage and lead this meeting [16].

**Results**

The case study "Acanmul" is an educational project that aims to develop a mobile application that allows to have at hand, all the information of the tourist destinations in the state of Campeche, Mexico.

The specific objectives of the project are:

- The user can consult a travel package with its predefined destinations or can put together their own package, which includes images, description and price.
- The user can visualize the route of the chosen package on Google Maps and can obtain the mileage and price.
- A function or space for direct contact with the Client to quote customized trips that are not covered within the packages.

The IT solution was carried out by applying the Scrum framework for project management.

For the research study, the Project Planning stage is specifically considered. Table 5 shows the main Scrum processes and the processes, tasks and artefacts defined in the Acanmul project planning.

Processes defined in the Scrum Framework
Sprint Planning. Daily Scrum. Sprint Review. Sprint Retrospective. Sprint Grooming o Refinement.
Process and tasks for the Planning stage in Scrum
Phase 1: Project Initiation Define the project. Draft the project scope. Assign Scrum project roles (Product Owner, Scrum Master and Developers). Create the Product Backlog. Elaborate User Stories. Prioritise and order User Stories. Associate acceptance criteria to User Stories. Use a software tool to create the Product Backlog (Jira).
Artefactos para la Planificación en Scrum
Product Backlog (Lista del product).

**Table 5** Elements of the Planning Stage using the Scrum framework for the education project.

Source: Own elaboration

During Phase 1: Project initiation. As a result of the initial meeting with all those involved, the project is defined and its scope is drafted in a first document, which contains among the most relevant data the business rules, deliverables and responsibilities and contact information.

The identification of roles in the project was directly related to the skills of the team members established for the subject and in correspondence to the roles of Scrum Master, Product Owner and Developers.

The definition of main functionalities is written based on the three-word rule of the Scrum framework:

- Like <role>.
- I want <events>.
- For <features>.

Immediately afterwards, the Planning Poker technique is used to assign the value and priority of the User Stories identified within the first Product Backlog and making use of the PlanningPoker.com tool.

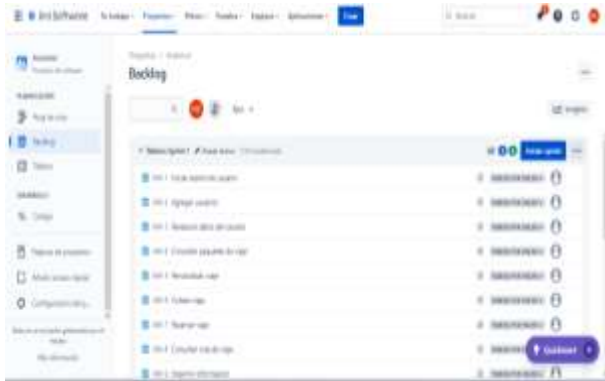
Planning Poker is based on a technique known as Wideband Delphi, which is a consensus-based estimation process. Table 6 shows the Product Backlog obtained from the Acanmul project.

ID	User Story Name	Description of the User Story	Value	Priority
01	User login	as a user I want to access the Acanmul mobile application to book a trip.	3	Media
02	Add users	as a user I want to have an account and password to access the Acanmul mobile application.	5	High
03	Restore user data	As a user I want to get a new password for my account to regain access to the Acanmul mobile application.	5	High
04	View travel packages	as a user I want to search for tourist attractions in the region and all relevant information.	4	Medium
05	Customize trip	as a user I want to customize a package to my liking to get to know the touristic places of the region of my personal interest.	5	High
06	Quote trip	as a user I want to make a quotation of a travel route to adjust to the costs or economic investment that I need to pay.	5	High
07	Book a trip	as a user I want to book a travel route to get to know the region's own tourist attractions without worrying about finding information or reservations.	4	Medium
08	Consult travel route	as a user I want to search for tourist attractions in the region and all relevant information.	3	Low
09	Print information	as a user I want to print my travel route to know my trip characteristics.	3	Low
10	Manage information	as an administrator I want to update and configure trip information to make changes to trip routes, trip features, trip prices and add trip information.	5	Medium

**Table 6** Product Backlog of the Acanmul project.

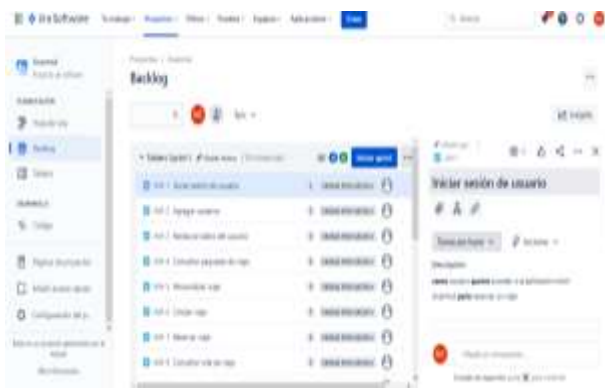
Source: Own elaboration

On the other hand, using the Jira Software tool with the aim of managing and monitoring the development of the Acanmul project, the specification of the Product Backlog is completed. Figure 1 and Figure 2 show the Acanmul Project Planning within the Jira Software tool.



**Figure 1** Planning of the Acanmul Project within the Jira Software tool

Source: Own elaboration



**Figure 2** Task description within the Jira Software tool.

Source: Own elaboration

## Conclusion

The Planning of the Acanmul project is carried out considering a time span of two weeks, including an initial meeting and specific meetings for the definition of the initial Product Backlog. Following the Scrum framework. Similarly, evidence in the project start-up phase of the initiation phase:

- The soft competences of: teamwork, leadership, organisation, responsibility and empathy.
- Disciplinary competences: Capacity for logical reasoning (Planning Poker technique), use of specific technologies for agile project management (Jira), Scrum framework, use of the GitHub collaboration tool.

It is important to consider that the active participation of the client was constant. In the Planning Poker technique meeting, an expert in the tourism area was invited for his intervention in assigning value and priority to the User Stories in the construction of the initial Product Backlog. The start of the project exceeded the time expectations by being completed in a period of two weeks. Therefore, it can be affirmed that the use of the Scrum framework for educational projects in the requirements specification stage was successful in the case study, leading to the development of generic and disciplinary competences of the project team members. Finally, it is highlighted, in the academic-scientific field, that this case study can be used to apply standards, frameworks and/or methodologies in educational projects and its use as a teaching-learning strategy.

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