Review of student satisfaction on project planning and implementation steps

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Abstract

The survey examines the area of usefulness and satisfaction of the implementation and selected steps of planning and execution of software development in the Web Systems Development course. Different approaches to the planning and implementation of information and communications technology solutions projects are presented, which the participants of the course apply for their project work. During the computer laboratory exercises, a monitoring was conducted over the design and development of projects that required students to build their own online classrooms, covering the requirements of the course to obtain the grade. A survey was conducted among the course participants to check how useful they found the selected design approaches and how satisfied were they with their products. Of total 60 students, 25 participated in the survey. They had to provide a self-assessment of the project items based on 8 milestones of development, which covers tools, frameworks and requirements of project development, on which the educator later provided a peer review. At the same time, an analysis was conducted whether the participants felt good about their products and if they therefore gave a higher self-assessment than the professional assessment given later. The results show that participants who have a positive feeling about their approach to the project also feel better about the suitability of their own products later on. It was also discovered that participants mostly underestimate their own abilities and give lower self-assessments of the project compared to peer reviews.

Keywords

project work, framework, planning, implementation, development, students, ICT.

1. Introduction

Project work is the process of capturing, defining, developing and presenting a product to consumers [1]. Such a process can be undertaken by individuals with full control over the implementation, but in industry and other sectors, project work is divided into several teams and actors that need to be properly managed to achieve optimal results. In information technologies (IT), the development of a software solution is a complex and time-consuming process that can be shortened through proper and effective project planning and management [2].

Group work is often divided into different roles. Depending on the size of the teams and the environment in which the project is being implemented (economy, education, bureaucracy, etc.), the planning and implementation of the project itself needs to be properly controlled and resourced. To this end, various frameworks have been developed to guide teams and their members through different levels of creative thinking and planning. In the IT sector, project implementation is even more complex, as it is necessary to allocate tasks well to members with the appropriate experience and to create a timetable for the duration of the development of a particular component [3]. It is helpful that these skills are taught in contained environments, such as learning institutions or training courses.

There are various approaches and frameworks available that can help to make the planning and subsequent implementation of information communications technologies (ICT) projects more organized. Frameworks offer various guidelines and questions to present to developers the different

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aspects that should be well covered in the final product, with a focus on user experience and market durability [4]. The choice of frameworks depends on the purpose and complexity of the project, as well as the size of the group itself and the resources available. However, the wrong choice of frame can significantly increase the cost of implementation, thus not achieving the desired impact of the frames. At the same time, over- or miss-planning can occur through inappropriate allocation of resources such as money, time, material goods and human resources [2].

One of the aims of the course is to prepare students for real-life situations and to equip them with useful skills for their chosen jobs. In the IT sector, there is an increasing emphasis on group work and project implementation [1]. One such example is the design and development of a group-based online classroom project during the laboratory exercises of the Web Systems Development course. However, an interest in students' opinions on the chosen steps in the planning and later the execution of the project, and how self-critical they are of their own products is the aim of this study.

1.1. Motivation and contribution

The aim of this paper is to present the opinions of students of the Web Systems Development practical computer courses on standard approaches to project planning and assignments, and how they perceive the usefulness and applicability of the techniques they have learned in the context of project implementation. The aim is also to find out how satisfied they are with their own approach to carrying out the aforementioned planning and development steps.

1.2. Structure

After the introduction, section 2 describes the theoretical background to the planning and implementation of project work from an IT service development perspective. An explanation of different frameworks and techniques of the approach, and the potential drawbacks in specific situations will be given. Section 3 covers presentation the methodology, where research questions and test hypotheses will be given. A description of the criteria for sample selection and the measurement instrument used during the research will be provided. Section 4 presents the data collected in the form of tables and graphs. Section 5 covers the definition of the results obtained and answers to the research questions. Section 6 provides conclusions, states the limitations of the research and indicates possible approaches that could provide better quality results for future studies.

2. Theoretical framework

This chapter presents the aspects and benefits of proper planning and implementation of ICT solution projects for students. These will be referenced in the description of the Web Systems Development course.

Project work is the process of defining, planning and implementing a work process to achieve a goal, using appropriately allocated resources in teams. From an ICT perspective, the importance of good organization and execution began to take shape around 1970, when the demand for software solutions increased significantly and systems became increasingly error-prone. Thorough documentation also helped to allocate resources and thus reduce the cost of producing software solutions.

2.1. Project planning

Before starting to develop a software solution, it is a good idea to prepare the relevant definitions and the objectives to be achieved during the development. There are many frameworks that guide groups or individuals to answer and define the various aspects that are good to capture for a more

focused and thoughtful product. These can be especially useful to the students of ICT courses with few experiences in group-based environment [5].

Within the scope of the project, the manager or client must appropriately allocate the following resources: time, money, labour and material resources. A well-developed plan and focus help to optimise the use of resources, even when fewer resources are available. Some research warns that excessive planning and agreeing can unnecessarily waste resources for the further implementation of a project [6]. Constraint and a proper approach are therefore recommended.

There are several approaches to planning. Implementation frameworks are designed precisely to ensure that the members of a project fill all the requirements that their product might need in a shorter time. From functionality to process connections and even end users. The design process goes through several iterations, where each iteration adds and refines the software solution for the market. The frameworks use more focused and tailored commonly used design techniques such as brainstorming, mind mapping and prototyping [2]. While some frameworks were originally designed to help school children become more organised in their task design, such approaches have also proved useful for projects at industrial and higher education level, such as the Double diamond approach and SCAMPER (an acronym for seven perspectives of creative solutions to challenging problems: Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, Reverse), which use basic techniques with better reasoning and questioning to guide the project team towards a better design of the final product [4; 7][4].

2.2. Implementation of the project work

Effective teamwork is the next step in quality planning. Once the requirements of the solution, allocation of available resources and user experience and interface have been defined, the team needs to get down to the actual development of the solution. Depending on the size of the project, the time available and the number of participants, a coordinated approach to implementation should to be taken. In the beginning, the Waterfall approach was often used, which takes the project in steps from start to finish [8]. It is based on detailed documentation and divides the work into groups, where selected elements of the software solution are developed in order. Problems can arise when a particular section takes too much time to develop, as subsequent groups cannot proceed until the prerequisites for them have been fully developed [3].

Agile project delivery frameworks have therefore evolved in the opposite direction. The first guidelines were set out in 2001 at the Snowbird Resort in Utah at an association where developers set out 4 main principles and 12 rules for effective agile project management [9]. The emphasis is on the dynamism and flexibility of project participants and on more organised project delivery, rather than on extensive documentation and unilateral development. Such teams require more experienced developers who are able to take action when the selected component encounters problems in development. The method places greater emphasis on communication between individuals in the group as well as the client of the software solution. This is highlighted by some as a negative approach in some cases, as the production of reports is desirable from all team members. The latter takes time and attention away from the developers to actually develop the product [3].

2.3. Course of Web Systems Development

The course is mandatory subject for second-year students of Media Communications programme in spring midterm at the Faculty of Electrical Engineering and Computer Science. The aim of the course is to expand knowledge on web systems, to learn and understand processes for modern web systems development, implement such solutions by using modern web technologies, programming languages and multimedia content. The course also provides historical insight, protocols and frameworks for better approach to web systems development. It spans over 15 weeks of theoretical and practical exercises [10] .

For practical exercises the students should use the provided theoretical knowledge in order to conduct their own project work. Themes vary on yearly basis, but students have to reach 8 different milestones during the course runtime. Each of the milestones have to be defended in order to receive allocated points. Students must divide into groups of 2-3 students, where individual work is highly discouraged. After that, they receive instructions based on different steps of development, which they have to complete in weekly manner, similar as to how Agile project management frameworks operate. The goal of the exercises is to create a functional website, utilizing Hyper Text Markup Language (HTML), JavaScript, MySQL (Structured Query Language) and PHP: Hypertext Preprocesor (PHP), while also using the Bootstrap Cascading Style Sheets (CSS) framework for website responsiveness to fasten the development time. At the beginning, students have to create a shared Github repository for their project, where under the Projects section they specifiy and keep track of tasks, deadlines and deliverables. In first 5 weeks, the groups need to conceptualize and design their systems with the help of tools such as Miro, Balsamiq Wireframes and Figma. After that they prepare their devices for development by installing local development technologies that support the required specifications (such as Xampp or Docker). Over the next 10 weeks, they must program a functioning website that matches the designs and allows data to be read and stored in a database. All files related to the project must be uploaded and updated in the GitHub repository.

3. METHODOLOGY

After reviewing literature and existing research, a task to answer the following research questions has been assigned. Data collection has been carried through a survey and peer review of the submitted products was received.

3.1. Research questions

The research assignment asked two research questions (RQs):

- What is the correlation between the usefulness of the steps in the planning process and the self-assessment of the products during the planning process?
- Do project participants perceive their product as better than the peer reviewer?

Based on the scientific questions, the following hypotheses (H) were set:

- H1: A higher rating of the usefulness of the project implementation steps leads to a higher self-assessment of the relevance of the products.
- H2: Self-assessment of step and product performance is higher than expert assessment.

3.2. Sampling and survey participants

The research is related to the usefulness of planning and self-assessment of the success of the project implementation during the practical computer exercises of the course Web Systems Development, so a sample of the second year students of the Media Communication programme at the Faculty of Electrical Engineering, Computer Science and Informatics, University of Maribor was selected. Participation in the study was sent via email and notification on the internal Moodle platform named eStudij, and participation was optional.

3.3. Measuring instrument

During the study process, students were asked to create a project on the topic of Online Classroom in the exercises of the subject Web Systems Development, which was to build an arbitrary web-based system that delivers selected material and tests the knowledge by conducting a short questionnaire. They were divided into several groups, with two to three students working together

on the project. They also had to decide on the content and the central theme of their online classrooms. Individual work was discouraged. The process took 15 weeks, during which 8 assignments were given. Their content and the time available depended on the complexity of the scope. In the first four steps, students were guided by the teaching units to prepare a plan and short documentation on a selected sub-topic, to review existing solutions, to design a wireframe model and a prototype of the web-based system. In the remaining steps, they worked on the development of the web-based system based on the defined design and on adding functionality according to the learning unit criteria.

The data were collected by means of a survey, as it proved to be the easiest way to distribute and obtain the data. A convenience sampling method was chosen, which was derived from 2nd year students of Media Communication at the Faculty of Electrical Engineering, Computer Science and Informatics of the University of Maribor. Participants were offered a free opt-out from the survey without consequences, and participation protects their personal data and does not require them to provide it. On the first page, a brief theoretical background and the reason for conducting the questionnaire were provided, which included the definition of the privacy policy and the estimated duration of the questionnaire. The questionnaire was designed in two parts, at the beginning of which a short theoretical background was provided relating to the expected statements and answers.

In the first part, students were asked to give their opinion on the usefulness of the individual planning steps and development tools. The questions were related to the evaluation of the usefulness of the following processes: creating a description of the software solution, creating a sketch of the user interface of the software solution, analysing existing solutions by defining positive and negative features, creating a wireframe and creating an interactive prototype of the software solution. They also evaluated the usefulness of development approaches that reduce development time, such as using the Bootstrap framework and moving to the PHP programming language. In the second part, they were asked to self-assess the relevance of their own products. These related in a more extended form to the design and implementation steps tested in the first part of the survey. In this part, a practitioners' evaluations of the individual projects was provided.

The first part consisted of 8 questions related to the perceived usefulness of the planning steps, which were rated on a scale from 1 to 5, where 1 represents "disagree" and 5 "agree". The second part consisted of 17 questions where participants rated their own performance of individual steps on a scale of 1 to 5, where 1 represents "very poor" and 5 "very good". The products developed during the laboratory exercises were evaluated.

The survey was published on the web portal 1ka.si and was conducted in the period from 31 July 2024 to 21 August 2024.

4. Data analysis

The survey was sent to sixty (60) individuals taking the Web Systems Development course. Of these, 25 participants completed the survey in full, 11 left the survey after the prompt, 7 left the survey after clicking on the link, and 17 participants did not respond to the prompt. The second part of the survey was also completed by one expert evaluator of the tasks. These represented our sample. After reviewing the data, a definition of indicators and aggregation of the question responses was divided into three continuous variables: average utility score, average self-assessed relevance score, and average expert assessment of relevance score.

In a first step, a normal distribution of the variables has been checked using the Shapiro-Wilk test.

Table 1
Showing the normal distribution of the data.

	Kolmogorov-Smirnov[a]	Shapiro-Wilk

	Statistic	df	Sig.	Statistic	df	Sig.
avg_usefulness	0,172	25	0,054	0,950	25	0,256
avg_self_grade	0,119	25	.200	0,973	25	0,714
avg_evaluator	0,111	25	.200	0,968	25	0,590

As can be seen in Table 1, for all these variables the significance is greater than 0.05, which means that the data are normally distributed and statistical analyses can be done.

For hypothesis H1, a test was conducted whether there is a correlation between the assessment of the usefulness of the planning steps and the self-assessment of the success of their implementation. Pearson correlation has been used to calculate this.

Table 2
Correlation check variable with Pearson test.

		avg_usefulness	avg_self_grade
avg_usefulness	Pearson Correlation	1	.464
	Sig. (2-tailed)	°	0,020
	N	25	25
avg_self_grade	Pearson Correlation	.464	1
	Sig. (2-tailed)	0,020	°
	N	25	25

As can be seen in Table 2, the correlation level is 0.461, which means a moderately good correlation. Since the significance level is less than 0.05, the null hypothesis can be rejected and the correlation between the variables could be confirmed.

For hypothesis H2, a test was conducted whether research participants are more forgiving of their own mistakes and thus give a higher rating of adequacy compared to an expert's rating of adequacy. For the statistical analysis, an Independent Samples T-Test has been used and the results obtained are shown in Figure 1.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance		Mean	Std. Error	95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Difference	Difference	Lower	Upper
avg_grade	Equal variances assumed	,463	,500	-,613	48	,271	,543	-,06723	,10966	-,28771	,15326
	Equal variances not assumed			-,613	47,071	,271	,543	-,06723	,10966	-,28783	,15337

Figure 1 Result of the independent samples test.

As it can be seen, there is no statistical correlation between self-assessment and professional assessment of the performance of project work. The data are too scattered as can be seen on Figure 2 , and the significance is greater than 0.05, thus accepting the null hypothesis.

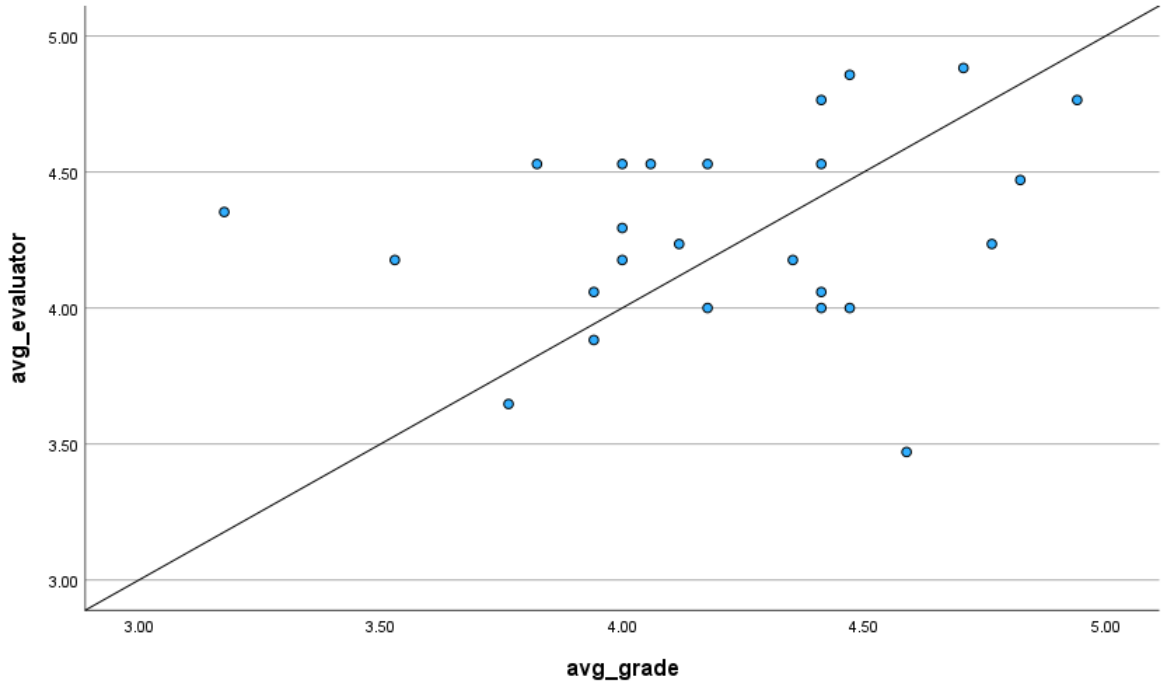

Figure 2: Scatterplot of values for the variables of average self-assessments and expert assessments

5. Discussion

In the following section, an interpretation of responses to the results of the statistical analyses will be given, and answer to the research questions will be provided.

From a group of 60 individuals, 25 relevant responses were obtained, representing 41% of the total desired sample. In the first part of the survey, a check on how useful the respondents find the selected steps was performed. The first part yielded an average rating per participant of 4.18, with lowest score being 3.13 and highest being 4.88. The second part consisted of 17 questions and yielded a superficial participant self-assessment of 4.21, with lowest being 3.18 and highest being 4.94. The expert rating of the second part was on average 4.28, with lowest being 3.47 and highest being 4.88. This shows that the average grading is somewhere on par between the participants ratings and expert ratings.

(RQ 1) Is there a correlation between the usefulness of the steps in the planning process and the self-assessment of the products during the planning process?

To answer the question, a statistical test to test whether there is a correlation between the two variables: the usefulness rating and the self-assessment of the product was used. The Pearson correlation test showed a moderate correlation between the two variables, which does not invalidate the hypothesis H1. This shows that there is a moderately strong correlation between a good design utility score and a good self-assessment of product relevance during development, meaning that the participants were satisfied with the different steps of project management to the degree where they feel more satisfied with their final product.

(RQ 2) Do project participants perceive their product as better compared to the peer reviewer?

In this case, a comparison of the data from the second part of the questionnaire is examined. Self-assessments of the product steps and expert assessments of the adequacy of the steps were compared. Although the data was normally distributed, the use T-Test for independent samples to concludes that there is no statistical relationship between the two variables. Thus, the hypothesis H2 is rejected, which states that individuals are better at self-assessing their own products compared to expert assessment. Even though the satisfaction of the participants with project

leading was positive, this behavior still doesn't reflect properly on their actual achievements through their self-esteem on grading of the project deliverables.

6. Conclusion and further work

In this study, a survey on opinion of the planning and implementation of an ICT project by students who carried out a small-scale web design project during laboratory exercises, with the design of Web Classroom system as the central theme was conducted. The objectives and approaches of ICT project planning and implementation using different frameworks were presented, and application of one of them during the actual study course. Students of the course were invited to participate in a survey where they could give their opinion on the usefulness of the selected planning steps and later self-assess the appropriateness of the implementation from their side. At the same time, a peer review of the products was also provided. The data acquired shows that individuals who have a good opinion on the project planning steps also have a better self-assessment of their own products later on. At the same time, it was found that individuals rate their own products lower than the expert evaluator, which leads to an understanding that in majority of cases the students self-esteem about their work does not properly reflect the actual work being done.

6.1. Restrictions

There were some limitations to this study. One of the first was that the participants had a number of workloads during the course of the study and could not focus fully on improving the quality of the project. Despite their participation in the study, not everyone had the same abilities and motivation to implement the projects, which can be observed in the variance of some factors such as the assessment of the benefits of the planning steps and then the implementation of these steps. For a more comparable expert evaluation, more expert evaluators would be needed to give a better proxy and transparency over these projects. A limitation was also present to conducting a questionnaire with ad hoc sampling, which may not effectively represent the whole population. The sample that is analyzed is relatively small (N=25).

6.2. Further work

In the future, a greater focus on project planning and a more detailed specification of the implementation requirements is suggested. There was a strong focus on prototyping and then full graphical implementation using the Bootstrap framework, which caused problems for some participants as they were unable to achieve an identical look and feel of the systems they were developing. The research would have been better conducted if the groups of students had been split so that one third designed with one framework, one third designed with one other framework and one third designed without a framework. The latter is more difficult to implement as the aim of the learning process is to learn the defined guidelines of the subject and to appropriately grade all of the course participants on the same grading scale and instructions. Another suggestion relates to a more structured questionnaire, where the data could be better related to each other and the effects of the frameworks on the planning and implementation of ICT projects could be better tested.

6.3. Acknowledgements

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6.4. Declaration on Generative AI

The authors have not employed any Generative AI tools

6.5. References

[1] Letouze, P.; De Souza, J. and Martins Da Silva, V. (**2016**). *Generating Software Engineers by Developing Web Systems: A Project-Based Learning Case Study*, : 194-203.

[2] **Zwikael, O. and Gilchrist, A.** (**2023**). *Planning to Fail: When Is Project Planning Counterproductive?*, IEEE Transactions on Engineering Management 70 : 220-231.

[3] **Natarajan, T. and Pichai, S.** (**2024**). *Transition from Waterfall to Agile Methodology - An Action Research Study*, IEEE Access : 1-1.

[4] **Boonpracha, J.** (**2023**). *SCAMPER for creativity of students' creative idea creation in product design*, Thinking Skills and Creativity 48 : 101282.

[5] **Mu, C.; Li, F.; Tseng, S.-P. and Xue, Q.** (**2024**). *Analysis of Teacher–Student Interaction in the High School IT Class with IT-based Interaction Analysis System*, Sensors and Materials 36 : 2409.

[6] Gholizadeh-Tayyar, S.; Lamothe, J.; Dupont, L. and Loustau, J.-P. (**2018**). *A Decisional Framework for Concurrent Planning of Multiple Projects and Supply Chain Network*. In: Temponi, C. & Vandaele, N. (Ed.), *Information Systems, Logistics, and Supply Chain*, Springer International Publishing.

[7] He, Y.; Yang, H.; He, H. and Zheng, X. (**2023**). *Design of smart tourism platform under Double Diamond Model design thinking*, : 100-104.

[8] **Serrador, P. and Pinto, J. K.** (**2015**). *Does Agile work? — A quantitative analysis of agile project success*, International Journal of Project Management 33 : 1040-1051.

[9] (**2023**). *What is Agile Methodology?*, GeeksforGeeks .

[10] (**2023**). *Web Development course description*, moja.um .