Graduation Project Monitoring Platform Based on a Personalized Supervision Plan

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Abstract. Thesis supervision is a complex and important process that can directly affect the outcome of the graduation project. Poor communication between the student and the supervisor, lack of progress tracking tools and a mismatch between the preferred supervisory styles make it more likely that the project will not be finished on time or will be abandoned. Therefore, having a dedicated tool that handles all these issues could significantly contribute to the success of the graduation project. In this context, we introduce an innovative platform called Thesico, which aims to provide comprehensive support for the thesis supervision process. More specifically, the system proposes an individualized supervision plan, based on the preferences of the student and teacher with respect to support and structure. The system also facilitates the management of the project tasks (by means of Kanban boards), the intermediary assignments and the student-teacher meetings. In addition, the quality and progress of the supervision process can be assessed by means of a dedicated collaboration score computed by the platform.

Keywords: Thesis supervision · Graduation project · Supervisory style · Supervision plan · Student-teacher collaboration · Project management · Educational platform

1 Introduction

The final year / graduation project, together with its implementation process, plays an important role in the student's academic growth. Furthermore, the key to a successful Bachelor or Master thesis does not entirely consist in choosing the right project and supervisor, but it is also affected by the coordination approach.

Despite the latest technological evolution, some universities do not use a specialized tool for the thesis supervision process. Without an application that can be used for thesis completion monitoring, the process is based only on the supervisor's experience and preferences [10]. Furthermore, a survey was conducted in [1], which highlighted that the limitations imposed on student-teacher communication represent the main factor that can lead to the abandonment/delay of the thesis completion. A similar idea was also presented in [8], where the authors pinpointed that collaboration is affected by the parties' availability. In [1], it was also noted that no standard methodology is used for the thesis supervision process and the communication between the supervisor and the

student is handled using various ad hoc means, e.g. email, phone calls, SMS. While this approach is flexible since it is chosen by the student-teacher pair, it can also have limitations or cause problems like losing track of the implemented work and/or of the provided feedback, being hard to manage and review the current status of the thesis [1].

Another factor that directly affects the quality of the collaboration between the student and the teacher is represented by the number of supervisees for a single supervisor, which without a specialized platform, can be very tedious for the instructor [5].

Since the student-teacher collaboration depends on the compatibility between the involved parties, their preferences should be taken into account. Hence, the supervision process must be suitable for both the student and the teacher preferences and schedules.

In addition, Romdhani et al. pinpointed that the student learning experience can be improved by using a specialized tool [10]. Starting from these ideas, we propose a dedicated platform, called Thesico (**Thesi**s **co**ordination), which is a web application that can be used to handle the student-teacher collaboration process and project management while working on the thesis. By means of Thesico, the users will be able to follow a supervision plan (suggested by the system based on the preferences of the parties or custom, proposed by the supervisor), and to manage the meetings, assignments, and project tasks. Furthermore, they will be able to evaluate the collaboration process by visualizing various statistics (including a collaboration score).

The rest of paper is structured as follows. The next section provides an overview of the related work which includes similar systems and the theoretical aspects that have been considered while implementing the Thesico platform. The third section presents the mechanism and workflow of the Thesico system, while the fourth section illustrates its main functionalities. Lastly, the fifth section includes some conclusions and future research directions.

2   Related Work

Two of the most important steps that can assure the success of a graduation project are: i) choosing a project theme and supervisor that match the student's needs and ii) smoothly handling the interactions with the supervisor to discuss the current state of the project, the next tasks, the challenges encountered and any other organizational elements that are needed in the project implementation phase.

Regarding the first step, studies show that a positive relationship between the student and the supervisor and a good compatibility between them with respect to personality and supervisory style can lead to increased engagement, performance and well-being [6, 7, 11]. In this context, we already implemented a platform called SPA (Smart Project Allocation) which aims at finding the best fit for the student based on several factors (supervisory style and personality of the teacher, domain and complexity level of the project) [2]. In addition, SPA provides a way to dynamically allocate the thesis projects based on the student-teacher and student-project compatibilities, in a fair and transparent manner. We therefore aim to integrate the SPA system with our proposed platform, in order to handle this first matching and allocation step.

Regarding the second step (i.e., project monitoring and coordination), Almeatani et al. suggest that in general the resources provided by the university (free accounts

for different project management tools or access to resources) are not enough for the student and the supervisor since they can lose track of the discussed aspects (status, feedback, planned meetings) and their schedules also affect their interaction [1]. Since the supervision process is very complex, it needs to be supported by a specialized tool that will handle the management of each component of this process; hence, several systems have been proposed in the literature for this purpose.

One such system is Git4School, introduced in [9], which includes a dashboard with statistics regarding the students' GitHub[1] activity. For example, the statistics are built based on the homework status (if it was implemented without help from other students or if it was implemented before the teacher's solution has been published). While this system aims at providing an overview of the student's activity based on the homework assigned by the teacher, the authors conclude that the usage of a specialized tool improves the supervision process by providing a real-time overview of the learners' activity which can be used to identify the students that need more support from the teacher [9].

Another similar platform, called TSS (Thesis Supervision System), is proposed in [1] and it can be used to handle two types of interactions: the supervisor-supervisee interaction and the student-student communication. Using TSS, the supervisors can provide feedback and both students and teachers can schedule meetings. Furthermore, the supervisees can manage their project tasks, under the coordinator's supervision and they can also interact with other students that have projects from the same domain and they can share information [1].

A related project supervision system is presented in [10], which handles the project allocation part but also provides the possibility to manage the tasks and milestones that should be validated by the teacher. In addition, more generic project management platforms such as Jira[2] could also be used to monitor the tasks of a student project, but without dedicated educational support features.

Our goal is to integrate the most useful functionalities from the above systems, but also take into account the students' and teachers' preferences with respect to supervisory style. Implementing a personalized supervision plan is an innovative feature of our Thesico platform, which builds on the user profiles created by the SPA system. More specifically, the supervisory style consists in the principles that are present in the teacher-student collaboration (supervisor-supervisee relationship) [3]. We follow the conceptual model proposed by Gatfield [4], in which the supervisory styles are characterized by two factors, structure and support; four supervisory styles are thus defined: *Laissez-faire, Directorial, Pastoral,* and *Contractual*.

Firstly, the *Laissez-faire* style is defined by a low level of structure and support (i.e., the supervisor provides limited task guidance or personal interaction). Secondly, the *Pastoral* style is described as an approach with a low level of structure, but a high level of support (i.e., the supervisor offers personal care but limited task-driven directions). Thirdly, the *Directorial* style is represented by a high level of structure but a low level of support (i.e., the supervisor tends to focus on the project tasks, but less on the personal interaction). Lastly, the *Contractual* style is defined by a high level of structure and support (i.e., the supervisor provides both project task direction and personal care) [4].

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[1] https://github.com.
[2] https://www.atlassian.com/software/jira.

Starting from the students' and teachers' preferred supervisory style, Thesico platform proposes an individualized supervision plan, as described in the next section.

3 Thesico Prototype

3.1 Designing an Approach for Individualized Project Supervision

Thesico platform was designed in order to support and facilitate the thesis supervision process, by providing a standard workflow for project tasks, assignments, guidance meetings and milestone meetings. The project management issues, as well as the communication and collaboration between the supervisor and the student are thus handled in one comprehensive platform.

With respect to project management, a Kanban board[3] is included, which provides a visual representation of the work in progress, with cards that represent tasks, structured in columns that represent the work status. Regarding the supervision process, the concept of a custom plan is introduced, which aims to take into account the preferred supervisory style of the student and teacher. As mentioned in the previous section, each supervisory style is defined by two components: structure and support. In Thesico, the structure component is based on two platform features: the assignments and the milestone meetings. The assignments are used to handle the thesis documentation completion process (intermediary and final versions), while the milestone meetings are oriented on specific project tasks, where the student presents the progress of the project. On the other hand, the support component is represented by the guidance meetings between the student and the teacher, which can be used for general discussions, providing feedback and organizational issues. A predefined supervision plan is proposed by the system for each of the four supervisory styles (Laissez-faire, Directorial, Pastoral, and Contractual), which can be further individualized by the teacher according to the specific needs of the students.

More specifically, the Thesico workflow is as follows. First of all, the administrator configures various system settings, such as the number of milestone meetings, the number of assignments and guidance meetings for each supervisory style, the penalty for delayed assignments, the weights used to compute the collaboration score (more details will be presented in the following subsection). Next, the administrator imports the student and teacher data from the SPA platform [2], which was previously used for matching students with supervisors and dynamically allocating the graduation projects.

Subsequently, the actual thesis development and supervision process starts. The teacher can customize the predefined supervision plan, schedule meetings, create assignments, add project tasks, grade assignments and milestone meetings as well as the final thesis. The student works on their project, submits assignments, and updates the tasks status on the Kanban board. Both the student and the teacher are asked to assess the usefulness of the guidance meetings by providing a rating after each such meeting, which will be further used for computing a collaboration score, as described in the following subsection.

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[3] https://en.wikipedia.org/wiki/kanban_board.

More details regarding the Thesico functionalities are presented in Sect. 4. With respect to implementation, the platform was built as a RESTful application with a client-server structure. The frontend was developed in TypeScript using the Vue.js framework[4]. The backend is based on a REST API implemented using the PHP programming language and the API Platform framework[5], which internally uses the ADR pattern (Action Domain Responder)[6].

3.2 Assessing the Student-Supervisor Collaboration

The Thesico system provides the possibility to evaluate the quality and progress of the supervision process by computing an *overall collaboration score* based on the following components: structure, support and user rating.

Firstly, the *structure score* aims to assess the completion rate for the two structure features: the assignments and the milestone meetings. The *assignments score* indicates whether the work was submitted on time by the student; for each assignment, the score is computed according to the following formula:

$$Sa_i = \begin{cases} 100, \textit{ if assignment i was turned in on time} \\ 100 - p * d, \textit{ if assignment i was turned in late} \\ 0, \textit{ if assignment i was not turned in} \end{cases}$$

where p represents the penalty for delayed assignments (per day) and d represents the number of days late (note that if the result is negative, i.e. the assignment was turned in very late, then the score is set to 0). An *average score for all the assignments* is subsequently computed as follows:

$$Sa = \frac{\sum_{i=1}^{n} Sa_i}{n}$$

The *milestone meetings score* measures the completion rate for the predefined milestone meetings, as follows:

$$Smm = \frac{\textit{number of completed milestone meetings}}{\textit{set number of milestone meetings that need to be completed}} * 100$$

Thus, the *structure score* ($Sstr$) is computed as the average of the two scores above (Sa and Smm).

Secondly, the *support score* ($Ssup$) measures the completion rate for the predefined guidance meetings, as follows:

$$Ssup = \frac{\textit{number of completed guidance meetings}}{\textit{set number of guidance meetings that need to be completed}} * 100$$

Thirdly, the *rating score* (Sr) is computed based on the ratings provided by the teacher and the student with respect to the perceived usefulness of the guidance meetings.

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[4] https://vuejs.org.

[5] https://api-platform.com.

[6] https://github.com/pmjones/adr.

Finally, the *overall collaboration score* (*Sc*) represents the weighted average of the three scores above:

$$Sc = Sstr * w\_str + Ssup * w\_sup + Sr * w\_r$$

where *w_str*, *w_sup* and *w_r* are the weights associated to each score (structure, support and rating score respectively), which can be configured by the administrator.

4 Illustrating Thesico Functionalities

As mentioned before, the Thesico platform has three user roles (administrator, teacher / supervisor and student / supervisee). In the following three subsections we present the perspective of each role respectively, illustrating the main functionalities provided by the system.

4.1 Administrator Perspective

The system administrator has the main role of retrieving data from the SPA platform (which was used in a previous step for allocating thesis projects based on student-teacher compatibility factors) and importing it into Thesico. In addition, the administrator is able to configure various system settings, based on the specific requirements of the university program:

- *General settings* – the upper limit for the number of milestone meetings and the penalty applied to late assignments
- *Supervisory styles settings* – the recommended number of assignments and guidance meetings for each supervisory style
- *Weight settings* – the predefined weights for the supervisor's ratings as well as for the structure, support and rating scores, used for computing the overall collaboration score.

4.2 Teacher Perspective

The teacher (supervisor) is provided with the following main functionalities in Thesico:

- *Dashboard* – a page used to view general information (the grades and the collaboration scores of the supervised students) and a calendar with the guidance and milestone meetings for all supervised projects. This functionality is presented in Fig. 1.
- *Student management* – module used to view, search and order the supervised students. For each student, the teacher can define the supervision plan, see the project description, provide a final grade for the thesis and access the project module.
- *Project statistics* – the teacher can see various details regarding each project, e.g.: percentage of completed guidance meetings / milestone meetings / assignments, collaboration scores, charts with the status of the project tasks (as depicted in Figs. 2 and 3).

- *Meetings calendar* – the teacher can schedule meetings (guidance or milestone), edit / cancel a meeting, mark it as missed or completed. Furthermore, if a milestone meeting is completed, the teacher can provide a grade (to assess the student's progress) and if a guidance meeting is completed the teacher can provide a rating (to assess the usefulness / satisfaction with the meeting).

Fig. 1. Thesico - Supervisor dashboard

- *Assignments calendar* – the teacher can create / edit / delete an assignment, view the documents uploaded by the student (if available) and grade a submitted assignment.
- *Project tasks / issues* – the teacher can access a page where they can view the tasks of the project using two different components: a table and a Kanban board. The issue types are taken from Jira[7] (e.g., Epic, Story, Task, Bug, and Subtask type); the issues

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[7] https://support.atlassian.com/jira-cloud-administration/docs/what-are-issue-types.

Fig. 2. Thesico – Project statistics: meetings and assignments status
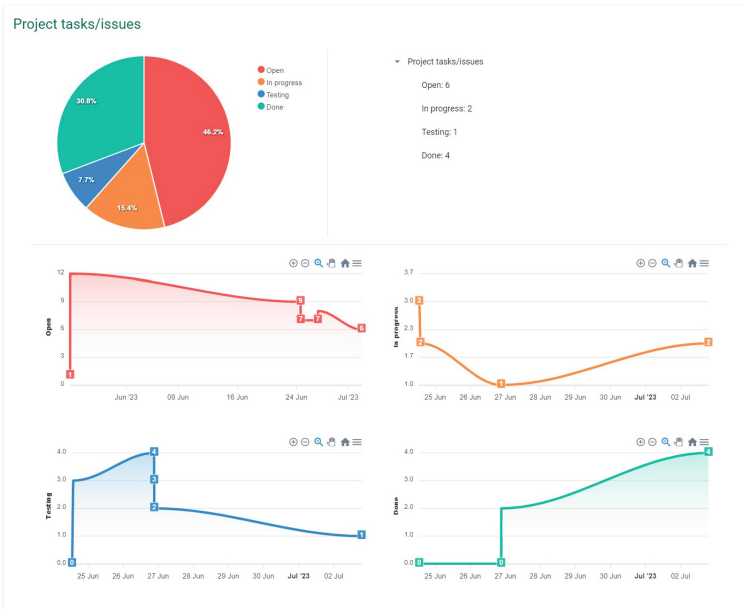

Fig. 3. Thesico – Project statistics: tasks status

that have the type set to Epic cannot have parent issues and are used to organize bigger pieces of work that need to be done. Thus, these items will not be displayed in the Kanban board but in a separate table and the user will be able to order and search them. The remaining types of issues will be displayed on the Kanban board for a better user experience when updating the statuses. In addition, the teacher can also access a dedicated page for each task, which contains the following data:

o General information about the task - title, description, related tasks.

o The status of the task - the issue type, the current status, the creation date, and the date when the last update was performed. The teacher can also edit the details of each task.

o The attachments component – which includes the documents that have been uploaded for that task (if any); the teacher can also add new attachments or delete them.

o A timeline component – which is used to show a history with the status updates that have been performed for the current task.

4.3 Student Perspective

The student (supervisee) is provided with the following main functionalities in Thesico:

- *Dashboard* – a page used to view the collaboration score and the meetings / assignments that are scheduled for the following week.
- *Project statistics* – the student can see various details regarding their project, including charts with completed meetings / assignments and tasks status (similar with the teacher perspective illustrated in Figs. 2 and 3).
- *Meetings calendar* – the student can view the meetings that are scheduled, together with various details, such as description, date, status ('Proposed', 'Completed', 'Missed'), grade (if provided by the teacher for a milestone meeting). Furthermore, the student can give a rating for a completed guidance meeting, in order to evaluate the usefulness / satisfaction with that meeting. This functionality is presented in Fig. 4.
- *Assignments calendar* – the student can see the assignments that have been created and for each assignment they can upload / remove files and check the grade provided by the teacher.
- *Project tasks / issues* – this module is very similar to the one presented for the teacher in the previous subsection. In addition to the actions that can be performed by the teacher, the student can also update the status of each task and order them using the Kanban board. A part of this functionality is illustrated in Fig. 5.
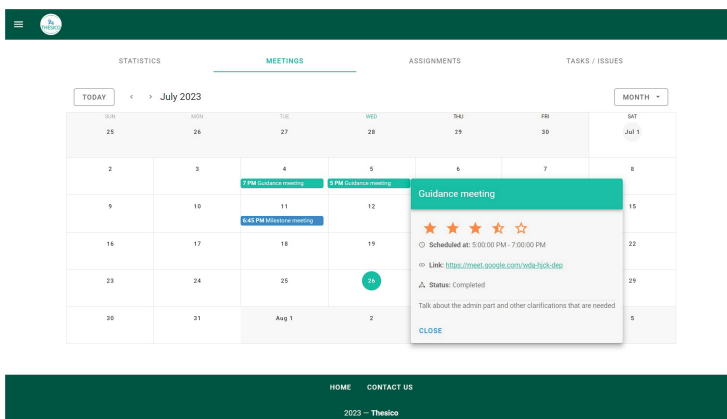

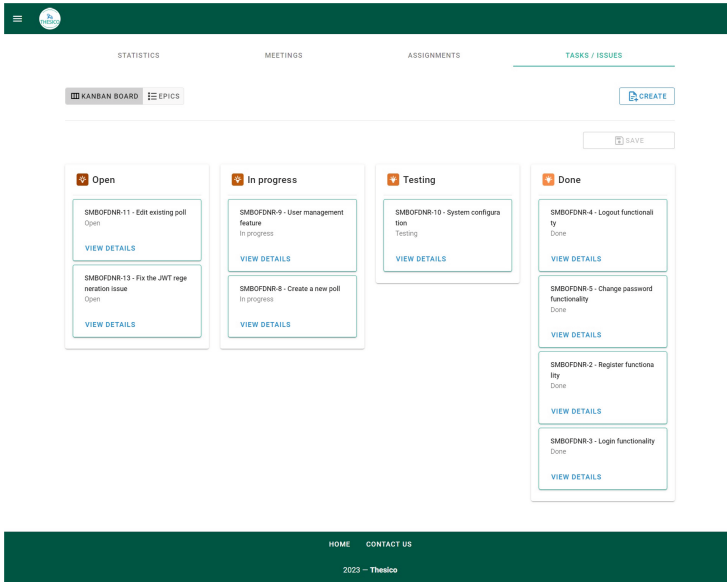**Fig. 4.** Thesico – Meetings calendar

Fig. 5. Thesico – Project tasks / issues (Kanban board)

5   Conclusion

We proposed an approach for managing the coordination process of a graduation project based on a personalized supervision plan, which takes into account the preferred supervisory style of the student and the teacher. We designed and implemented a dedicated platform, called Thesico, which provides support for the thesis supervision process. By means of the system, the teacher can schedule meetings, create and grade intermediary assignments, follow the progress of the project and visualize various statistics. The student can manage the project tasks and receive feedback and guidance from the teacher throughout the process.

As future work, the system could be extended by integrating the GitHub API[8] to gather more information about the student's activity based on the performed commits on GitHub. The communication and collaboration between the student and the teacher could also be further supported by implementing a chat, as well as a wiki page for project related resources and guidelines. We also aim to use the Thesico system in real world settings, in order to assess the usefulness of the personalized supervisory plan and gauge students' and teachers' satisfaction with the platform.

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