

An alternative supervision model for postgraduate projects

A course-specific approach

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ABSTRACT

Most postgraduate students are required to undertake an individual project under the guidance of an academic supervisor. The increasing population of postgraduate students ([1]) introduces challenges under traditional supervision models (i.e. one topic and one supervisor per student), e.g. managing supervisors' workload, topic allocation by student preference, and inconsistencies within cohorts. Departments/Schools face similar challenges as they introduce new courses to meet educational and market needs. This paper discusses the introduction of an alternative supervision model. On a per-course basis, this model relies on: i) small supervision teams, and ii) fewer high-level topics (i.e. instead of one detailed topic per student). Both are proportional to the cohort size to ensure the scalability of the model is maintained with increasing student numbers. The paper concludes with the results of a preliminary study on the application of the model to one postgraduate course at a UK Computer Science Department.

CCS CONCEPTS

• **Social and professional topics;** • **Computing education;**

KEYWORDS

Postgraduate project supervision, Project supervision models, Postgraduate conversion courses, Software development courses

ACM Reference Format:

Konstantinos Liaskos. 2023. An alternative supervision model for postgraduate projects: A course-specific approach. In *Computing Education Practice (CEP '23)*, January 06, 2023, Durham, United Kingdom. ACM, New York, NY, USA, 4 pages. <https://doi.org/10.1145/3573260.3573268>

1 INTRODUCTION & DESCRIPTION OF THE PROPOSED MODEL - WHAT IS IT?

This paper presents an alternative supervision model for postgraduate projects and discusses our experience from the application of the model to one MSc conversion course (Software development) at the Department of Computer & Information Sciences (CIS), University of Strathclyde, Glasgow. The focus of the paper is on the changes applied to the Department's existing/previous (i.e. traditional) supervision model from a practical perspective: supervision teams,

prerequisites, marking schemes, supervision meetings, dissertation size and structure, management of the supervision process, monitoring student progress, student feedback, and topic suggestion, selection, and allocation. Furthermore, the paper discusses the scalability of the proposed supervision model under changing circumstances: the pandemic and the course cohort size.

1.1 Previous/existing supervision model - Why are we doing it?

In the context of the Department's strategy to expand its postgraduate portfolio, 2018/19 was a pivotal academic year. Two new conversion MSc courses (in Software development and AI) were introduced, with a prediction for an increase of the overall postgraduate population by 100 students within the upcoming two academic years.

In the first year (2018/19), the Department followed its existing/traditional supervision model for these two new courses. The key characteristics of this model are as follows:

- *Overall management of the supervision process*: done centrally at Departmental level by the MSc dissertation coordinator. This person is also in charge of managing a dedicated webpage via the University's Virtual Learning Environment (VLE) where postgraduate students can access relevant resources, view announcements, and submit their MSc dissertations.

- *Marking schemes*: five marking schemes are available depending on the project type, e.g. experimental, extended review etc.

- *Dissertation size and structure*: 18000 words (+/- 10%), with the structure depending on the aforementioned marking schemes. Regardless of the project type, students are expected to include an extended literature review in their dissertation.

- *Supervision teams*: not applicable, as students can be supervised by any academic who has proposed an MSc project topic.

- *Topic suggestion/selection/allocation*: managed centrally at Departmental level by the MSc dissertation coordinator. Perspective supervisors are expected to suggest unique project topics. The number depends on each academic's workload model, but a typical expectation is between six to eight topics per academic supervisor. Students are then asked to submit six choices from the list of topics, ranked by preference. Finally, the project coordinator completes the topic allocation based on the student choices. However, there is no guarantee that students will be allocated to their top (or even any of their top) choices.

- *Supervision meetings*: each student is entitled to a total of five hours of supervision. These are individual and face-to-face (or remote during the pandemic).

- *Student feedback*: each student is entitled to detailed feedback on a single chapter, and high-level feedback on a full draft of their dissertation/thesis.

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CEP '23, January 06, 2023, Durham, United Kingdom

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ACM ISBN 978-1-4503-9821-3/23/01...\$15.00

<https://doi.org/10.1145/3573260.3573268>

- *Monitoring student progress*: done during the supervision meetings.

- *Pre-selection information*: each supervisor has the flexibility to choose how they provide information to the students interested in their proposed topics, e.g. arrange one-to-one meetings, schedule office hours for students to drop in and ask questions etc.

1.2 Teaching context - Where does it fit?

This Section focuses on one of the aforementioned new MSc courses, in particular the MSc in Software development course. In its first year of delivery, the Department met its recruitment goal, with a cohort size of twenty students. In fact, this was the most successful launch of a new course in the Department's history. The existing project supervision model (as described in 1.1) was utilized for this cohort. The only adjustment was the requirement that the course director was expected to supervise ten students from this cohort to achieve some level of consistency at cohort level. The remaining students were supervised by other academics without any restrictions as to whether a supervisor should be part of the course's teaching team.

Upon completion of the academic year, the existing supervision model was reviewed in the context of the course, and the following issues were identified:

- *Prerequisites*: the existing supervision model relies on "Research methods", a taught module delivered in the second semester. This module covers research methodologies and gives students the opportunity to start working on their literature review prior to the official start of the MSc project period. However, this module is not part of curriculum of the conversion courses.

- *Project types and dissertation size and structure*: our conversion students struggled a lot under the current supervision model due to the lack of a formal introduction to research methods. In particular, the expectation to produce a thesis of 18000 words (+/- 10%) that includes an extended literature review and a detailed description of their methodology was unrealistic. Additionally, some project types (e.g. experimental) proved to be very challenging for students lacking the theoretical background on research methodologies. Finally, some of the available project types were not relevant to the course objectives. Programming is core for a software development course, but students working - for example - on a non-development project should spend less time (if any) on programming to focus on other aspects of their project (e.g. extended literature review, experimental design etc.).

- *Consistency and expectations from students*: students appeared to be more comfortable when supervised by academics who were part of the course teaching team, i.e. they knew their supervisor prior to project selection. In some cases, this led to a situation that students tried to choose a supervisor, instead of a project topic. Finally, it was also reported that some supervisors had unrealistic expectations from the students due to the fact that they were not fully aware of the technical and/or academic skills (e.g. programming level, research skills etc.) of the conversion cohort; hence, students were treated similarly to those studying on non-conversion courses.

2 THE PROPOSED ALTERNATIVE MODEL

The issues/challenges discussed in 1.1.1 motivated a few changes to the existing project supervision model to address those issues in the upcoming academic year. Furthermore, this was required due to the fact that the course size doubled in 2019/20 (from twenty to forty students); hence, there was a need for a revised supervision model in the context of a course that was becoming increasingly popular so that things remain realistic for both students and supervisors. A team consisting of the postgraduate director, the MSc project coordinator, and the course director oversaw designing and implementing the new model. Initially, the key changes for the MSc in Software development course in relation to the characteristics discussed in 1.1 were as follows:

- *Overall management of the supervision process*: no changes applied; hence, this is still done centrally at Departmental level by the MSc dissertation coordinator.

- *Marking schemes*: changed from five project types to one, i.e. application-based projects. This resulted in producing a new marking scheme, which is dedicated to the course and shifts the focus to: development and the overall software engineering approach for the full project lifecycle.

- *Dissertation size and structure*: changed from 18000 words (+/- 10%) to 8000 words (+/- 10%). The structure of the dissertation/thesis is aligned with the aforementioned marking scheme. The latter includes a marking rubric that clearly explains the expectations for each marking criterion.

- *Supervision teams*: a dedicated supervision team was introduced, led by the course director. Academics who teach on the course were also part of the team. Each supervisor is expected to supervise around twenty students.

- *Topic suggestion/selection/allocation*: this is still managed centrally at Departmental level by the MSc dissertation coordinator. However, one core change was applied: academics are expected to suggest high-level, generic project topics instead of detailed, unique ones. Only academics that are part of the dedicated supervision team are expected to propose high-level topics, with an expectation of two/three topics per academic supervisor. Students are then asked to submit three choices from the list of topics, ranked by preference. Finally, the project coordinator completes the topic allocation based on the student choices. There is still no guarantee that students will be allocated to their top (or even any of their top) choices, but in practice the new model makes it easier to allocate top choices to students. It has to be stressed that the projects are still conducted on an individual basis (i.e. these are not group projects), which is achieved by allowing students to make further decisions under their allocated high-level topic; hence, the final submission must be unique.

- *Supervision meetings*: another core change was moving from individual and face-to-face (or remote during the pandemic) meetings to weekly, cohort-wide, lab-based, drop-in meetings on a per supervision basis. Each supervisor is entitled to a total of two hours per week for all students under their supervision. Supervisors are given the flexibility to use those two hours as they feel it's best for their students, e.g. meet the students individually or in groups on a per high-level topic basis.

- *Student feedback*: no changes applied; hence, each student is still entitled to detailed feedback on a single chapter, and high-level feedback on a full draft of their dissertation/thesis.

- *Monitoring student progress*: no changes applied; hence, done during the supervision meetings.

- *Pre-selection information*: each supervisor is expected to arrange information sessions for each high-level prior to the selection process.

- *Prerequisites*: it was decided that the aforementioned "Research methods" module should not be added to the course curriculum. Instead, the assessment plan of an existing semester two Software Engineering module was amended to include an individual assignment on each student's allocated topic. This change gives students the opportunity to start working on their topic prior to the official start of the MSc project period, with the focus being on planning the development and software engineering approach they wish to follow instead of research methodologies and/or literature review, which is the expectation for non-conversion students attending "Research methods" under the existing model.

2.1 Amendments due to the pandemic

The new supervision model was never applied in its initial format due to the need to move to remote learning when the pandemic started in 2019/20. The only aspect that was affected was the format of the supervision meetings. These had to take place online via Zoom instead of on-campus in the labs, with no other changes to the approach described above.

2.2 Amendments after the first year

The supervision team reviewed the new supervision model after its first year and concluded that there were some inconsistencies around monitoring students progress on a per-supervisor basis, which in turn caused confusion to the students across the cohort. As a result, a further change was applied by introducing a set of rules in terms of expectations for satisfactory progress:

- *Monitoring student progress*: students are expected to attend at least 50% of the weekly supervision meetings over the formal project period. Additionally, students are expected to submit brief progress reports to their supervisor every four weeks. These reports include: progress since the previous report (i.e. achieved goals, issues resolved, and unresolved/ongoing issues) and a high-level plan for the upcoming four weeks. At the start of the formal project period, it is made clear to the students that attendance and the progress reports will be used as evidence to monitor their progress and assess their overall performance.

3 EFFECTIVENESS OF THE NEW MODEL - DOES IT WORK?

This Section discusses the initial findings after the adoption of the new supervision model in the context of the MSc in Software development course. These findings are based on both qualitative and quantitative data from both the students' and the Department's perspective.

3.1 Student performance

One of the main concerns about the new model was whether its introduction would negatively affect student performance, i.e. MSc project results. Below are some basic descriptive statistics of student marks under the two models, with the focus being on the two academic years that the transition took place:

2018/19: under the existing /previous model

- Cohort size: 20 students
- Median: 61%
- Minimum: 50%
- Max: 90%
- Mean: ~68.8%
- Std. Dev.: ~9.9

2019/20: under the new model

- Cohort size: 40 students
- Median: 71%
- Minimum: 4%
- Max: 85%
- Mean: ~66.6%
- Std. Dev.: ~16.2

The statistics suggest there was a tiny drop of the mean project mark and a higher standard deviation under the new model, which can be attributed to the wider diversity of the 2019/20 cohort caused by the fact that the cohort size was doubled and the transition to remote learning due to the pandemic. However, there was not any significant changes in terms of student performance that would suggest that the new model did not scale well under these different circumstances.

3.2 Staff workload

One of the main challenges for the Department has been the management of the workload for academics expected to supervise post-graduate projects. Under the existing supervision model, each academic is expected to spend 24 hours per student, plus propose one unique, detailed topic per student. The overall increase of the post-graduate student population along with the introduction of two new popular courses introduced further challenges. Under the new model, each supervisor is expected to spend 12 hours per student, and suggest only two/three high-level topics. Below is an overview of the effect the new model had on staff workload management per academic year:

2018/19: under the existing /previous model

- Cohort size: 20 students
- Total hours: $20 \times 24 = 480$ hours
- Number of supervisors: not fixed; could be as many as the cohort size
- Total number of topics: 20; must be unique

2019/20: under the new model

- Cohort size: 40 students
- Total hours: $40 \times 12 = 480$ hours; would have been 960 hours under the old model; 50% decrease
- Number of supervisors: 2; 20 students per supervisor; it could be as many as 40 under the old model
- Total number of topics: 6; 3 per supervisor; it would have been 40 under the old model

2020/21: under the new model

- Cohort size: 55 students
- Total hours: $55 \times 12 = 660$ hours; would have been 1320 hours under the old model; 50% decrease
- Number of supervisors: 3; increase by 1 compared to 2019/20; it could be as many as 55 under the old model
- Total number of topics: 9; 3 per supervisor; increased by 3 compared to 2019/20; it would have been 55 under the old model
- 2021/22: under the new model
- Cohort size: 64 students
- Total hours: $54 \times 12 = 768$ hours; would have been 1536 hours under the old model; 50% decrease
- Number of supervisors: 3; no changes compared to 2020/21; it could be as many as 64 under the old model
- Total number of topics: 9; no changes compared to 2020/21; it would have been 64 under the old model

3.3 Student experience

Qualitative observations over the three years under the new supervision model have been positive. Below are some highlights:

- *Decision making, creativity and satisfaction*: the introduction of high-level project topics allows students to make further decisions and use their creativity within their allocated topic, which contributes to higher student satisfaction.
- *Consistency*: this is one of the major benefits under the new model. This is achieved at various levels, for example: the small, dedicated supervision team increases consistency at cohort level, and at course level as previous good theses can be used as samples for future cohorts. Additionally, the course-specific marking scheme increases consistency in terms of student expectations across different supervisors. In the cases that supervision meetings are organized on a per-topic basis, further consistency is achieved by sharing the same information with all students working on the same high-level topic. Finally, the small, dedicated supervision team makes it possible for the vast majority of students to be allocated to their top topic choice, which in turn improves the overall student experience and satisfaction.
- *Course objectives*: the reduced thesis size in conjunction with the restriction to a single project type (i.e. application-based) allows students to fully meet the course objectives, as 90% of the overall project marking criteria focuses on the overall software engineering approach from requirements gathering to testing and evaluation, with the 50% being specific to programming that is core to this course.

4 CONCLUSIONS

4.1 Inspiration - Who else has done this?

The adoption of the alternative supervision model was motivated by an internal review of the existing Departmental model in the context of the new conversion courses; hence, it was not based on external ideas. However, the design of the dedicated marking scheme and the rubric was based on both internal resources and external samples ([2], [3]) to ensure that the outcome aligns with national and international standards.

4.2 Further development - What will we do next?

At this stage, the format of the new model has been finalized after the iterative fine-tuning, and it appears to scale well for the conversion courses. The University is currently reverting back to on-campus delivery; hence, supervision meetings are expected to take place as face-to-face, drop-in sessions, which was the initial plan. One further development that is currently under investigation is for the overall management (i.e. suggestion and allocation of topics, announcements, and submissions) to take place at course level. This would further increase consistency across the cohort. At Departmental level, the success of the new model has initiated a discussion for the application of the model to other non-conversion postgraduate courses.

4.3 Usefulness - Why are we telling you this?

The purpose of this paper is to share with the CS community the experience of adopting an alternative project supervision model, which has been successful for the CIS Department at the University of Strathclyde, Glasgow in: keeping the workload for academics realistic as the overall postgraduate population increases and the Department expands, and also enhancing student experience and satisfaction by introducing an approach that is tailored to the objectives of a particular course. Additionally, this paper can motivate a comparison with similar approaches [4], and a further discussion within the CS community in terms of how such practical approaches can be related to wider theories and frameworks in the area of project supervision models [5].

ACKNOWLEDGMENTS

My thanks to my colleagues at CIS, University of Strathclyde: Professor Ian Ruthven for permitting the release of information relating to the Department's supervision models, and Dr Martin Halvey and Dr Clemens Kupke for overseeing the implementation of the new supervision model.

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