The Perceived Effects of Introducing Coaching on the Development of Student's Soft Skills Managing Software Quality

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Abstract

Technical abilities (also known as hard skills) are just as crucial as soft skills (such as communication, cooperation, teamwork, etc.) in attaining professional success. Therefore it is important to pay much attention to soft skills when developing the curriculum of engineering educations. Many elements can have a direct or indirect impact on students' soft skills, including course topic, course module (i.e., laboratories, seminars, etc.), the medium of instruction, and learning activities. Many academics have investigated the development of soft skills in a variety of disciplines, including engineering, science, and business. The purpose of this study is to assess the perceived impact of coaching on the development of soft skills in MS and BS engineering students. During four planned sessions over a six-month period, MS students acted as coachers, while BS students received coaching from MS students. After each coaching session, all students were asked to complete a survey to evaluate their perception for how their soft skills had developed. The results of the perceived effects of introducing coaching activities are presented in this article. This article is a first step, in the series of our investigation, in identifying the students' perceptions about the development of soft skills. According to the survey, the MS engineering students who were the coachers had perceived to improve most of their soft skills. However, in the perception of BS students, their soft skills did not improve as compared to MS students, prompting us to conduct additional research in the future to discover what hampered the growth of BS students' soft skills as well as how MS students' soft skills were enhanced.

Keywords

coaching, soft skills, software engineering curriculum, coaching effect, soft skills development, software engineering method, online teaching method

1. Introduction

The major goal of academic courses is to address hard skills to meet market demands. Soft skills (i.e., social, behavioral, and interpersonal) are not adequately covered in academic courses, particularly in software engineering education [1, 2]. A superior performer is a professional who possesses both technical and behavioral skills [3]. It wasn't until 2009, at the *'Leuven Communiqu'*, that European Union Ministries of Education introduced three new aims to higher education (i.e., social component, student employability, and life-long learning). In addition, IEEE / ACM [4] and SWEBOK [5] have proposed incorporating various soft skills into the software engineering curriculum. Soft skills may be developed in a variety of methods, including stand-alone projects [3], support programs [3], or introducing specific courses on engineering professionalism [6].

Spencer et. al [3] mentioned *"formal activities"* as one of the ways to develop soft skills, thus motivating this study to use *"coaching activities"* to investigate the effects on development of soft skills. Stettina et. al [7] concluded that *"coaching in teams is shorter in nature and more appealing to the students"*.

The perceived impact of introducing coaching activities on the development of soft skills in Master (MS) and BSc (BS) computer engineering students is evaluated in this study. The software quality course is taken by MS students (i.e. seniors) to learn about how to improve software quality. Throughout the course, MS students coach BS students who are working on a real-time software project. MS students coach BS students to discuss the improvement of the software being developed through coaching meetings. We conducted a survey with MS and BS students after each meeting to assess the perceived impact of the session on the development of soft skills. The survey is designed to answer the following research questions:

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RQ1: How do MS students perceive the effects of conducting coaching activities on their soft skills development?
RQ2: How do BS students perceive the effect of being coached on their soft skills development?

The ten soft skills that we focus on in the study are: Collaboration, Communication, Creative thinking, Decision making, Giving clear feedback, Problem solving, Presentation, Storytelling, Leadership, and Desire to learn. More information about study context, detailed soft skills, data collection, and analysis is provided in Section 2.

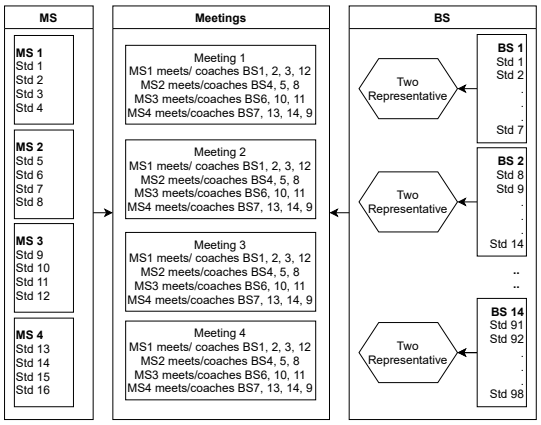

Figure 1: Study Settings Presenting MS and BS Groups and Meeting

2. Method

2.1. Study Context & Settings

This research examines two courses taught at Linköping University: *Software Quality (6 credits - MS)* and *Software Engineering - Bachelor Project (15 credits - BS)*. The MS students learn about the software quality concepts during the course through lectures, seminars, and labs. The BS students work on bachelor projects to develop software products for external real-time clients from the academia or industry with real requirements. MS students are responsible for coaching BS students on how to improve the quality of the software system they are creating for the clients. The BS students had some preparation. They have about 1 credit in software quality and about 1 credit in coaching.

As shown in Figure 1, the 16 MS students were separated into four groups, MS 1 through MS 4. Similarly, 98 students BS students were split into 14 groups called BS 1-14. Each MS group coached three to four BS groups as shown in Figure 1. There were four pre-arranged sessions (each lasting 90 minutes) in which the BS group assigned two representatives to meet with the MS group. These two BS group representatives were either team leaders or quality engineers. These two representatives will receive coaching on the software product's quality characteristics and will subsequently teach their team members. Each meeting was split into two 45-minute periods, allowing MS students to meet with only two groups at a time, avoiding overcrowding and ensuring adequate attention. The meetings were conducted digitally.

Students in the MS and BS programs received explicit instructions on the learning goals of these scheduled sessions. These instructions are available online[1]. All students were informed about the meeting's preparations, what to focus on/discuss during the meeting, and the meeting's conclusions. During each meeting, three teachers were present to answer questions and monitor the dynamics of the group.

2.2. Soft Skills

This chapter outlines the list of soft skills which were assessed after each meeting in the survey for MS and BS students. The following ten soft skills have been identified as essential in the working life of a software engineer by studies [1, 8, 9]

2.2.1. Collaboration

Collaboration skills enable students to work effectively with others to reach a common goal. They include open communication, active listening, admitting responsibility for mistakes, and appreciating your teammates' diversity.

2.2.2. Communication

It enable students to communicate themselves clearly and convincingly in both written and oral form. In addition, communication skills require attentiveness and responsive listeners.

2.2.3. Creative thinking

It refers to think critically, creatively, innovatively, and analytically, as well as applying these abilities to a variety of situations. Creative thinking refers

[1] https://www.ida.liu.se/ TDDE46/coaching/TDDD96-TDDE46.pdf

the ability to detect and appraise complex circumstances, as well as make acceptable judgments.

2.2.4. Decision making

It is about making critical choices concerning the progress of the software project.In addition, making judgments on client deliverables and teamwork.

2.2.5. Giving clear feedback

Giving clear feedback entails a number of factors: it must be timely, consistent, actionable, substantial, and offer ideas if necessary.

2.2.6. Problem solving

It helps in identifying the source of an issue and devise a feasible solution. This skill is intended to deal with difficult, unexpected, or complicated issues that come up during or after meetings.

2.2.7. Presentation

This skill refers about focusing on body language, speaking performance, and visual display when giving an oral presentation.

2.2.8. Storytelling

The storytelling ability engages the audience. It is about creating a compelling vision of where we are and where we want to go, attracting others to join us on our journey in a manner that pure facts and logic can't.

2.2.9. Leadership

To mimic the real working environment, activities are led at each moment by a professionals in the position of leader. This skill refers to arranging, planning, and coordinating the tasks required to meet specified goal. The leader is also in charge of providing the deliverable associated with each activity.

2.2.10. Desire to learn

This skill refers to demonstrating the desire to learn through preparation before coming to meeting, learning new technologies that can improve the quality of the software product, and ask questions during the meeting.

2.3. Survey Details & Participants

An online survey was conducted by each student after each meeting session with MS and BS students. The survey was completed by 44 students in age between 22 and 25 years: 16 MS students (4 females and 12 males) and 28 BS students (8 females and 20 males). During the course there was four meeting resulting in a total of 164 replies. The survey's questions are listed below.

Q1: What is your course code?

Q2: What is your BS project/ MS group number?

Q3: You are supposed to meet four times during the course for coaching meetings. What meeting number is this?

Q4: How many hours did you spend to prepare this meeting?

Q5: Describe a challenge faced during the meeting in simple words?

Q6: Rate the impact of coaching on your soft skills on Likert Scale (Improved, Slightly Improved, Unchanged, Slightly Worse, Worse)

- [S1:] Collaboration
- [S2:] Communication
- [S3:] Creative thinking
- [S4:] Decision making
- [S5:] Giving clear feedback
- [S6:] Problem solving
- [S7:] Presentation
- [S8:] Storytelling
- [S9:] Leadership
- [S10:] Desire to learn

3. Results

The answers to the research questions are presented in this section. The findings are given with regard to each soft skill and the perceived influence of coaching on it to enhance readability.

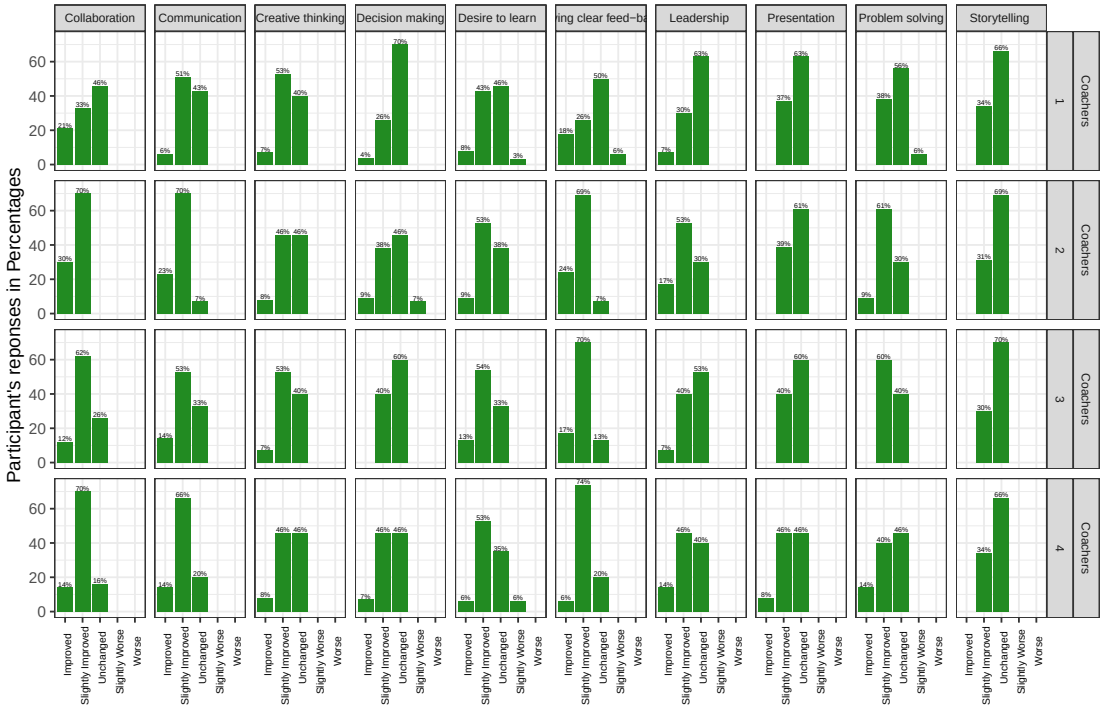

Figure 2: The perceived effect of coaching activities on the development of soft skills on MS students during meetings

3.1. Perceived Coaching Impact on Soft Skills of MS/BS students - RQ 1 & 2

3.1.1. Collaboration

MS students' perceived that their collaboration skills have improved as a result of coaching activities conducted within teams as well as with BS students, as illustrated in Figure 2. During the first meeting, 46% of students thought it was *'unchanged'* and as time passed (i.e., during the next three meetings), students felt it was *'slightly improving'* (i.e., approximately 70%). We can also observe that towards the end of the coaching activities, just 16% percent of MS students mentioned that collaboration had remained 'unchanged'– a substantial decrease from 46% percent at the start as shown in Figure 2. According to the survey results, coaching activities are perceived to have improved MS students' cooperation skills. BS students, on the other hand, consistently perceived their collaboration skills as *'unchanged'* throughout the coaching sessions, keeping a score of about 68% as shown in Figure 3. Although some students' perceived that their collaboration skills were *'slightly improved'*, but this is a small percentage as compared to those whose skills were *'unchanged'*. Unfortunately, at the first meeting, 6% percent of BS students rated their collaboration skills as *slightly worse'*. We speculate that MS students were rigorously trained for the coaching activities and upcoming activities by the instructors during lectures, seminars, and labs. MS students have planned these coaching meetings well in advance, thus leading to improved collaborations. On the other hand, BS students did not dedicate enough time before coming to the meetings mentioning it as a challenge (i.e., *'time for preparation'*) in Figure 4. Although we encouraged students to attend after the allocated hour, it was highlighted as one of the challenges in getting the most out of the meeting. These findings can be supplemented with a response to a fifth question concerning specific challenges encountered by the students throughout the meeting. As shown in Figure 4, the word *'Time'* repeated a lot as in *'time was short'* or *'little time'*. Unfortunately, we do not know if by time, they mean preparation time or meeting time.

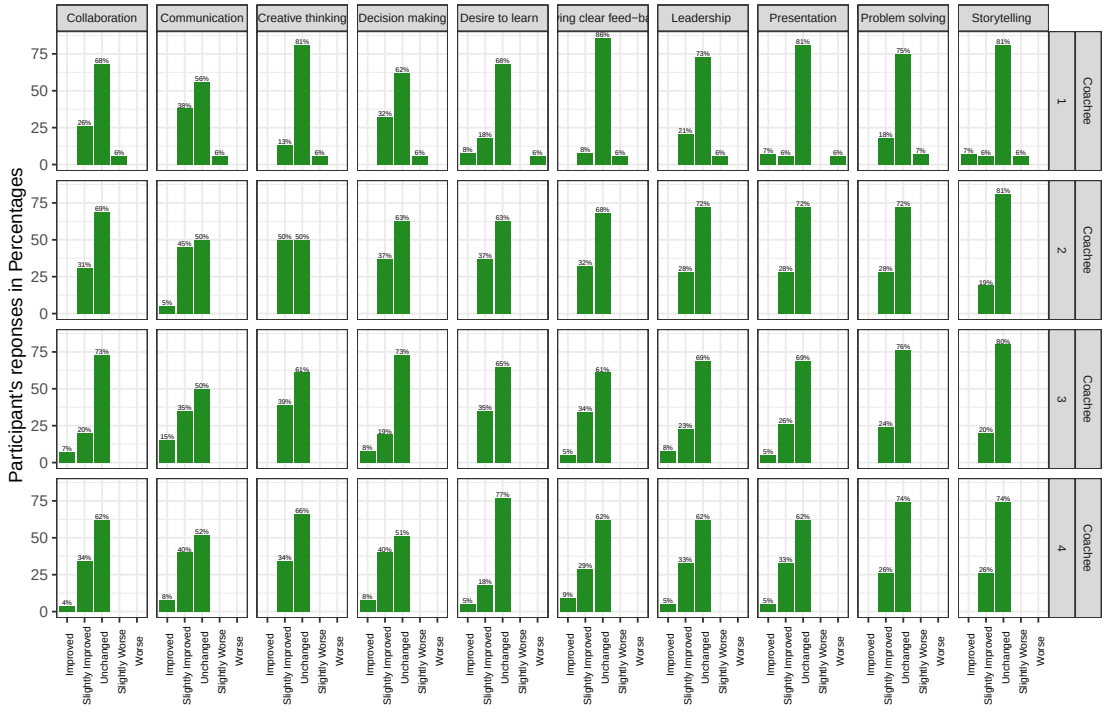

Figure 3: The perceived effect of receiving coaching on the development of soft skills on BS students during meetings

3.1.2. Communication

Many MS students have perceived their communication skills either *'improved'* or *'slightly improved'* during coaching sessions. Between session 1 and 4, students who considered it *'unchanged'* were dropped from 43% to 20%. Almost half of the students perceived their communication skill either *'improved'* or *'slightly improved'*. However, The similar percentage of the BS students felt that their communication skill is *''unchanged'* during or after coaching session. This trend is similar to what we observed with the collaboration skill. 6% students, similar to collaboration skill, considered it *'slightly worst'* during the first meeting. We observed a similar ratio 60:40 within BS students (i.e., Figure 3) between *'slightly improved'* and *'unchanged'*.

3.1.3. Creative thinking

Student's opinion was divided on creative thinking skill as we can see in Figure 2 that MS students ranging between 40%-46% perceived it as *'unchanged'*. Similar percentage of students perceived it *'slightly proved'*. One of the perceived reason is that we have not provided enough freedom to students to improve creating thinking by providing them a complete and detailed agenda[2]. One the contrary, in the perception of BS students, the percentage was decreased from meeting 1 (81%) to meeting 4 (66%) as shown in Figure 3.

3.1.4. Decision making

Decision making ability of MS students were perceived to be increased between coaching sessions from 30% (i.e., combining *'slightly improved'* and *'improved'*) to 53%. We can clearly see in Figure 2 that students who felt their decision making ability as *'unchanged'* were dropped from 70% to 46% between meeting 1 and 4. Decision making ability of BS students were also perceive to be improved little from 32% in meeting 1 to 48% in meeting 4, while maintaining a same percentage of approximately 57% with *'unchanged'*. MS and BS students were given several opportunity to make decision on meeting dates, agendas, topic matter, and deliverables, which influenced their decision-making abilities.

[2]https://www.ida.liu.se/ TDDE46/coaching/TDDD96-TDDE46.pdf

3.1.5. Desire to learn

MS students perceived coaching a factor to increase their desire to learn as show in Figure 2 improving the percentage from 43% to 53% considering it *'slightly improved'*. For BS students, this is the skill where more students felt it *'unchanged'* during all coaching sessions increasing the percentage from 68% (i.e., meeting 1) to 77% (i.e., meeting 4).

3.1.6. Giving clear feedback

MS students perceived an improvement with respect to giving clear feedback. 74% MS students felt improvement in giving feedback during the last session as compared to what they felt in the first meeting (i.e., 26% for *'slightly improved'* and 18% for *'improved'*). During the first meeting, 6% of MS students considered it *'slightly worse'* but it was perceived to be improved by the end of all coaching sessions. Similar positive trend can be observed with BS students (i.e., Figure 3) where 86% mentioned it as *'unchanged'* but by the end of last session, the percentage dropped to 62% showing a little improvement. This is to be anticipated, given that MS students were constantly reviewing BS's deliveries and offering comments to help the procedures and products.

3.1.7. Leadership

MS students' leadership abilities were perceived to be strengthened as a result of coaching exercises. 63% students perceived it as *'unchanged'* in meeting 1 but the percentage dropped to 40% in meeting 4. More students felt that their leadership skills was improving by the passage of time. Most of the BS students were consistent in perceiving their leadership skill as *'unchanged'* (i.e., around 70% during all sessions). Coaching had relatively little impact, in the perception of BS students, on their leadership abilities.

3.1.8. Presentation

In the perception of MS students, coaching did not have an impact on improving the presentations skills. By the end of coaching sessions, it is only 16 %/ 17% students who either felt that their presentation skills are improved ((i.e., 30% in meeting 1 to 46% in meeting 4) or stayed *'unchanged'* (i.e., 63% in meeting 1 to 46% in meeting 4). MS student's presentation skills were perceived to be improved through coaching activities. Following a similar patter in other skills, a large parentage of BS students did not feel any change in their presentation skills during the coaching activities.

3.1.9. Problem solving

Problem solving skills were perceived to be improved in MS students through coaching activities. Starting with 38% students during meeting 1, the percentage reached 61% (meeting 2 -3) and 54% (combined score of improved and slightly improved). 6% of those MS students who felt it *'slightly worse'* changed their opinion after few coaching sessions. Only 8% BS students felt it as *'slightly improved'* whereas approximately 74% BS students considered it *'unchanged'*.

3.1.10. Storytelling

We can observe a consistent pattern in Figure 2 where around 60-70% students perceived it *'unchanged'* during all meetings whereas 30-34% perceived it *'slightly improved'*. Similar pattern was observed with BS students where 74-80% students felt it *'unchanged'*.

Answer to RQ1 & 2: Coaching activities were perceived to enhanced eight out of ten soft skills among MS students except for creative thinking and story telling, which were perceived to be decreased slightly. As previously stated, the rationale was that by giving specific meeting agendas and prospective deliverable, they were unintentionally restricting their creative thinking and story telling abilities.

Receiving coaching, on the other hand, were perceived to have no substantial influence on the development of soft skills in BS students. For a greater percentage of BS students, the majority of soft skills were perceived to remained constant.

4. Discussion

At the beginning of our research, we believed that coaching activities had an equivalent influence in the perception of MS and BS students. Surprisingly, the majority of soft skills in the perception of BS students remained unchanged. During coaching sessions, however, MS students perceived these skills to be improved (i.e., aggregated score of *"improved'* and *'slightly improved'*). We plan to conduct interviews, as part of future work, with BS and MS students to learn why their soft skills were *'unchanged'* or, how they are improved. We speculate

Figure 4: Word map about the challenges faced by the students during coaching meetings

that MS students receive a weighted coaching module in the course that pushes them to prepare, study, and produce the results, thus developing their soft skills. The BS students knew that they would be requested to write about the cooperation in the common part of the report. However, BS students discovered that this was not just words on a paper; they had to redo their reports. There were no credits for coaching part for BS students.

There are several factors that have an impact on students' soft skills, either enhancing or being unchanged. For example, prior to the first coaching meeting, BS students were unfamiliar with the idea of software quality. Preparing for the meeting adds more effort as well as new concepts that take time, effort, and attention. On the contrary, each idea utilized in the coaching meeting was fully addressed with MS students throughout lectures, laboratories, and seminars. According to our observations, The difference in the perception of MS and BS is due to do's and don'ts of the coaching. During sessions, MS students began acting as instructors, clarifying topics and giving BS students with clear and sufficient solutions. Similarly, BS students expected MS students to do their duties. On many occasions, we need to explain to BS and MS students about what coaching is and what should be the expectations.

5. Related Work

Many researchers have investigated the activities that can impact the development of soft skills in engineering. Morales et al. described their experiences over a five-year period of carrying out activities in topics for the development of soft skills in the field of software engineering [1]. They highlighted the best practices that have enabled them to include soft skills into new degree programmes suited to Bologna. They employed Project Based Learning to assist students in acquiring the essential soft skills. Ahmad et al. [9] concluded that soft skills are in demand in the software sector, according to their survey. They demonstrated a misunderstanding of the importance of soft skills in an employee's professional competence and performance. Another study [10] conducted research aimed at understanding the students' problems when required to develop soft skills. They concluded that most of the students are aware of the importance of soft skills and understand how to improve them.

6. Validity Threats

An internal validity threat could be that participants did not understand the questions and its purpose correctly. We tried to reduce this by explaining all questions to all students during all sessions. The main purpose of addressing construct validity is to capture as much as possible of the available information to avoid all sorts of bias. We have eliminated construct validity threat completely by conducting survey with different participants. We have also eliminated the researchers' bias by involving all 3 researchers in the design of the questionnaire and protocol.

7. Future Work

We want to conduct one-on-one interviews with participants to learn more about their experiences, difficulties, and expectations. Furthermore, we intend to investigate why some of the soft skills were perceived to be *'unchanged'*. If soft skills were perceived to be enhanced, identify how and why.

8. Conclusion

Soft skills must be developed among university graduates in the same way that hard skills were developed through a number of various courses and activities. Coaching activities are crucial and have a big impact on soft skill development. We used MS and BS students in this study to undertake coaching activities, with MS students serving as coaches and BS students receiving coaching. We conducted a survey and found that students who coached others were perceived to improved their soft skills much more than BS students who were mentored. In the discussion and throughout the paper, we addressed several reasons for the perceived impacts of coaching on BS students. However, we were unable to identify the specific cause, leading us to conclude that a new study is needed to completely comprehend the perceived impact of coaching activities on BS students.

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