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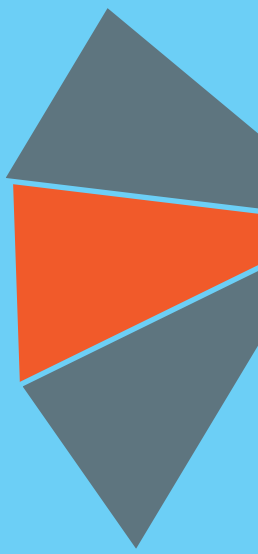
Supplemental Instruction

Volume 2:
Student Learning Processes



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Abbas Strømmen-Bakhtiar
This book is dedicated with all my heart to my wife Bente

Roger Helde
I dedicate this book to my three lovely daughters Ingrid, Solveig and Ina

Elisabeth Suzen
I dedicate this book to my children, David and Sara, whom I learn from every day

Preface

As the title indicates, this book is about student learning processes and Supplemental Instruction (SI), which includes everything from learning activities in supplemental instruction to developing guidance skills of leaders and more.

Chapter one starts our journey by looking at the student-active Supplemental Instruction programme (SI) and the students who lead this programme, the SI leaders. SI is a voluntary offer of professional guidance under the leadership of the students themselves. The question this chapter has tried to answer is: How do SI leaders understand and experience (a) SI as pedagogical programme and (b) SI as a leadership development programme?

Chapter two looks at the learning activities that are used in practice in Supplemental Instruction in basic engineering courses and the extent to which they are meaning oriented.

Chapter three looks at how SI leaders understand guidance in the SI programme and how they experience guidance in the SI programme. To achieve this, they have done a phenomenological study to find the central underlying meaning of an experience. This article presents the results of a study of SI leaders concerning their experience of facilitating an environment that provides learning opportunities.

Chapter four looks at small group teaching (SGT) and SI. The study was conducted to determine what significant differences were between SI and SGT. The authors investigated this question both from literature studies and from written responses from students from both groups.

Chapter five presents the authors' reflection on introducing different Supplemental Instruction models in teaching math-based modules on a range of programmes at University West in Sweden. They share their experience of using a traditional near-peer SI model, where senior students act as learning facilitators and a less common same-peer model, where learning facilitators come from the same cohort of students. The analysis of the collected data enabled the authors to draw up recommendations on how best to use the two SI models and in which contexts.

Chapter six presents an empirical investigation of digital transition and Supplemental Instruction in education, especially in accounting education. The authors looked at the web-based platforms (digital homework platforms) and SI. They found that students have a positive perception of WBPs but a neutral perception of SI.

Chapter seven deals with increasing pressure on the universities in Belgium, where the teaching staff are expected to deal with the ever-increasing number of the first-year student without increasing the supervisor capacities. This has resulted in a worrisome level of drop-out and failures, especially in challenging first-year courses. To address these two issues, the faculty of bioengineering has decided to run the pilot of an SI-PASS peer tutoring scheme. This chapter reports on the practical aspects of this dry-run and provides participant data about its perceived effects.

Chapter eight brings us to the end of our journey with an essay that looks at peer-assisted learning (PAL), which is another name for Supplemental Instruction. Its authors explain the details and structure of initial and ongoing leadership training, in supporting students to not only gain various skills through PAL leadership but also reflect on and articulate the skills to future studies or employment. Different PAL leadership roles and progression pathways are explained as a means to enhance employability.

We thank the Nord University, especially the Business school (Norway), and Lund University (Sweden) for their financial contribution to this project. Special thanks are also extended to Professor Terje Andreas Mathisen, the Vice Dean for research and others at Nord University's Business School for their support and encouragement.

The editors hope that you enjoy this book as much as we have.
Abbas Strømmen-Bakhtiar, Roger Helde, and Elisabeth Suzen

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1 Supplemental Instruction as a Programme for Developing Leaders and Facilitators for Learning

Elisabeth Suzen, Roger Helde & Abbas Strømmen-Bakhtiar

Abstract: The topic of this article is the student-active programme Supplemental Instruction (SI) and the students who lead this programme, the SI leaders. SI is a voluntary offer of professional guidance under the leadership of the students themselves. The purpose of SI is to improve student performance and reduce interruptions to studies through collaborative learning strategies. We have chosen to focus on the students who lead this programme, the SI leaders. The question we have sought to answer is: How do SI leaders understand and experience (a) SI as pedagogical programme and (b) SI as a leadership development programme? A phenomenological approach was chosen in relation to the aim of the study in order to obtain a deeper understanding of how SI leaders have understood and experienced their role as leaders and educational facilitators. The study was aimed at the SI leaders in the subject of physics working on the driving instructor education at Nord University, Norway, autumn 2017. We conducted two interviews with each SI leader, both interviews regarding their experience of being an SI leader. Six main themes emerged from our analysis indicating that SI leaders benefit from the SI programme, both in terms of leadership development and as a pedagogical learning arena for themselves as future teachers.

1. Introduction

One of the main challenges in higher education today is high drop-out rates among students (Aubyn et al., 2009; Schnepf, 2017; OECD, 2013). The transition from upper secondary school to studies at universities and university colleges where students are left more to themselves is difficult for many new students. In order to help the student to succeed in their studies, it is important that universities, university colleges, and higher education institutions respond to student needs for academic and social interaction.

Supplemental Instruction (SI) is perceived as a way of approaching these pressing educational challenges (Jacobs et al., 2008). It is a programme developed to support students in their learning process and aims to improve student performance and reduce the drop-out rate. SI does not focus on weak students, but on traditionally difficult courses with a high percentage of fail marks and poor exam attendance. In this way, SI is a programme for everybody and is offered on a regular basis. Since its beginnings in 1973, more than 1,500 universities in more than 30 countries have implemented the programme in their educations. The method is well described in different handbooks developed for the programme (Arendale, 1994).

SI complements regular teaching, where advanced students guide new students. The activity is organised in groups (8–15 students), led by an SI leader. These groups meet regularly every week during the semester at SI meetings. The role of the SI leader is not to be a teacher, but to facilitate learning through guidance, and to organise the programme. The students/participants work in collaborative groups, where they take responsibility for their learning through what is known as self-regulated learning. SI leaders are advanced students (selected students with an A or B in the subject) who receive SI executive training and are guided and observed by an SI supervisor.

According to Lockie and Van Lanen (2008, p. 2), a major difference between SI and other forms of collaborative learning is the role of the SI leader. Several studies have focused on the benefits for students from participation in SI programmes, but few investigations have focused on the value of the SI experience from the perspective of the SI leader (Lockie & Van Lanen, 2008; Malm et al., 2012). The role of an SI leader offers advanced students an opportunity to learn how to facilitate learning and how to lead learning activities among new students in their study programme. Based on this, the following research question was developed:

How do SI leaders understand and experience (a) SI as pedagogical programme and (b) SI as a leadership development programme?

Better leadership skills are often highlighted in descriptions of SI programmes. However, relatively few investigations have focused on the SI leader in terms of the leadership dimension, and the management experience and leadership development they gain through this programme. Studies concerning SI leaders include Congos and Stout (2003), who looked at the benefits of SI leadership after graduation when it comes to interpersonal factors, leadership, learning and work-related skills. Later, Malm et al. (2012), among others, conducted studies aimed at the transferability of the SI leader's skills and attributes to working life. Conclusions from both these and other studies regarding the role of the SI leader show that leadership development and management experience are important. However, they also indicate the need for more research.

The pedagogical theories that underpin the SI programme are based on social constructivism (Jacobs et al., 2008; Vuyelwa & Vuyisile, 2016). Dialogical and dialectical interactions between students and between students and SI leaders (facilitators) are processes that underlie the SI programme. Vygotsky (1978) believed that knowledge is socially constructed and that learning develops as a result of these processes. The SI leaders should therefore facilitate this and give the students an opportunity to discuss with fellow students and with the SI leaders (Jacobs et al., 2008). By involving the students in constructing meaning, the students can learn at a deeper level. In this way, SI is based on the premise that peer learning (learning with and from each other) is important and has a major impact on student learning in higher education (Boud et al., 2014).

2. Methods

We will describe the context for the SI programme and the methodological approach, data collection, and analysis.

2.1 Context and SI Programme Structure

The study was aimed at the SI leaders in the subject of physics working on the driving instructor education at Nord University, Norway. In total, 98 students were registered for the course, and altogether seven SI leaders run the SI programme in the course. The SI leaders were contracted as student assistants and received financial compensation based on the number of SI session hours they led. In the period of September – November 2017, four SI meetings were arranged each week, each meeting lasting two hours. There were always two SI leaders at each meeting, meaning that every SI leader had at least one meeting each week. The SI supervisor observed each SI leader at one meeting at least during the period and had several meetings with the SI leaders altogether. Before the semester started, the SI leaders were informed about our study, the voluntary participating in the study and the purpose of the study. They were all invited to participate, and all seven SI leaders in physics autumn 2017 participated.

2.2 Methodical Approach, Data Collection, and Analysis

A phenomenological approach was chosen in relation to the aim of the study in order to obtain a deeper understanding of how SI leaders have understood and experienced their role as leaders and educational facilitators. Phenomenology is both a philosophical movement and a research method used here to understand and explore the lived experiences of SI leaders. The study is rooted in a hermeneutical phenomenological understanding, based on Hans-Georg Gadamer's hermeneutical ideas and Martin Heidegger's understanding of phenomenology. Schools of phenomenology have developed different ways of collecting and analysing data. We have used interpretative phenomenological analysis (IPA), which is a method based on a hermeneutical phenomenological understanding (Smith et al., 2009). IPA has an ideographic focus, meaning that we aimed to gain insight into how a given person (the SI leader), in a particular context, understands a given phenomenon (the pedagogical and leadership parts of the SI programme). The one premise for participating in such a study is that the participants have experienced the phenomena. For a phenomenological study, the data collection process involves primary in-depth interviews and multiple interviews with the same individuals (Creswell, 2007). We conducted two interviews with each SI leader, both interviews regarding their experience of being an SI leader.

Existing literature on interpretative phenomenological analysis does not provide a clear representation of current methods of data processing. At the same time, Smith et al. (2009) present some basic elements that are relatable to researchers and that encourage IPA researchers to be innovative in the ways they conduct this sort of analysis.

The SI leaders' descriptions were firstly read individually and then explored several times in order to acquire an overall impression. We extracted significant statements from the transcribed interviews and grouped them into larger units of data, known as *meaning units* (Kvale & Brinkmann, 2009; Creswell, 2007). Secondly, these formulated meanings were organised into themes. Based on this, we noted what the participants in the study had experienced. This is called a *textual description* and includes verbatim examples (Creswell, 2007). Finally, we prepared a theoretical discussion of the main themes that occurred in the data (Creswell, 2007; Webster-Wright, 2010). This is often called a *structural description*, in which the themes are seen in relation to each other. For these reasons, literature related to the findings of phenomenological studies is often presented in the discussion, because what constitutes relevant literature depends on the findings and main themes that emerge (Smith et al., 2009). The purpose of a phenomenological study is to find the central underlying meaning of an experience. In an interpretative phenomenological study, the analysis is not a linear process. It is often necessary to go back and forth and to re-read. Phenomenology is a sensitive approach and a way of thinking as much as a way of analysing.

3. Findings

The themes that emerged from the analysis of the interviews with SI leaders were as follows: communication, facilitation of learning, strategic leadership, situational leadership, collaboration, and transferability of the skills to working life. These are elaborated in more detail below.

3.1 Theme 1: Communication

One theme that arose was communication in its different forms. The SI leaders express the importance of communication, both non-verbal and verbal. This includes everything from how they informed students about the SI offer, how they behave at SI meetings and how they meet the individual students, to the tone of voice and specific words they used. They are aware of the importance of their body language. "I have to be a bit careful how I approach the students physically. There are methods you can use for this. I might speak a bit too quietly too," (SI Leader 5, Interview 1). They use communication to make the students feel safe at the meetings and state the importance of giving positive feedback verbally to the students when they participate.

The SI leaders have experienced the importance of using learning questions, and of considering which questions are open and closed, which questions require knowledge, and which create understanding. As one SI leader claimed:

> I saw that it worked quite well when they got stuck into the tasks, asking the right questions and getting them on the right track. … Then they did the work themselves too, and that's probably the whole point that they will learn a lot better by doing the work themselves rather than just being given the answer. (SI Leader 6, Interview 1)

They claim that the main aspect of the pedagogical approach lies in asking the right questions.

Several SI leaders talk about their own fear of taking responsibility for SI, and especially their fear of talking in front of people. However, they appreciate being given the opportunity and the personal challenge, and after several SI meetings, they express a feeling of finding their identity as a leader. In this way, the SI programme functions as a way of developing their leader identity and makes them become more self-confident as leaders. All of those interviewed stated that SI had changed the way in which they look upon themselves as leaders.

The SI leaders value the communicative element of the SI leadership. Some of the SI leaders had work-experience as managers in various professions. However, they find SI different in terms of leadership than what they had previously experienced. SI has a communicative style of leadership and provides an arena for the SI leaders to try out this type of leadership.

> I think it's interesting on a personal level to be in an arena where I can try things out. Because I'm going to fail, but then I'll try again and again and again then maybe I'll get some experience and learn from that. Maybe I'll get better at it. And it would be good to gain acceptance for that kind of leadership. Because I can point and scream and tell you what you're going to do now, I'm good at that, but the other type of leadership I'm not so good at, and SI will probably give me this. (SI Leader 5, Interview 1)

3.2 Theme 2: Facilitation of Learning

SI leaders describe their pedagogical role as a coach and a facilitator for learning. Like a coach, they use questions and follow-up questions to help the students to reflect upon the tasks, find solutions and justify their choices. Like one SI leader says: "I usually say we teach others how to learn, and that we try to help them learn how to do things themselves," (SI Leader 2, Interview 2). The SI leaders define their role as a coach and not that of a teacher who will give them the answers. "It's not about standing there and teaching the subject, but you should rather help them figure it out. I do not jump into the first session there without looking into how I want to ask my questions" (SI Leader 4, Interview 1). In this way, communication skills also play a role in facilitating learning, where the SI leaders specifically talk about how they provide guidance and the value of communication in the guidance framework.

SI is all about peer learning, where students learn from each other. The SI leaders feel that the students learn a lot from each other and appreciate the coaching they get from the leaders. When the students discuss and find the answer together with fellow students, they built understanding and in-depth learning for the subject.

> Guidance and coaching – we should ask open-ended questions and never give the answer, because the whole idea is that the person should find the answer themselves and gain a sense of mastery and ownership of the answer they reach. And through discussion, they reach the answer together. (SI Leader 3, Interview 1)

The SI leaders see the responsibility they have to facilitate and enable this, because otherwise, the collaborative learning will not take place.

SI leaders are concerned with assessing where the students are in their learning process and facilitate further progress based on this assessment. The SI leaders emphasise that everyone should be allowed to participate on their own terms, and therefore want to involve everyone on this basis – there is no right or wrong way to participate.

The importance of creating a safe environment is a concern shared by all the SI leaders. Students must feel safe if they are expected to share, ask questions and even attend SI meetings, and SI leaders see their responsibility to facilitate this. They are also conscious of the responsibility of investigating why someone may not want to participate, and in particular, if they are not yet confident enough to contribute. This will entail a challenge for students' own learning, and SI leaders are very focused on creating a learning process that suits the students.

3.3 Theme 3: Strategic Leadership

By strategic leadership, we mean the planning and preparation that SI leaders carry out before they start the SI programme or attend an SI meeting. This includes how they plan to start the semester and introduce SI, how they arrange the room for SI meetings, how they plan to start the meetings and help the students to get to know each other, and so on. The SI leaders are concerned with how to make the students feel welcome and safe at SI meetings, so that they feel confident to attend and participate in the discussions.

The SI leaders emphasise that they themselves must be professionally prepared for the meetings. As one SI leader says:

> Be professional and ensure that you have actually read about the subject itself. I do not want to arrive there the first time and be the person who forgot a part of what we're doing. Okay, we've got good enough grades, but that does not mean that we remember everything. So, a little repetition, so I'm able to follow the subjects for the class, know what they've worked on, that would be a big advantage. (SI Leader 4, Interview 2)

Being prepared for questions and reflections related to physics is important to the leaders. They see this as a part of improving the quality of SI and important to the students achieving the learning outcomes.

The SI leaders are less concerned about the meetings being structurally prepared, with established tasks and topics, because they do not find this to be in accordance with the intentions and principles of SI. They are not concerned about the strategic part of leadership when it comes to preparing what the students should be working on, but they see the need to clarify which room the meeting will take place in and that the framework factors, such as boards and, if necessary, tasks, have been clarified. For this, they need to collaborate with the administration at the faculty, both to book rooms and to get the necessary resources. As part of their strategic leadership, the SI leaders find it important to vary the weekdays on which the SI meetings take place.

In this way, they can help to ensure that even more students have the opportunity to attend the meetings.

3.4 Theme 4: Situational Leadership

Situational leadership deals with what happens in the actual situation or context. It concerns how to handle the unexpected. SI leaders are more concerned with the situation-oriented part of leadership than the strategic. "We do not necessarily follow a concrete plan. It's more an intention, maybe. An intent, not a goal" (SI Leader 5, Interview 2). This is related to how they handle the unexpected, both in terms of what happens professionally but also what happens on the interpersonal level, socially. SI leaders see their relationship with the students as an important factor in student learning outcomes, as well as for the whole student environment at the university.

Nord University's practice is to arrange all SI meetings with two SI leaders. Normally, one leader is used in SI programmes, but based on the former SI leaders' experience, the university has chosen to always use two. When there are two SI leaders, it is namely easier to handle the situational leadership. The leaders experience that it is easier to cater to the students' different needs, and the group can be divided depending on student learning needs. In addition, if many students unexpectedly attend a meeting, there are two leaders to handle this, and if they get stuck or become uncertain about what to do next, they can easily consult and discuss with each other.

The subjects to be discussed at the meetings are determined by the participants, so the SI leaders are more concerned that meetings should be based on participant needs and not on a pre-determined plan. This entails a challenge, because they must handle the unexpected and cannot prepare for all the issues or problems that are brought up.

> We did not have much control over what should be done, really. It was mostly the participants who chose the theme. So it was not easy to prepare for the meetings, because we had no idea what they were going to do. (SI Leader 2, Interview 1)

3.5 Theme 5: Collaboration

Collaboration with other SI leaders as colleagues and collaboration with professionals and the administration at the university is central and is perceived as an important support function for SI leaders. As SI leaders, the students take an SI leader course over three days and are subsequently observed in their role by a supervisor. They experience this course and the observations as meaningful.

> The course has given me an understanding of how to increase reflection among the students and how to make them think more themselves. Ask questions that challenge … as opposed to just saying "this is the way to do it." (SI Leader 4, Interview 1)

The SI leaders consider themselves to be a team. This creates a joint sense of security in their leadership. At SI meetings, they work together in pairs, but they always shift

co-partners from meeting to meeting. They feel that cooperation with different people challenges them and makes them more flexible and tolerant. They acquire complementary skills and form a complete unit. When they lead meetings in pairs, they have a partner to reflect with before, during, and after the meeting. They have someone to give feedback to and get feedback from. This makes them more self-reliant and more capable of solving different challenges as a team. The SI leaders say they do feel that they lack support, either from the SI supervisor, the subject teacher, or the administration at the faculty.

They emphasise that they, as leaders, must collaborate between meetings. In this way, they can exchange information regarding the meetings, the subjects or anything in particular regarding the students. They emphasise the importance of following the lecture series and the teaching given in the subject in order to familiarise themselves with the details, whether any questions have been specifically raised, and how far the group has come in the curriculum.

They also see the collaboration with students as important for SI. They want the students to experience SI meetings as a great place to be and to make SI a social arena where you can learn but also make friends.

> What I think we should focus on is the marketing part. That we get along with people in the groups as early as possible and that we focus on making it fun for those who come there. So, they are ambassadors for SI to their fellow students. I think it's important that we get as many participants as possible early on in the semester and have a positive atmosphere. (SI Leader 5, Interview 1)

3.6 Theme 6: Transferability of the Skills to Working Life

The SI leaders experience a great deal of self-learning and self-development in the SI programme themselves. They see a clear connection between experiences from facilitating learning to their own practice as a driving instructor. Their experiences from the SI programme are something they can easily relate to practice in their own education and future occupation.

> Asking the right questions is difficult to get right, but it has great transfer value to what you should do in your practice as a teacher later on. So there's a synergy effect for this profession, and I think that's very good too. (SI Leader 5, Interview 1)

SI leaders feel that SI is a valuable opportunity to challenge themselves and develop their pedagogical and leadership skills. They also value their experience as SI leaders because of the way they felt able to enrich student life, both academically and socially. The SI leaders consider the SI meetings to be both a place for learning the professional subject matter and a social arena where you can meet and make friends.

The reasons they wanted to be SI leaders in the first place is related to both social and professional factors. The SI leaders see the job as a great opportunity to prepare

themselves for their further work as driving instructors. This is a big part of their motivation for becoming an SI leader.

> I want to be a SI leader to become a better teacher. It's going to make me a better leader and help me feel confident in front of classes. … the more confident I am in front of classes, the better my teaching will be. (SI Leader 1, Interview 1)

They are also inspired by the SI leader job offering them possibilities to try things out and being an arena where you can fail but learn from your mistakes.

4. Discussion

SI leaders experienced that the SI programme enhanced their professional and personal development as leaders and coaches. Being an SI leader helped to develop their communication skills, their abilities and understanding of how to be a coach, to be confident in a classroom, to organise and plan, but also to handle the unexpected, and to collaborate with other SI leaders, students and the faculty.

The facilitation of learning is something the SI leaders experienced as one of their main objectives as leaders. When the SI leaders use their own words to describe SI as an educational approach, they refer to it as an arena to facilitate learning. The SI leader becomes the leader of a learning community, where knowledge is socially constructed, and communication and collaboration are fundamental to learning. The most challenging aspect of this role for the SI leaders is finding the right questions to ask the students that demand reflection and further work. The SI leaders find this crucial because they claim that the main intention of SI is to help develop an understanding of the subject.

The SI leaders feel it is easier for the students to participate in discussions in small groups than a large auditorium. Studies show that students are more open to receiving guidance and academic input from fellow students if the environment is perceived as safe and non-threatening (Power & Dunphy, 2010). When the teacher is not present, the students themselves become experts, and this leads to more motivation to participate in the discussion (Jacobs et al., 2008).

The SI leaders define communication to include all processes by which people influence one another. This means that all actions and events have communicative aspects, as soon as they are perceived by a human being (Ruesch & Bateson, 2017). The SI leaders are very aware of both verbal and non-verbal communication, as well as the social context within the groups of students. They consider their main job to make all the students feel at home and safe within the group. They experience this as important for student learning outcomes. Several pedagogical theories support this, including that of Klafki (2001), who claimed that in order to develop trust in oneself and others, we must develop emotional and social security between student and teacher, and this requires time and effort.

The SI leaders express both strategic and situation-based roles in SI. They see strategic leadership as important but emphasise that it must not take over the situation-based leadership. They state that situational leadership must have room to be appropriate, seen in relation to the intentions of SI. They find it important to not plan too much in advance but that an SI leader instead should be professionally prepared and up to date. Such professional preparation is, according to SI leaders, the most important aspect of strategic leadership. Previous classroom research shows that teachers who master the spontaneous and unexpected have more success in classroom leadership (Klette, 2013). Situation-based leadership is crucial to handling the challenges and situations you encounter as a teacher. The SI leaders define this as the most important aspect of their leadership. A leader who can easily adapt their practice depending on the situation makes a better leader (Day & Sin, 2011).

SI leaders define leadership as a social activity that must be understood as context-dependent (Wennes & Irgens, 2015). From this perspective, we see furthering knowledge as a relational process – an ongoing constructive process of creating meaning. Relational leadership has a different ontological understanding to that of transformational leadership and traditional theories of leadership where the individual qualities as a leader are the focus (Northouse, 2001; Wennes & Irgens, 2015; Komives et al., 2006). In relational leadership, the focus is on the social constructive process. In the field of leadership theory, the literature claims that both perspectives are important and should be taken into account. The SI leaders confirm this through their weighting of strategic, situational leadership and communication and self-development as a leader. This supports a more practice-based epistemology, seeing the professionals as reflected practitioners (Schön, 1983/2001).

When leading learning processes, both reflection-in-action and reflection-over-action are essential (Schön, 1983/2001). The purpose of this is to find out what must be done to develop and improve. In order to further develop their leadership and educational skills, SI leaders must be willing to analyse and evaluate their own management of SI meetings. To analyse their own practice, the SI leaders reflect, both alone and together with the other SI leaders as a collaborative group. At Nord University, SI meetings always involve two SI leaders as a team, and the partners are changed between each meeting. In this way, leaders can easily use each other as team colleagues. This includes the possibility of giving and receiving direct feedback to each other and assessing the way forward or how to do it next time. The SI leaders experience a great deal of flexibility in relation to being two SI leaders at each meeting. In this way, they can easily divide the group if needed, work on different subjects or at a different tempo. The change of partners from meeting to meeting also forces them to collaborate with different people.

Recent leadership theory has a stronger belief in learning, and that leadership is something that must be learned through education, experience and reflection, in one or another combination (more than personal qualities; Wennes & Irgens, 2015). This indicates a shift from focusing on how to choose the person with the right personal characteristics to focusing on how to improve the leaders' practical skills (Wennes &

Irgens, 2015, p. 33). Today, it is more common to see leadership as a social activity, and it is therefore difficult to understand context dependency. The relative, contextual, emotional and processual factors are central in one way or another. The SI leaders experience the collaboration with each other as leaders and coaches as important to their own learning and development. Their development of identity as leaders and coaches is strongly dependant on the course, the collaboration, the experiences from SI meetings and their personal development. In relation to their own learning, they see the SI leadership role as an important learning arena for their future profession. Essentially, this applies to their confidence as future teachers and the confidence in knowing how to facilitate the learning processes of others.

Very few studies on Supplemental Instruction have focused on leadership as personal development. Couchman (2009) describes the reasons why leadership is perceived as a personal experience and claims that the phenomenological understanding of "lived experience" and practical actions for everyday life provide powerful data. The SI leaders in our study experience the SI programme as personal development, where several of them chose to become SI leaders because they assumed it would entail a personal challenge.

5. Conclusion

Six themes emerged in our study. Overall, they show that SI leaders consider the SI programme to be both a leadership development programme and a pedagogical learning arena for themselves as future teachers. A sociocultural understanding of leadership implies that it is dynamic, context-dependent, and related to participation and interaction. The opportunity to develop pedagogical and leadership skills should be a strong selling point for many SI leaders. Some of the SI leaders also refer to this as a key reason for them becoming an SI leader.

The SI leaders perceive SI to be an arena for learning and personal development. They are very satisfied with their SI colleagues and the possibility of actively using their colleagues for feedback and debriefing straight after the meetings. The use of two SI leaders at every SI meeting gives them an opportunity to give and receive feedback and to reflect on the profession together as a learning community. Based on the experiences of the SI leaders, it is fair to say that the SI programme can be considered a leadership development programme. It appears that SI creates independent SI leaders, who value the situation-based part of leadership. Although they find this challenging, none of the SI leaders felt that they lacked any support or guidance from the supervisor or the faculty.

The SI leaders experience communication, both verbal and nonverbal, as an essential aspect of SI. This is also related to how they meet the students, the collaboration with others and the facilitation of learning when guiding the students. Some of the SI leaders were insecure about their own ability to talk in front of people and take responsibility, but this also motivated them to apply for the job. They are also concerned

with the importance of meeting the students and making them feel safe at SI meetings. This makes it easier for students to participate and learn from SI. Altogether, communication is experienced as challenging but also crucial.

Our research concludes that SI leaders benefit from SI, both in terms of their role as facilitators for learning and in relation to leadership development. Further qualitative studies are needed to assess the transferability of the skills to working life and the value and experiences gained from this.

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2 A Study on Learning Activities in Supplemental Instruction

Joakim Malm

Abstract: The present study focuses on the learning activities that are used in practice in Supplemental Instruction in basic engineering courses and the extent to which they are meaning oriented. A survey method, based on action verbs, is used and complemented with a student experience questionnaire on SI. The verbs chosen by both the students attending SI and the SI leaders to identify learning activities show a clear pattern. The explanations of the verbs by both groups in an SI context are consistent and give a good description of what actually occurs in an SI session. Thereafter, the SOLO taxonomy is used to determine the learning levels of the chosen verbs and corresponding learning activities. The analysis indicates that learning activities in SI sessions in the present study are largely geared towards a deep approach. This result is supported by the results of the student experience questionnaire on SI.

1. Introduction

Supplemental instruction is a learning programme that can be employed as a complement to regular education in a difficult course. The idea with SI is to create a safe environment where students can focus on and discuss the material in the course that they find hard to understand. The SI session is led by an experienced student – the SI leader – who has completed the course successfully. The task for the SI leader is to provide structure to the sessions and initiate collaborative exercises to process the material. However, the SI leader is not a teacher in the sense that they do not impart new knowledge to the students, they do not provide solutions or answers to problems, and they are not in any way involved in the assessment of the students on the course. The job of the SI leader is to provide guidance to the students on how to identify the difficult parts of the material and demonstrate ways to process these parts for a better understanding, while fellow students are used as learning resources. Thus, SI combines training in study strategies with the processing of course content. More detailed descriptions of the SI programme and its theoretical foundations can be found in, for instance, (Blanc, DeBuhr, & Martin, 1983; Hurley, Jacobs, & Gilbert, 2006; McGuire, 2006; Martin, 2008). The goals of SI are to:

1) improve student learning,
2) improve student performance,
3) increase continued enrolment and retention.
   (International Center for SI, University of Missouri–Kansas City, 2016)

Much of the focus in research studies and evaluations has been on the latter two goals. An overwhelming majority of the studies show that these goals are achieved. Bowles

et al. (2008), Fayowski and MacMillan (2008), and Rath et al. (2007) are just a few examples. A reason why student learning in SI has not gained the same attention may be that student performance appears to be seen as a proxy for student learning; for instance, see Congos and Schoeps (1993). It has been assumed that positive results from quantitative studies on student performance mean that the student learning experiences in SI sessions have provided them with a deeper understanding of course content (Dawson, Van der Meer, Skalicky, & Cowley, 2014). But is it really so? Studies by Trigwell and Prosser (1991), Lizzio et al. (2002), Diseth and Martinsen (2003), and Hasnora et al. (2013) indicate that a deep approach may not be related to academic achievement, or only weakly so. Other studies by Arnold and Feighny (1995), Duff et al. (2004), M. Richardson et al. (2012), and Gürlen et al. (2013) suggest that strategic learning approaches may yield better results than deep approaches. Ashwin (2003) studied how an SI-like peer support scheme affected academic achievement and learning approach. He showed that the students attending peer support attained better marks in course examinations (in chemistry, mathematics, and statistics). However, these students also had a statistically significant drop in deep approach to learning, while the score on surface approach was stable. For students not attending peer support, meaning and reproducing orientations did not experience significant change. Ashwin argued that the students "had become more strategically orientated in their approach to studying as a result of their attendance at peer support sessions." Thus, it is not self-evident that students, based on improved performances, adopt a deep approach to learning in SI sessions. The type of assessment used in the course can also be a variable that influences work in SI sessions towards a more reproducing learning approach.

Are there other studies on learning in SI sessions? In general, qualitative studies on SI are rare (Dawson et al., 2014), and those that at least partly focus on student learning in SI sessions are even more so. Most of the latter studies deal with the learning environment, often rather synoptically. The main conclusions from these are that SI provides a safe learning environment (Bengesai, 2011; Longfellow, May, Burke, & Marks-Maran, 2008), emphasises social aspects of learning (Hammond, Bithell, Jones, & Bidgood, 2010; Paideya, 2011), and develops transferable skills (Ning & Downing, 2010) and confidence (Smith, May, & Burke, 2007). However, the studies also raise concerns about learning in SI. These include overreliance on SI (Bengesai, 2011), lack of structure and efficiency in study sessions (Capstick, 2004), session attendance being assessment-driven (Packham & Miller, 2000), and reservations regarding the idea that peer-assisted learning contributes to a deeper approach to learning (Hammond et al., 2010). An extensive study on learning in a peer-assisted learning (PAL) scheme was made by Capstick and Fleming (2004). There it was found that PAL (i.e., learning intervention based on SI and adapted to local conditions) appears "more focused on a meaning rather than a strategic approach to study." However, the meanings of meaning and strategic orientations are expressed vaguely, leading to some dubious interpretations of results. Furthermore, meaning and strategic oriented approaches seem to be seen as opposites, which is not true. In another study of learning in SI sessions

in upper secondary school, Holm (2014) found inconclusive results as to whether SI leads to meaning-oriented learning.

From the literature review above, it is apparent that little is published about the student learning processes that actually occur in SI sessions. The objective of the present study is to contribute to a better understanding of how students perceive learning and learning activities during SI sessions in the context of basic engineering courses. We will primarily focus on the extent to which learning activities are directed toward a deep learning approach. For this purpose, action verbs are used together with the SOLO taxonomy, see Biggs (2003), by linking verbs of different cognitive complexity with SOLO categories, see Table 1. Here, the higher qualitative levels of the SOLO taxonomy have to be reached in order for a learning activity to be seen as geared towards a deep approach. A student evaluation of the SI programme was also used to determine conditions for a meaning-oriented approach in SI sessions to support or dispute the conclusions based on used learning activities. The Research Questions are thus the following:

1) How do students perceive the conditions for a deep approach to learning during SI sessions?
2) How do students describe the learning activities taking place during SI sessions using action verbs? Are there clear patterns? What conclusions can we draw with respect to how learning activities in SI sessions are directed toward a meaning or reproducing a learning approach?

2. Methodology

Levels of understanding can be described using verbs of different levels of cognitive complexity (Biggs, 2003) and structure using, for instance, the SOLO taxonomy. The SOLO taxonomy was designed to deal with learning outcomes (Biggs, 2003). However, it has also been applied in classifying learning activities in SI sessions based on video recordings in upper secondary school (Holm, 2014). In order to answer the research questions under Research Question 2, regarding learning activities and whether they are directed toward a deep- or surface-learning approach, the idea in the present study is to let students identify the action verbs that best describe the learning activities in which they engage during SI sessions. A survey was handed out in late autumn 2016 to SI attendees in two basic math courses (Linear Algebra and Calculus in One Variable) for first-year engineering students at Lund University. The survey contained a list of 45 verbs corresponding to different complexity levels in learning in the SOLO taxonomy (see Table 1).

The students were asked to mark the three most representative verbs that described their activities at SI sessions. Furthermore, each verb was to be given a short explanation in the context of an SI meeting, in order to follow up whether it corresponded to the intended level of complexity. The survey was distributed at SI sessions during one of the last weeks of the courses. In total, 114 students visited SI in linear algebra

that week (of the 220 registered on the course), and 67 (58%) handed in completed questionnaires. In the same week, there were 227 students visiting SI in the calculus course (of the 598 registered on the course), and 130 (57%) handed in completed questionnaires. Thus, the survey responses should be fairly representative of SI attendees in the two courses.

The results from the completed questionnaires are first analysed with respect to patterns in learning activities based on the chosen verbs. The meanings of the verbs for the students in an SI context are thereafter checked in relation to the original placement in the SOLO taxonomy, according to Table 1. Approximately 80% of the completed questionnaires had useful explanations of the verbs that could be matched with SOLO levels. After appropriate corrections, the last part of the analysis is to determine the relative representation of SOLO levels in SI, based on the frequency of the chosen action verbs. If the learning environment in SI is indeed directed towards a deep approach, there should be a pronounced representation of activities corresponding to the qualitative phase of the SOLO-taxonomy in the SI sessions.

Are the 45 action verbs used in the survey enough to cover all learning activities that may occur in an SI session? In an earlier pilot study during the spring semester 2016, covering SI sessions in math, chemistry and mechanics, the students were en-

Tab. 1: The action verbs used on the survey ordered according to suggested associated level in the SOLO taxonomy

Quantitative phase		Qualitative phase	
Unistructural (I)	Multistructural (II)	Relational (III)	Extended abstract (IV)
Identify	Explain	Analyse	Generalise
Define	Solve	Apply	Hypothesise
Name	Describe	Argue	Reflect
Tell	List	Compare	Theorise
Memorise	Do algorithms	Contrast	Create
Quote	Clarify	Criticise	Synthesise
Do a simple procedure	Examine	Explain causes	Value
Recognise	Interpret	Relate	Develop
Recall	Extend	Motivate	Assess
Repeat	Rework	Predict	Debate
	Prove		Validate
	Classify		
	Combine		
	Revise		

Note. The pre-structural level has been omitted in the table. In the actual survey, the verbs in the table were rearranged. The instruction on the survey was: "Mark the three verbs you think best describe what you and your co-students do in your SI sessions. Give a short explanation of each of the three chosen verbs in the context of an SI meeting."

couraged to add verbs they felt more appropriate to describe activities in an SI session. However, the additions were few and not appropriate in a list based in the SOLO taxonomy. The most commonly added verb by far was *discuss*. The issue with this verb is that it does not have an unequivocal place in the SOLO taxonomy.

The appropriate SOLO level for the verbs in Table 1 was determined based on three sources: Biggs (2003), Brabrand and Dahl (2009), and Lignan University (2016). In the few cases that the sources disagreed on an appropriate SOLO-level for a verb, the lowest level was chosen in order not to overestimate complexity.

The same survey was also distributed to the SI leaders in the same week as for SI attendees, with the difference that the instruction was to: "Mark the three verbs you think best describe what your students do in your SI sessions. Give a short explanation for each of the three chosen verbs in the context of an SI meeting." All 12 SI leaders in the course linear algebra, and 22 of 24 SI leaders in the calculus course handed in completed questionnaires. (All completed questionnaires from SI leaders had useful explanations of the verbs that could be matched with SOLO levels). The results from these were then compared with those of the participants to see if both group's perceptions of learning activities in an SI session agreed.

An SI Experience Questionnaire (SEQ) was used to answer Research Question 1 on whether the conditions in SI sessions stimulate a deep approach to learning and thus support or dispute the results from the action verb questionnaire. The first part of the SEQ was also used to check that the SI sessions were run according to SI principles (see Figure 1). The SEQ was handed out to participants during the last SI session. Out of 310 attending students, 254 (82%) handed in surveys – 85 on the algebra course and 169 on the calculus course. The responses to all questions in the survey were similar in the two courses, which is why the results are combined in the Results section below. The SEQ focuses on the following areas:

- What motives did participants have for attending SI sessions? Are they related to a strategic or a deep study approach? Five statements were formulated to cover this topic (see Figure 2).
- Was SI really happening in SI sessions? A number of control characteristics for an SI session were included in the questionnaire (see Figure 1).
- What impact did the SI sessions have on the course? Are the impacts more in line with a deep or a strategic learning approach? Five statements regarding course impact were included in the questionnaire (see Figure 3).
- Another objective of SI is to train in some generic skills such as teamwork, critical thinking, problem-solving, and presenting course material in front of others. Generic skills are positively correlated with a deep learning approach and negatively correlated with a surface learning approach (Lizzio et al., 2002), and investigated as a part of the survey (see Figure 4).
- Student perceptions on factors such as workload during SI sessions (Trigwell & Prosser, 1991; Lizzio et al., 2002), academic self-confidence (Duff, 2004; Baeten et al., 2010), intrinsic motivation (Cano & Berbén, 2009; Wilson, 2009), and overall

satisfaction with sessions (Karagiannopoulou & Christodoulides, 2005; J. Richardson et al., 2007) are positively related to a deep approach and negatively to a surface approach. Items covering these factors were included in the survey (see Figure 5).

3. Description of the SI Programme at Lund University's School of Engineering

The teaching in engineering courses at Lund University is usually fairly traditional. Lectures are used to present the course material, while tutorials, and sometimes labs or seminars, are primarily used to process the material. The student is commonly expected to be an independent learner who, via these resources, can acquire a good understanding of the course material. However, for a new student, the learning challenge can be overwhelming. The students are often unprepared by secondary school to handle the increased amount of course material to be covered, the decreased teacher availability, and the increased demand of a qualitative understanding of the course material in order to pass the course. Therefore, SI has been introduced at the school of engineering as a means of helping new students become independent learners. Furthermore, new students are encouraged to see fellow students as learning resources, making their studies more rewarding and efficient as well as enjoyable.

The SI programme at the school of engineering at Lund University is mainly attached to two basic mathematics courses in the first semester for new students: Linear Algebra and Calculus in One Variable. The objectives and learning outcomes in both courses are primarily to obtain a good problem-solving ability within the subject, be able to explain mathematical concepts, definitions, theorems and proofs and obtain a good mathematical reasoning capability. The regular education consists of lectures and exercises focusing on mathematical problem-solving. The primary examinations are five-hour written exams focusing mainly on problem-solving, and to a lesser extent on explaining theory. In the calculus course, there are also a couple of smaller numeracy tests and two presentations of assignments (oral and written). Here SI complements the individual training done in exercise and self-study time, focussing on explaining concepts, definitions, theorems, and proofs, obtaining mathematical reasoning skills, as well as developing mathematical problem-solving ability.

Both courses are considered difficult in the sense that the failure rates on the main course examinations are quite high on average (about 20–50%). Each new student is assigned to an SI group attached to one of the two courses. Participation in SI is voluntary. A two-hour SI session is scheduled weekly for each group under the guidance of an older student, the SI leader, who has successfully taken the course previously. All new SI leaders receive a two-day training prior to their work. The training is based on two universally used training manuals authored by the International Center for Supplemental Instruction at the University of Missouri–Kansas City (2014; 2004). They

also receive continuous support during their assignment to help them develop in their roles as SI leaders:

- They are observed and coached twice during the semester (more if required),
- They attend supervision meetings every second week, and
- They also write short reflective reports after each meeting.

In the course linear algebra, spanning half a semester, each student is scheduled for seven SI meetings. The calculus course runs for the entire semester, and each student is scheduled for 14 SI meetings. The average attendance at SI sessions in the autumn of 2016 was 41% in linear algebra and 45% in the calculus course. The percentage of all registered students in the two courses being in at least one SI session was 75% in linear algebra and 84% in the calculus course. Earlier studies by Malm, Bryngfors, and Mörner (2011, 2012, 2015, 2016) for engineering students at Lund University have shown that student groups with no, low, average, or high SI attendance have similar characteristics with respect to factors such as gender, age, prior academic achievements, motivation, learning approaches. Thus, it appears, as there are no major differences between students attending SI or not. The average number of students in an SI session was 10.1 in the linear algebra course ($SD = 4.4$) and 11.8 in the calculus course ($SD = 5.5$). The location for a typical SI session was a classroom designed for 20–35 students.

How do we know that SI methodology was actually practised during SI sessions? Partly it was checked via control mechanisms within the SI programme, such as observations and coaching, supervision meetings and reflective reports from SI leaders after each meeting. These controls showed nothing to dispute that SI methodology was in fact used during sessions. However, the best way of controlling whether SI was run according to key principles is to ask students. The student perceptions on some key features in SI during sessions are presented in Figure 1. As seen in the figure, the study pace seems well adjusted to the students. Possibly the pace might be increased a fraction in some meetings to be optimal, but generally, it appears to be right. This is valuable information since an inappropriate workload is positively associated at a significant level with a surface approach (Trigwell & Prosser, 1991; Lizzio et al., 2002).

Other key features of an SI meeting are clearly supported by participant perceptions of the meetings, including:

- Easy-to-ask questions
- Easy-going, positive and supportive atmosphere
- Content in meetings being decided by participants together with SI leader
- Work done through discussion in groups
- SI leaders helping by asking questions

Also, attending students have no difficulty in seeing how SI differs from regular education. Thus, it seems that we can conclude that it really was SI that we are studying in the present case.

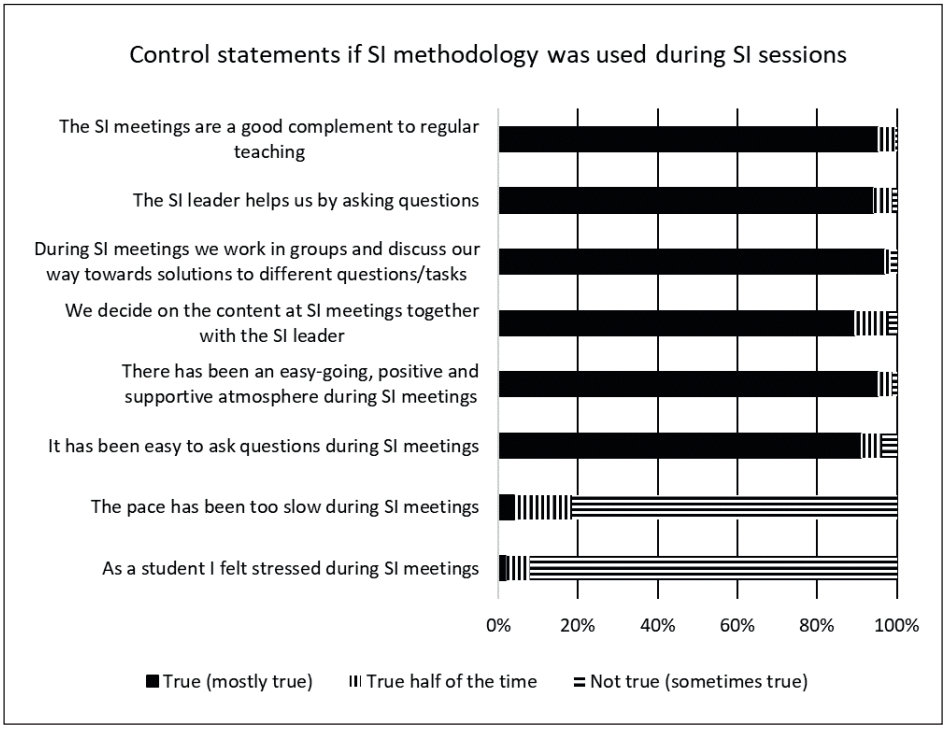

Fig. 1: Statements on the SEQ questionnaire controlling for SI sessions being run according to some key SI principles

4. Results

The main action verbs chosen by students to represent learning activities in SI sessions in the two courses are given in Table 2. It is interesting to note that they are the same nine verbs that stood out in both courses. These nine verbs also represent roughly 80% of all marked verbs on the surveys and should therefore be representative of learning activities in SI in the two courses. It is natural that the verbs *explain* and *clarify* are so frequently chosen as learning activities. A key task in SI sessions is to focus on course material that is difficult or unclear and explain it to each other in groups. Problem-solving is central in both mathematics courses, explaining why the verb/activity *solve* often becomes a part of SI sessions. However, none of these three activities – explaining and clarifying course material and solving mathematical problems – mean that students necessarily adopt a deep approach to learning. On the other hand, the verbs *analyse*, *reflect*, *explain causes*, *motivate*, *argue*, and *apply* suggest that learning activities reach into the qualitative phase of learning. The fact that these verbs were chosen so frequently indicates that learning in SI sessions has, to a large extent, a meaning-oriented approach.

Tab. 2: The most common verbs used by students and SI leaders to describe learning activities in SI sessions in the two basic courses in mathematics

Linear Algebra		
	% of answered surveys that marked the verb	
Verb	Students	SI leaders
Explain	48%	50%
Clarify	40%	33%
Analyse	30%	33%
Reflect	27%	50%
Solve	25%	25%
Explain causes	21%	17%
Motivate	19%	17%
Argue	18%	0%
Apply	12%	8%

Calculus in One Variable		
	% of answered surveys that marked the verb	
Verb	Students	SI leaders
Explain	49%	45%
Solve	38%	32%
Clarify	35%*	14%*
Reflect	24%	27%
Analyse	20%	9%
Motivate	18%	32%
Argue	15%	9%
Apply	13%*	50%*
Explain causes	10%	9%

*Note. % = percentage of answered surveys that marked the verb. Only verbs being marked on ≥10% of student surveys were included in the table. Statistically significant differences ($p < 0.05$) in response frequencies for a verb between students and SI leaders using a chi-square test are marked by *.*

The results from the action verb survey handed out to students are confirmed by the SI leaders (see Table 2). The choice of verbs and the frequency in these choices are largely the same for students as for SI leaders. In the calculus course, however, statistically significant differences between students and SI leaders exists in marking frequencies for two verbs. The SI leaders consider applying theory in problem-solving as a much more integral part of SI sessions compared to participants. Students, on the other hand, seem to value clarifying presented course material more as a learning activity in SI sessions compared to SI leaders. Why is it that these differences appear in SI in one course and not in another? One explanation might be that the course material in linear algebra is, for the most part, new to the students, while the main part of the material in the calculus course is familiar to the students from high school (albeit at a more advanced level). This may result in SI leaders feeling that it is not so much a clarification of the calculus course, but rather the application of theory in problem-solving that is the best way to obtain a deeper understanding of course content. Apparently, the participants do not seem to perceive the learning activities the same way.

What then do the verbs mean for students and SI leaders in the context of an SI meeting? Do the definitions of these verbs differ from their specified level in the SOLO taxonomy in Table 1? A majority of the student (and SI leader) explanations state or hint that explanation in an SI setting is an interactive task. You explain for each other in order to get different viewpoints of a concept, method or how to solve a problem. Some examples:

- "We go through things that have been hard to understand by explaining for each other in groups"
- "Explaining is what we mostly do for each other, we don't think the same, we do things differently, and thereby we learn things from each other"
- "Explain: learn from each other, students explain course content for each other" (SI leader).

In general, the definition of the SI activity *explain* is about describing how something is. This suggests that one usually does not try to understand the underlying meaning or how it is connected to other parts of the course material. Therefore, a SOLO II level seems motivated for the verb and its associated activity in the present case.

The student and SI leader definitions of *explain* and *explain causes* are, for the most part, distinctly different (the former being student views without apparent follow-up questions and the latter being "why things are as they are"), but sometimes it appears as if the meanings get mixed up:

- "Explain causes: We explain and get problems explained for us" (Student definition)
- "Explain: Why do we solve the problem this way?" (SI leader definition)

From a SOLO level point-of-view, the cases where definitions of *explain* and *explain causes* are mixed up seem to cancel each other out.

The student and SI leader explanations of the verbs *solve* and *apply* are intimately linked to mathematical problem-solving. Some examples:

- "Solve: We solve problems in groups and present and explain solutions on the whiteboard"
- "Solve: SI in mathematics means a lot of problem-solving, where students solve problems together in small groups" (SI leader)
- "We often apply what we have done during lectures by solving difficult problems in groups"
- "The students analyse the theory from lectures in SI and apply it in solving problems" (SI leader)

The difference between the two in the explanations by students and SI leaders is the link between theory and practice for the verb *apply*, which is usually missing in the definitions of *solve* in an SI context. Thus, the SOLO II and III levels for *solve* and *apply* seem appropriate in the present case.

The student and SI leader definitions of the verbs *clarify*, *reflect*, *analyse*, *motivate*, and *argue* are also in the context of student interactions. The verb *clarify* that was assigned to SOLO II, often appears to go beyond the multistructural level into a meaning-oriented domain in student and SI leader explanations:

- "Clarify: When almost everyone is stuck and they don't understand a problem or concept, there is always someone that has at least understood a part of the whole.

Thereafter someone else gives feedback on that and a third on that and so on à meaning of SI"
- "Clarify: By going through things more thoroughly and discussing with others you increase the understanding"
- "Clarify: When something wasn't clear in a lecture, the students work together to clarify what the meaning is" (SI leader)

Thus, the placement of the verb *clarify* in the SOLO taxonomy is ambiguous in the present case – both SOLO II and SOLO III can be relevant. In order not to overestimate this verb's importance with respect to a deep learning approach, we will consider it to be SOLO II in the summary of results below.

The meanings of the verbs *analyse* and *reflect* in an SI activity context are generally of a qualitative nature, according to students and SI leaders. Some examples:

- "Go through problems and analyse step-by-step why you do as you do"
- "Analyse concepts and methods to understand their underlying meaning" (SI leader)
- "We reflect a lot, which gives us a chance to summarize and connect what we have studied"
- "Reflect: Simply that you get time to think about what you actually do, how to best tackle a problem, but also to reflect on how you are progressing generally and how the maths course feels"
- "*Analyse* and *reflect* have, in my opinion, similar meanings, but I think the words suit SI sessions as I try to get the students to think about and understand what different concepts or parts of the course mean" (SI leader)

As illustrated in one of the SI leader's explanations, the verbs *reflect* and *analyse* in SI activities sometimes have a similar meaning according to participants and leaders. The verb *reflect* appears to be in the context of the course material, according to students and SI leaders. Thus, it is not equivalent to the fourth SOLO level extended abstract. This also seems natural, considering that the courses to which SI is attached are basic first-year courses. It is unlikely that students will go beyond the given course material. This also appears to be the case for other chosen SOLO IV verbs like *generalise* and *debate*. They are more in a relational context than extended abstract.

The verbs *motivate* and *argue* as SI activities are partly similar in student and SI leader explanations:

- "Motivate: You have to explain and motivate why you do as you do and are thereby 'forced' to understand the course material"
- "Motivate: Large focus on participants understanding what they do and being able to motivate why they do it a certain way" (SI leader)
- "You often have to argue for your way of thinking, which is a great way to check if it's right"

- "Argue: Argue as to why you solve problems a certain way" (SI leader)
- The way the students and SI leaders explain the corresponding activities in SI sessions for these two verbs confirms their place on the SOLO III level.

In general, the verbs and associated SI activities described by students and SI leaders agree well with the SOLO levels defined in Table 1. One exception is, as mentioned above, the SOLO IV level, which appears not to be reached during the SI learning activities in the present case. The associated verbs are instead relational, i.e., SOLO III. Based on how often the listed verbs were chosen, we can now get an idea of the magnitude of learning activities with respect to different SOLO levels. A summary of the results is given in Table 3. In both courses, about half of the learning activities are quantitative (SOLO I–II) and associated with learning of facts, definitions, concepts, theorems, and proofs or solving problems. The other half of the activities in an SI session are qualitative in nature (SOLO III) and associated with a meaning-oriented approach. It is likely, however, that learning activities become a part of each other and are not so easily distinguished during an SI session. For instance, you have to explain or clarify course material that is difficult, to be able to analyse it or apply it. In summary, the action verb survey suggests that a deep approach to learning is a large and natural part of SI sessions in both courses.

Tab. 3: The percentage of chosen action verbs to describe activities in SI sessions with respect to SOLO taxonomy levels

	Linear Algebra		Calculus in One Variable	
SOLO level	Students	SI leaders	Students	SI leaders
I	8%	6%	8%	9%
II	43%	39%	51%	35%
III	49%	55%	41%	56%

Can we find support for the results from the action verb survey, via student responses on the SI Experience Questionnaire, that a deep learning approach is common in SI sessions in the two courses? Student reasons for attending SI are presented in Figure 2. Three reasons can be considered as strategic – to pass the course, to get a good grade, and as an efficient way of studying. A clear majority of the students consider all three to be good reasons to attend SI. However, it seems that strategic and deep approach reasons are aligned. A majority of students enjoy discussing course material with other students. And the main reason for attending SI sessions appears to be to get a better understanding of the subject.

The influence of the SI meetings on the course is shown in Figure 3. Also, here there is an alignment of strategic and deep approach outcomes. Most students experienced that attending SI meetings gave them efficient support in the course, likely improved their results in the course and gave a better understanding of what was expected of them in the course. Most students also reported deep approach outcomes because of

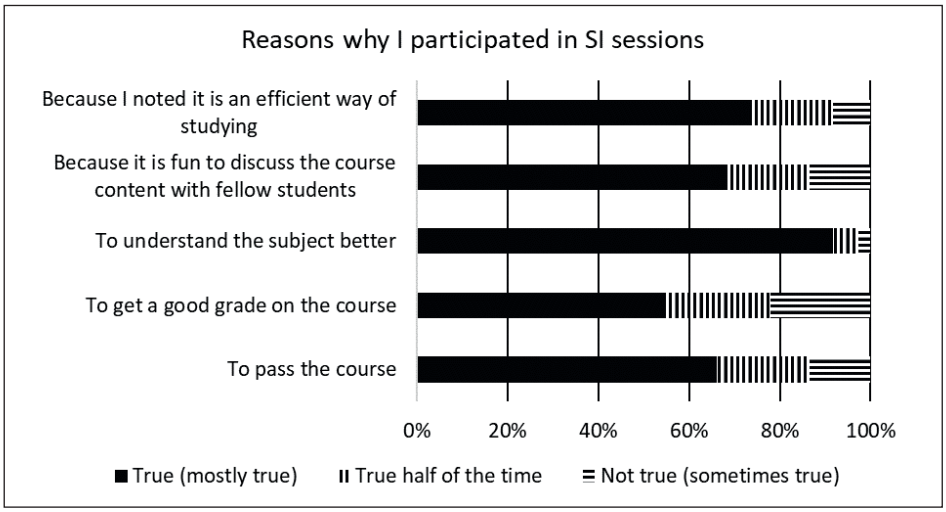

Fig. 2: Statements on the SEQ questionnaire checking for motives (strategic and meaning-oriented) to participate in SI sessions

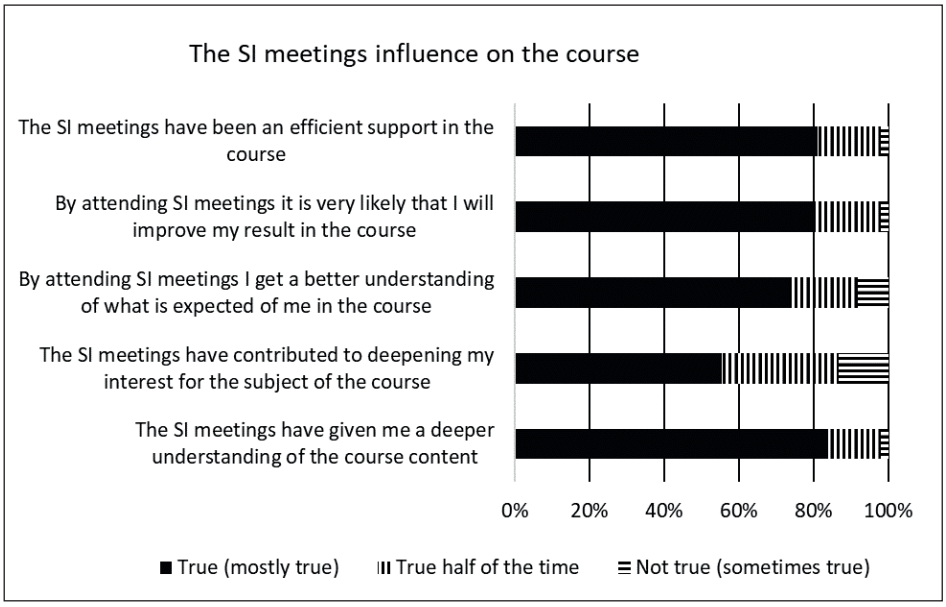

Fig. 3: Statements on the SEQ-questionnaire checking for SI session influences on student coursework

SI – deepened interest in the course subject and especially a deeper understanding of the course content. Thus, it would appear that these student experiences, with regard to reasons to attend SI and the influence of SI meetings on the course, confirm the findings from the action verb survey. SI sessions promote a deep approach to learning.

Other indicators that are positively correlated to a deep learning approach and negatively correlated to a surface learning approach are presented in Figures 4–5. Generic skills are trained, at least to some extent, for the majority of students attending SI meetings, which promotes a deep learning approach. Also, most student experiences with regard to intrinsic motivation, confidence (at least to some extent) and the pos-

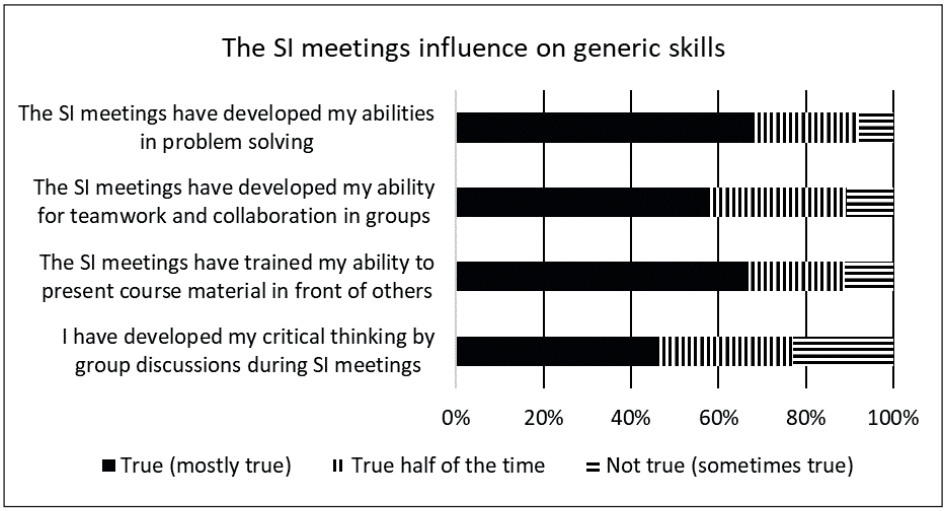

Fig. 4: Statements on the SEQ-questionnaire to investigate if students trained or developed certain key generic skills during SI sessions

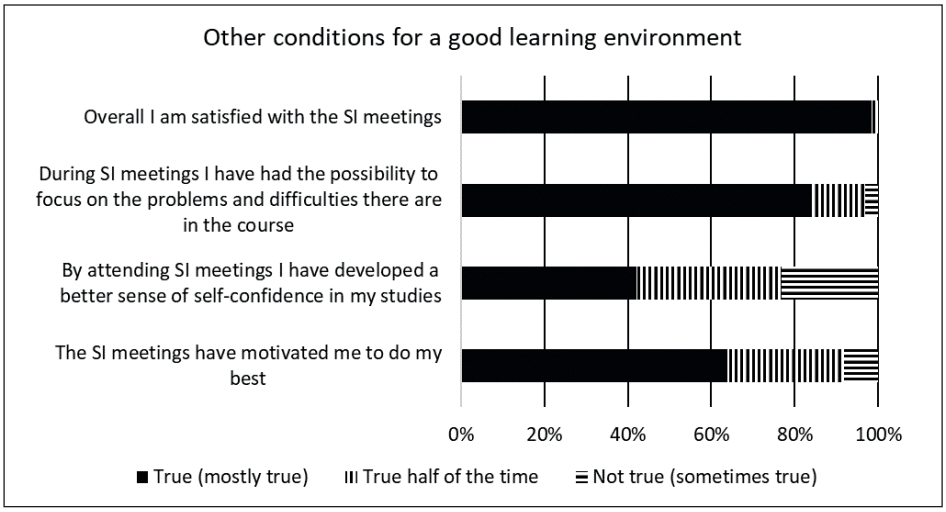

Fig. 5: Statements on the SEQ-questionnaire to check to what degree certain conditions for a good learning environment were fulfilled during SI sessions

sibility to focus on the difficulties in the course as well as the overall satisfaction with SI sessions, all support a deep approach to learning in SI sessions.

5. Discussion

Based on the results above, we can now answer the research questions stated in the introduction. SI sessions appear to provide good conditions for a deep learning approach, as seen in the results from the SEQ in Figures 2–5. Examples of such conditions, positively related to a meaning oriented approach, include a well-adjusted study pace, good overall satisfaction with sessions, an environment that promotes intrinsic motivation and academic self-confidence, and the training of generic skills, see for instance Trigwell & Prosser (1991), Baeten et al., (2010), Wilson (2009), J. Richardson et al. (2007), and Lizzio et al. (2002). Meaning-oriented reasons (e.g., understanding course material) and strategic reasons (e.g., passing a course, getting good grades, and support in course work) for attending SI are both of importance, as well as SI's impact on the course, although student attendance in SI mostly seems to be determined by the former.

The students (and SI leaders) attending SI in the two math courses appears to use certain key action verbs to describe the learning activities in SI: *explain* (causes), *clarify*, *solve*, *analyse*, *reflect*, *motivate*, *argue*, and *apply*. Roughly half of all the marked verbs are on a qualitative level in the SOLO taxonomy. This indicates that the learning activities in SI are largely directed toward a meaning-oriented study approach, a result agreeing well with the outcome from the study of Capstick and Fleming (2004) on learning approaches in SI/PAL. This finding does not mean, however, that the student learning outcomes from SI sessions are necessarily meaning-oriented, just that the learning activities promote deep learning. The fact that more than 80% of responding students agreed with the last statement in Figure 3, "The SI sessions have given me a deeper understanding of the course content," gives a hint that learning outcomes are also affected.

It appears that the methodology applied above for investigating to what extent a learning intervention like SI actually supports deep learning is useful. The list of action verbs provides structure when students think about what activities they actually engage in, in a learning situation. The subsequent explanations of the verbs in the context of the studied learning environment provides a more specific meaning to the learning activities. This in turn allows the use of a tool like the SOLO taxonomy to investigate to what extent a deep approach is used in learning situations. However, it is assumed that collaborative activities focused on learning are prominent activities in SI sessions. This may not be the case. For instance, if there are many students participating in SI, it will be hard for the SI leader to follow up with all groups in the session. Are they working efficiently, or have they become stuck on something and started talking about non-study related matters? It can also be difficult to know if it really was SI that was happening in the SI sessions. The International Center for Supplemental

Instruction at the University of Missouri–Kansas City promotes an ambitious set of observations and supervision for all practitioners, to ensure that it is actually SI being carried out in sessions. However, in practice, the possibilities to observe and supervise are often limited due to cost and availability of qualified personnel. Therefore, there may be a need to collect complementary data in order to understand how the SI programme really worked. A student experience questionnaire on SI, like the one above, is one way of doing it. In this way, you also have the possibility of getting confirmatory data as to what extent the learning activities were meaning oriented.

The study above obviously has limitations regarding the generality of the action verb method in studying learning activities in an intervention such as SI. The method has just been applied to one subject and then at a basic course level. In other words, the method needs to be applied to other subjects in order to see if unequivocal results are achieved. To some extent, this was done in two minor studies at the school of engineering at Lund University in spring and autumn of 2017 (see Table 4). Late in the spring semester of 2017, the action verb questionnaire was handed out to SI participants connected to a course in organic chemistry. All 37 students attending SI that week handed in surveys (out of 49 students registered in the course). The results in Table 4 show clear similarities to those from the math courses. Explain and clarify seems to be to main activities also in organic chemistry. Several verbs indicating qualitative learning levels like *argue*, *motivate*, *reflect*, and *analyse* are also frequently marked, suggesting that SI sessions also here are largely geared towards a deep learning approach. The main differences between SI in math and organic chemistry seem to be that learning facts plays a larger role in the latter (like knowing common organic functional groups) as indicated by students marking verbs like *identify*, *memorise*, and *recognize*, to a larger extent. In addition, problem-solving seems to take a back seat in SI in organic chemistry compared to mathematics as indicated by the verb solve not being marked by students in the former course.

The action verb survey was also tested in five introductory international master's courses at the school of engineering during autumn 2017. The objective was to see if other courses and course levels, as well as a more diverse student group, would give different results with respect to learning activities in SI. The five master's courses were Urban Water, Digital Communication, Foundations for Risk Assessment and Management, Bioprocess Technology, and Fundamentals of Logistics and Operations Management. In total, 43 out of 45 students attending SI that week handed in surveys in the five courses (111 international master's students were registered in the courses), fairly evenly distributed. Since the number of submitted questionnaires are too small for each course to give reliable results, an aggregate was used instead, see Table 4.

Although one has to be careful in interpreting these results, there again seems to be clear similarities in SI learning activities compared with the math and organic chemistry courses. The verbs *explain*, *clarify*, and *solve* appear to once again describe the most prominent learning activities in SI. As was the case in the other courses, these activities are combined with more qualitative learning activities described by verbs like *analyse*, *reflect*, and *apply*. Thus, also in the case of master's courses, with

a more diverse student population, the activities in SI seems to be directed toward a deep study approach but not more so than in introductory courses at the bachelor's level. Perhaps this is due to that the master's courses also are introductory where you need to learn a lot of new material. Presumably, in later courses, you work in higher cognitive levels with finding ways to apply things you already know. In both the organic chemistry course and the investigated master's courses, you do not seem to reach SOLO IV level in learning activities. The student descriptions of verbs like reflect linked to this level are more in line with the SOLO III level.

Tab. 4: The most common verbs used by students to describe learning activities in SI sessions in a basic course in organic chemistry and an aggregate for five introductory master's courses

Organic chemistry		Aggregate of five introductory master's courses	
	% of answered surveys that marked the verb		% of answered surveys that marked the verb
Verb	Students	Verb	Students
Explain	41%	Explain	42%
Clarify	32%	Solve	32%
Argue	32%	Clarify	35%
Motivate	27%	Analyse	33%
Reflect	19%	Reflect	16%
Identify	19%	Apply	14%
Analyse	14%	Recall	14%
Apply	14%	Argue	12%
Explain causes	11%	Revise	12%
Memorise	11%		
Recognise	11%		

Note. % = percentage of answered surveys that marked the verb. Only verbs being marked on ≥10% of student surveys were included in the table.

If we return to limitations of the present study, the action verb method's generality needs to be tested by application to other subjects outside of engineering. For this purpose, the list of action verbs likely has to be extended to capture all relevant learning activities in other subject areas. Furthermore, the method needs to be applied at different levels of a subject. The method was not tested with regard to the SOLO IV level, which likely can be reached in graduate courses. The method also needs to be applied at different higher education institutes and different SI programmes to test its generality. This first test of the method seems promising, however. You get a good overview and understanding of what learning activities actually occur in an SI session, and to what extent a deep approach is used. It also seems as though the type of activities are fairly consistent between SI leaders, and from session to session.

6. Conclusions

The present study is focused on learning activities in SI sessions and how an action verb survey can be used to capture and classify them with respect to levels of learning. The case study is an SI programme connected to two basic mathematics courses in the first semester in engineering. The generality of the method is obviously limited prior to tests in other subjects and in other higher educational environments. These first results are promising, however. The verbs chosen by both students attending SI and the SI leaders to describe learning activities show a clear pattern. The explanations of the verbs by both groups in an SI context are consistent and give a good description of what actually occurs in an SI session. An analysis using the SOLO taxonomy shows that the learning activities in SI sessions in the present study are largely geared towards a deep approach. This result is supported by the results of an SI experience questionnaire for attending students.

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3. Developing the Guidance Skills of SI Leaders

Elisabeth Suzen

Abstract: SI is a voluntary programme of professional guidance under the leadership of the students themselves. The purpose of SI is to improve student performance and reduce interruptions to studies through collaborative learning strategies. SI complements regular teaching, where advanced students guide new students. The question I raised in this study was: How do SI leaders understand guidance in the SI programme and how do they experience guidance in the SI programme? The results presented in this article are based on a secondary analysis of a study carried out among SI leaders at Nord University in 2017. A phenomenological approach was chosen in relation to the aim of the study in order to obtain a deeper understanding of how SI leaders have understood and experienced their role as educational facilitators. As a phenomenological study, the data collection process involved primary in-depth interviews and multiple interviews with the same individuals (Creswell, 2007). Two interviews were conducted with each SI leader, one at the beginning of the semester and one towards the end.

The purpose of a phenomenological study is to find the central underlying meaning of an experience. This article presents the results of a study of SI leaders concerning their experience of facilitating an environment that provides opportunities for learning. In guiding the students, the advanced students experienced being in a guidance situation, and it has been important to bring these experiences to light. How do SI leaders understand guidance in the SI programme and how do they experience guidance in the SI programme?

My findings show that SI leaders express an expectation that their work as an SI leader will contribute to their own personal development. They experience that it is important to create a sense of security among the students by clarifying the forms of guidance and adapting the guidance to each student's abilities. They state that as SI leaders, they need to be able to deal with and handle the unforeseen and, through guidance, support and help the students to find their own answers to their questions. As such, the SI leaders perceive themselves as a learning support for the students.

1. Introduction

Student-centred learning through guidance is a key element of the Supplemental Instruction (SI) programme, as for learning in general. During the past decades, we have seen enormous developments in the field of learning and guidance. From a situation where lectures and teacher-led activities served as significant access points to information and knowledge, the learning challenge of today is about critically engaging with widely available knowledge, transformative practices serving both profession-related

but also life-long learning goals, and developing capacities to self-evaluate, self-regulate, and manage one's own learning (Damşa & De Lange, 2019; Boud et al., 2018).

The background to this development is the emergence of post-modern society, which emphasises the construction of knowledge within a social, cultural, and historical context. There is thus more competition for the truth in today's society, which provides more options but also places more demands on individuals to manage this freedom. This is the experience and risk of having to face a world beyond absolutes and yet live and learn in a meaningful way. It challenges students to think and act according to their own perceptions without recourse to recitation or transcending ideals (Curzon-Hobson, 2002). It is no longer the case that someone owns the truth, neither teachers nor others, and this affects learning in that it becomes more of a sequence of guidance. Knowledge is socially constructed, and the dialogue becomes the criteria for truth (Kvale & Brinkmann, 2009; Skagen, 2004). This has influenced how we look at learning, where various student-active learning methods have received increasing attention.

Supplemental instruction is a voluntary programme where advanced students provide guidance to new students in subjects in which there is deemed to be a high risk of failing or drop-out. SI therefore complements ordinary teaching. SI has also proven to have a social value since it is often offered to first-year students who, as a group, are generally new to both the institution and their place of study. It has therefore been demonstrated that SI has both an academic and social function. SI leaders, whose job it is to facilitate cooperative learning at SI sessions, receive training under the programme. SI leaders are students who have previously taken the course, have good academic knowledge of the course in question and have taken a three-day SI leader training course. In the training, they are taught how to facilitate learning by helping the students to cooperate and find their own solutions. My study concerns SI leaders' understanding of this guidance role. The following research question was examined:

How do SI leaders understand guidance in the SI programme and how do they experience guidance in the SI programme?

2. The SI Leader as a Facilitator for Learning

The SI programme defines the SI leader's task as follows: "Their job is to help students think about the lectures they hear and the books they read, and then put it all together during the SI review sessions. What SI leaders won't do is re-lecture" (University of Missouri, 2014, p. 30). The course material also points out that a key facilitation skill is to redirect the discussion to the group (University of Missouri, 2014). The SI leaders are responsible for facilitating discussions about course content and related study skills, and for preparing learning activities (Dawson, Van der Meer, Skalicky, & Cowley, 2014). This indicates that a large part of the SI leader's job is to facilitate learning by *guiding* the students at SI sessions.

Guidance is not clearly defined in the field of education. In the literature, concepts such as counselling, consultation, supervision, coaching, tutoring, and mentoring are synonymous with guidance (Tveiten, 2019, p. 20). Corsini, Wedding, and Dumont (2008) estimated that over 400 theoretical models of counselling currently exist. In their review of the literature on mentoring, Crisp and Cruz (2009) found more than 50 different definitions of the word. Parsloe and Wray (2000) concluded that despite the definitional variety on mentoring, all include verbs like support, guide and facilitate. The most important point, however, is not that everyone has to agree on a single definition but that they should know the definition that applies to their particular situation (Parsloe & Leedham, 2009). In the field of Supplemental Instruction, mentoring, supervision, guidance, counselling, and facilitating have been used. Since the academical staff in the SI programme has the role as an SI supervisor, I have chosen to use the word guidance for the supervision done by the SI leaders, even though the theory mainly uses supervision.

When the SI leaders guide and supervise the students to help them advance in their learning process by redirecting discussion to the group and helping them to think, this is an expression of an understanding of guidance based on a humanistic perspective and humanistic psychology. Supervision is humanistic in nature and can be defined as a formal, pedagogical, relational, and enabling process related to professional competence (Tveiten, 2005). Relationship and dialogue are central aspects, and the supervisor's competence is of great importance (Tveiten, 2005). The supervision is based on a here-and-now situation and is forward-looking (Tveiten, 2019). This is influenced by Carl Rogers' ideas on client-centred therapy, phenomenological understanding and existentialism as illustrated by, among others, Søren Kierkegaard (Rowan, 2014).

Within this framework of understanding, the individual is considered unique and, essentially, inherently good, with the ability to realise their possibilities and deal with their conflicts and problems. The individual has the ability to learn from their experiences, choose their own values, and be constructive and responsible. People have a lust for learning and must therefore be given the freedom to learn without being forced. Rogers was not concerned with teaching methods but recommended that students have resources available and that students are used to providing guidance. This highlights the students as active participants and this line of thinking also forms the basis of the concept of involvement in pedagogical practices.

Outside the USA, the SI programme has also been referred to as PASS (peer-assisted study sessions) and PAL (peer-assisted learning; Dawson et al., 2014). In this context, peer-assisted learning is often used to describe what happens in the SI programme. The SI leader role can in this sense be described as peer support (Ashwin, 2003), and can be seen to have much in common with what is otherwise referred to in the literature as *peer tutors* (PT; Glynn, MacFarlane, Kelly, Cantillon, & Murphy, 2006) or peer facilitators (Ashwin, 2003). Some studies emphasise the difference between collaborative and cooperative learning, while others use the concepts interchangeably. A small number of studies explore cooperative learning and this form

of active pedagogy in higher education (Tsay & Brady, 2010), while Arendale (2004) believes SI to be a programme for collaborative peer learning. Regardless of the choice of concept, the role of the person providing guidance remains the same. They are seen as a facilitator with the aim of guiding groups of students (Van Leeuwen & Janssen, 2019). One important difference between SI and other group work is precisely the SI leader (Lockie & Van Lanen, 2008). The SI programme emphasises using an SI leader to facilitate learning by actively involving the students in their own learning process. SI is a programme for peer learning, the intention of which is to support learning by drawing students into interactive relationships with peers using small groups to facilitate learning (Lockie & Van Lanen, 2008).

There are few studies that examine the benefits of being an SI leader and learning of a more general educational nature (Malm, Bryngfors, & Mörner, 2012). The research that does exist shows that through the SI programme, SI leaders changed their view of what was important in learning (Ashwin, 2003) and gained practice in using collaborative techniques (Couchman, 2009). The benefits for SI leaders include improved communication, interpersonal and leadership skills, and greater self-confidence (Malm et al., 2012). Through the SI programme, the SI leaders realised the importance and value of collaborative learning (Lockie & Van Lanen, 2008). Former SI leaders experienced benefits relating to communication and interpersonal relations skills (Congos & Stout, 2003) and saw the SI leader role as an important source of learning for their future profession (Helde & Suzen, 2019). In different ways, the SI programme gives the SI leaders experience and insight into pedagogical issues. However, as well as there being little research on SI leaders' pedagogical experiences, there are also few articles that specify what actually takes place at SI sessions. The absence of an unambiguous definition of what an SI session comprises is relatively consistent with literature about other academic support interventions (Dawson et al., 2014).

The purpose of the guidance is to facilitate learning, development, and mastery (Tveiten, 2019). There are different approaches to this, including to assist, instruct, teach, provide advice, and be a role model. All of these approaches border on guidance. People need these approaches in different ways in different situations, but they are not guidance – guidance is something different. It is helping others to discover things themselves and to release their own problem-solving forces (Nordbøe & Enmarker, 2017). The purpose and goal are to discover new insights, learning (competence development), growth (personal and academic), and mastery (Tveiten, 2019). Mastery skills as a concept therefore comprises different aspects such as cognitive, affective, psychomotor, personal, and professional (Tveiten, 2019, p. 22). Improving mastery skills means that the focus persons already have these skills but that they are further developed. Guidance therefore means encouraging resource awareness and using these resources expediently (Tveiten, 2019). Tveiten's (2019) view of guidance means that the focus persons themselves have the best preconditions for finding the way that is right for them, and guidance is thus approaching the focus persons with a belief in and willingness to help them realise this. Guidance methods are, as such, different ways of making the focus person's discovery and learning process easier.

Guidance requires conversation (Nordbøe & Enmarker, 2017; Skagen, 2004; Tveiten, 2005), and dialogue is the most important tool. A dialogue might include the supervisor asking questions, challenging, supporting, confirming, and stimulating the focus persons to reflect (Nordbøe & Enmarker, 2017). This dialogue is based on humanistic values and knowledge of guidance, learning, communication, ethics, and other topics, depending on the object of guidance (Tveiten, 2019, p. 23). As such, it is important to create a good relationship and a good atmosphere between the person providing guidance and the focus person(s). The participants are equal persons with different roles. It is the focus person's experiences that are paramount, while the person providing guidance actively participates in what happens and is focused on seeking the other person's perspective rather than their own.

3. Method

The study is based on a secondary analysis of qualitative data from an earlier study conducted among SI leaders in the Road Traffic Division at Nord University. This concerned the topic of SI leader experiences and understanding of SI as an educational tool and SI as a leadership development programme (Helde & Suzen, 2019). The dataset in the original study comprised 14 semi-structured interviews and two questionnaire surveys completed by seven SI leaders. In the present study, the secondary analysis has been performed on the basis of the semi-structured interviews. The transcribed interviews were analysed using interpretative phenomenological analysis (IPA), which is an inductive approach. Smith and Osborn (2003) state that IPA involves a "double hermeneutic" as the researcher is trying to make sense of the participant, who is trying to make sense of their experience. The decision to use this analytical approach was made on the basis of the research question and data from the original study, which employed a hermeneutic phenomenological approach to obtain data from interviews (Helde & Suzen, 2019). The interviews therefore consisted of open questions with follow-up questions, with a focus on SI leader understanding and experiences.

The first step of the secondary analysis was to review the transcribed interviews and extract significant statements or sentences that best described how the participants experienced the phenomena (Creswell, 2007, p. 61). The next step was to combine the statements into overriding themes. The statements were used as a basis to form a description of what the participants experienced (Smith, Flowers, & Larkin, 2009). For this part of the process, I used abstraction (to group together similar statements from participants), subsumption (underlying recurrent themes in the statements that deserve a separate status), polarisation (differences between the statements), frequency (how often they occur), and function (whether the statement has an underlying meaning) (Smith et al., 2009). In this last level of analysis, I developed a theoretical discussion of the main tendencies in the material in line with interpretive phenomenology (Webster-Wright, 2010), the goal of which is for the reader to be left with a

better understanding of what it is like for someone to experience this (Creswell, 2007, p. 62). In phenomenological research, experiences are open to different interpretations (Suzen, 2018), with the most important factor being to strive to understand our participants' perspectives as best we can.

To maintain anonymity and confidentiality, pseudonyms were assigned at the point of collection of the interviews, and everyone was given male names. When writing the study, all details that could reveal the identity of the participants were suppressed.

4. Findings and Discussion

The main tendencies in the material are presented by theme and together describe how guidance in the SI programme is understood and experienced from an SI leader's perspective. The following six themes emerged from the data: (a) expectations concerning own personal development, (b) creating security by clarifying the form of guidance, (c) adapting group guidance to individual abilities, (d) dealing with the unforeseen, (e) helping the others to find their own answers, and (f) being a learning support. These are presented below.

4.1 Expectations Concerning Personal Development

The SI leaders expect their work as an SI leader to contribute to personal development. As Edward says,

> It's interesting on a personal level to be part of an arena where I get to try things out. Because I will make mistakes, but then I'll try again and again, and then I'll maybe gain some experience from that too.

In guidance, those seeking and providing guidance are both in development processes, or inner journeys towards learning (Skagen, 2004, p. 11). This process is described by, among others, Daniel in the following statement: "I hope that my last class will be better than my first, as such." They expect to be personally challenged, and that this will contribute to their personal development and growth. Andrew stated that he had chosen to become an SI leader precisely because he expected it to be a challenge and that he would not become better if he did not try. This was also expressed by George, who in the same way as the others, expects the SI programme to provide learning: "So I expect it will be good practice for me" (George). "That I maybe grow as a teacher, or that I get that kind of thing out of it" (Frank).

The SI programme includes follow-up of the SI leaders, where they receive guidance from the SI supervisors along the way. This provides learning support in their work. The SI leaders also have expectations related to this role, and that the supervisor would support their personal development. "I expect follow-up of my own role – expect to receive guidance myself" (Daniel). The SI programme at Nord University has used two SI leaders at each session so that they are also able to support each other. SI

can as such be said to have similarities to peer learning, since it also "involves people from similar social groupings who are not professional teachers helping each other to learn and learning themselves by so doing" (Topping, 2005, p. 631).

4.2 Creating Security by Clarifying the Form of Guidance

SI leaders find that the students need to feel secure in order for them to be able to contribute to the guidance. They find it important to prepare the students for this work method. This means clarifying the form of guidance with the students, its purpose, and how it will take place in practice. They believe that this creates a sense of confidence and predictability for learning. It was also considered essential that the students and leaders get to know and feel secure with each other.

> The people who are going to learn something feel secure much faster once they get to know us. That they can share, ask and things. That can be a bit hard when they don't know us or each other – it can make it a bit difficult to ask for help. At least if they think they're the only ones who can't do it. Should maybe keep an eye out and be a bit more aware that maybe not everyone is asking questions, but see whether they understand it, see if they're actually keeping up. (Ben)

To share and reveal their own academic shortcomings, the students need to feel secure, and the SI leaders feel that they are responsible for creating this sense of security. "That they dare to ask more, what you could call 'stupid questions'" (Frank). Trust is a fundamental element in the pursuit of higher learning. It is only through a sense of trust that students will embrace an empowering experience of freedom, and the exercise of this freedom requires a risk (Curzon-Hobson, 2002). C. R. Rogers (1959) describes a secure guidance relationship as a *safe relationship*. The quality of the relationship between the person providing guidance (SI leader) and the focus persons (the students) affects the quality of the guidance (Tveiten, 2019, p. 22). People need relationships in which they are accepted. For Rogers (1967), acceptance is considered the ultimate liberating force since humans both require and give acceptance and move toward self-actualisation.

In addition to creating a sense of security, information about the SI programme could also motivate the students to participate, according to the SI leaders. They find it important that the participants are familiar with what is going to happen and that they prepare the students for the work method. Daniel thinks that the students might benefit more from participating in SI when they get to know the programme, "the students who have likely come so far in the system that they know how it works and will use it in a better way" (Daniel). This entails being assured that what is said and the reactions and reflections that arise are not shared with others (Tveiten, 2019, p. 55). It also means establishing rules and procedures for what takes place. Although the SI leaders are very against establishing clear rules for the SI programme, they recognise that some things need to be made clearer to the students. It is beforehand that

alternatives and possibilities can be assessed and limits and rules for the work can be clarified.

Participation in the guidance should be voluntary because it is assumed that change processes are most expedient when they are voluntary. As such, it is assumed that the ability to tolerate the consequences of increasing awareness is greater when the process is voluntary (Tveiten, 2019). Participation in SI sessions is voluntary, and the students attend of their own free will, which in turn could make them more open to guidance. This is also mentioned by the SI leaders, who feel that one of the most important aspects of the programme is that it is built on a voluntary approach and has the flexibility to be adapted. However, the framework must be clear in order to create a sense of security.

4.3 Adapting Group Guidance to Individual Abilities

SI leaders find it essential that SI sessions are perceived as meaningful by the students. To achieve this, each individual student is addressed based on their level. The SI leaders believe this adaptation of guidance to each student's abilities to be a key factor. This applies in particular to personal abilities.

> It is in any case an advantage to include everyone. But then not everyone is as comfortable in group situations, and then you have to be considerate in relation to that too. It would be a shame to scare people away from SI, that would just make it worse. So yes, I think it's fine to try to get them to cooperate, but not force anyone into anything. (Frank)

Although dialogue is emphasised in the SI programme and in guidance in general, the SI leaders are keen to point out that taking part in discussions does not come naturally to everyone.

> That's quite individual too, because it's not a given that taking part in a big discussion works for everyone. Some people probably learn by listening to the others having a discussion as well. That's also possible. But we need to find that out in one way or another. What's easiest for them and what they like, and it has to work for them too. If not, they won't come again, and then we're no better off. (Andrew)

Everyone needs to feel integrated, and the SI leaders feel that this is their responsibility. However, the SI participants will naturally be at different levels, academically speaking, and it is important to reach everyone at their level. The SI leaders are therefore concerned with creating good learning processes and that their guidance is on the students' premises. This means, among other things, listening to the students and allowing them to steer the guidance process. As George puts it, "It pays to follow up the things that people wonder about."

The SI leaders are also keen to ensure that the work method itself is adapted to the participants' different abilities. They believe this is also about how they behave in relation to the students.

> What I normally do, I need to be a bit careful about how I approach them physically. There are some methods for that. Maybe be a bit quieter, not use quite so loud a voice. What I ask them about is a bit private. Look a bit at what they do, and ask what they think about the task itself, so they can admit that it's difficult. I understand that not everyone manages to keep up the same progress … That the people who actually need SI get help. (Edward)

This is an expression of recognition of the other person, where they approach the individual students with acceptance and respect when providing guidance. This is a fundamental recognition that must exist in order to meet the intention of the guidance (Gordon, 2012).

Approaching the individual at his or her level is arguably a basic principle of providing guidance. As philosopher Søren Kierkegaard (1813–1855) wrote about the art of helping: 'If one is truly to succeed in leading a person to a specific place, one must first and foremost take care to find him where he is and begin there. This is the secret in the entire art of helping' (Kierkegaard, 1998). As emphasised by Kierkegaard, the guidance begins by the person giving guidance placing themselves at the service of the recipient. These are fundamental ideas in existentialist philosophy and are more generally accepted in current guidance practice. Approaching the individual on their terms is also the starting point for the zone of proximal development concept, as described by Vygotsky (1978).

Dialogue is the most important work method when guiding the students. In SI, the SI leaders emphasise the use of questions, active listening and the importance of giving the students time. It is possible to stimulate reflection and dialogue by asking questions (Tveiten, 2019, p. 217). In principle, the person providing guidance should not give the answers but enable the person to find out how to find the answers, which is also described by the SI leaders in this study. This can be challenging for some and is conditional on the person receiving guidance being familiar with what the process entails and that they are prepared and able to receive guidance. The SI leaders emphasise that the students should be well-informed about the work method and the importance of creating a sense of security by clarifying the form of guidance.

In the SI programme, it is emphasised that the way the sessions are organised should enable flexibility in terms of adapting them to participant needs (University of Missouri, 2014). In coaching, a goal is often key, but in the form of guidance provided by the SI leaders, such emphasis on goals is not part of the work method. The most important thing to the SI leaders was that the guidance was adapted to each individual student and that all students can participate on their own premises. The SI leaders found relational aspects of guidance to be more important, where they have a process-based focus rather than a focus on the goal or product.

4.4 Dealing With the Unforeseen

The SI leaders did not believe that the SI sessions could or should be planned, since SI calls for flexibility, which in turn requires the SI leaders to deal with the unforeseen. This is because it is the students who should benefit from being there, they believe, and the activities and sessions must then take place on the students' premises, thus requiring the leaders to be able to handle what arises.

> What is important to me is that the student has a positive experience of the session to then come back later and work more on the material … if we have a plan for the session, it can quickly become us steering the students away from a good learning process. (Edward)

They emphasise not preparing for sessions, since this could in the worst case be detrimental to the student learning processes. Their attitude is therefore to be prepared for most things: "We asked them what they wanted to work on. So we didn't have much control over what needed to be done really" (Ben). SI leaders work in a dynamic context. In this context, C. Rogers (2012) emphasises that guidance is not a static method or a set of techniques, but a process that is in constant dynamic change. Guidance must be adapted to student needs and tempo, which are constantly evolving. The students are also different, and the SI sessions must be adapted accordingly: "I believe that SI should have a platform where there is room for everyone" (Chris). The dynamic process means that the guidance can take different tracks, and the SI leaders state that these sidetracks can hold great learning value. They deem it important to follow up the sidetracks at times since they may wish to clarify something basic, for example, assumptions.

> You learn more by incorporating other things. The more you draw in other things in a conversation, the more you learn. I mean, that someone says something the others have wondered about, but haven't dared to ask about. It's better to let the conversation flow than that you have to talk about something. (Ben)

> If it gets sidetracked into something more basic, I think it's very important to focus on the basic bit. (Frank)

These sidetracks can also be important to the social environment at the SI sessions.

> Sometimes, I think it's important to sidetrack in order to make it more fun. You need to see whether people are tired mentally or should maybe take a break instead. It really depends on the situation – it's sort of intuitive. I need to read the people there to see whether we need a break or whether it's OK to sidetrack for two minutes to gain focus or look at it afterwards. (Edward)

> I think that's just fine by me. If they want to talk about something else, that's why I'm there in a way, to listen to them and not necessarily find the answer. I think that we're there to help them and not to get through an agenda. (Chris)

However, they also feel that it is important not to let the students sidetrack too much since this can also be detrimental to others.

> But if one person is sidetracking, maybe you should try to return to the focus; "we're in the middle of an assignment, can we do that first?" for example. A bit like, "Don't try to stop it, but take it and try to find out what we should do – should we take a break, try to find the focus again?" (Chris)

According to C. Rogers (2012), one of the misunderstandings related to the role of the person providing guidance is that they want to adapt so much that they become passive and do not become sufficiently involved. This can be perceived as rejection by those approaching them and does not lead to the perception of being valued (C. Rogers, 2012, p. 19).

The SI leaders perceive the challenge of dealing with the unforeseen as a learning opportunity and a possibility for personal development. "So there'll obviously be occasions where nothing goes as planned. But that's just an experience in itself" (Andrew). The SI leaders express the ability and desire to put the others, the students, in focus during the guidance process. This is something that is generally considered a challenge in guidance and a difficult task for the person providing guidance (Gordon, 2012). As Daniel says, "I just have to improvise until they get the outcome from the session they need … we need to get to grips with the problems where they are."

The SI leaders do not want a fixed agenda for the sessions since they do not believe it to be in line with the intentions of the SI programme either.

> I mean, it's not important that they turn out as planned. Because if we plan to bring up something, it may be something completely different than the topic the students want to bring up. And then it's better to discuss what they want to bring up, rather than what we want to bring up. Because they're the ones who are supposed to learn. (Ben)

> We don't go there with a specific plan, it's more of an intention, maybe. An aim, not a goal. (Edward)

However, they do indicate the importance of being prepared themselves – that they go through both academic content and other possible tracks in advance. In certain cases, a plan can function as a lifesaver if something goes awry.

> It's obvious that if we have a bad plan, the student can easily get a bad impression of what we're actually doing. So, the plan isn't important, but then it is important all the same. Don't waste the time of the people who come, that those who come feel that coming there creates a good outcome for them and that it's great to be here. (Edward)

They state that the guidance is not streamlined and that they need to be open to what comes. The most important thing is that the students experience it as something good, they believe.

4.5 Helping the Others to Find Their Own Answers

The SI leaders state that SI is about the students finding the answers to their own questions together and that SI leader guidance should help and support the students in this process.

> Helping others to find their own answers, as long as we don't cross the line to them needing a psychologist, in a way. … Helping others to find the answers to their own learning without giving them the answers – they should find the answer. … Ask open questions, never give the focus person an answer, since the whole thing is about the person finding the answer themselves and achieving a sense of mastery and ownership over the answer that emerged. And through the discussion together, let the focus person find the answer. (Chris)

The SI leaders also feel that even if the answers are not always the best, it is still important that they do not intervene and give advice but let the students think out the answer themselves and discuss it further: "If they have a theory, they can try it out and see if it's right. If it's not, they can find another way as a group" (Ben). This is related to the SI leaders' understanding of guidance and their role in it, which they point out is to support rather than to teach or give advice.

> Instead of opening the door or getting people through the door, I just point in the direction of the door, which is even further away from the goal basically. And I've never really been there before, never that far away. … Instead of standing there with the answer and, in a way, feeding it to them, I stand far away and point. As far away as you can get really. (Edward)

In this work, the SI leaders feel that it is important to ask open questions that invite the students to reflect.

> Maybe not be that specific in the questions you ask … maybe try to ask slightly more general questions so that they have to think more themselves and discuss it in the group … not lead them, not make it easy for them to find things out. I think that can help them to discuss things among themselves. (Frank)

In this work, dialogue is the most important tool, and this dialogue forms the core of the guidance.

> This should be an open discussion where they do assignments, we're there to guide them through the assignment. It doesn't have to be more complicated than that. … It's easier with a slightly open discussion and group dynamics. I mean if you're like 30 people in the auditorium, it's very difficult to have an open group discussion. It can easily feel like more of a teaching situation. (Chris)

In this student cooperation, the SI leaders also see that they have a role in and responsibility for them working well together. This means that when guiding them, they may need to step back and let the process take its course.

> So it's important to bear that in mind, to get them to work well together. And it might not be a bad idea that I – that the less I say the better, maybe. That they work, if they manage to work together, I think that everyone in the group will get more out of it. (Frank)

In this, there is a belief in student cooperation in a group, or that "the group as a whole can provide for itself better than can any single member of the group" (Gordon, 2012, p. 235), which is an expression of group-centred leadership.

The SI leaders are clear that they should not give the students the answers, and nor do they want to give them too much advice and tips, since they want them to work and find the answers themselves. The guidance is more a form of support to find a direction in which the students can go. "You steer the line of thinking towards where you think it will be useful" (Edward). The challenge of providing guidance in something you are personally skilled at is that it can easily go over to teaching or just giving advice. Guidance in professions, as is the case in SI, is both academic and personal since it is one's own practice that becomes the object of reflection and modification (Tveiten, 2019).

The SI leaders have experienced that they need to tolerate silence, be patient with the SI participants and not give them answers and advice immediately, even though it may be tempting, and instead ask open follow-up questions. "Maybe let it go a minute longer so people kind of have time to think" (George). Giving time and space to silence can also be challenging in guidance situations and is what those providing guidance often struggle with the most (Gordon, 2012): "Really just keeping quiet sometimes. … So I personally have to learn to pull on the reins there. I learnt quite quickly that I just have to try and be patient and rather try to ask the right questions" (Daniel). When they manage to do this, they experience that the silence is important to let the students think.

> The most interesting thing about this as a work method was to use silence as a coach. To use the gaps and silence to let the person think. Don't be bothered about the silence, that it's awkward. Just continue to not say anything, maybe the focus person will find out more reasons. Very efficient. (Chris)

The silence can also get student thoughts onto a different track.

> I don't necessarily think it's awkward that it's quiet, because it means that they're thinking. Then there's someone or other who starts to think along other lines and starts to wonder a bit, doubt a bit, yeah, I don't know what that could be. And starts asking, and then you get a conversation going again. (Chris)

Providing support to each individual so that they can find the answer themselves is an understanding of guidance that can be related to a phenomenological perspective, where perceptions and experiences lead us to the case itself. The SI leaders do not, for example, express a master–apprentice perspective, since they see the non-master, i.e., the students, as the masters of themselves. The person providing guidance is not the

expert but rather facilitates the others to find their own problem-solving skills. This represents something different than giving advice and recommendations. According to phenomenology, understanding is far more important in interpersonal interaction than explanations and causal analyses.

4.6 Being a Learning Support

Approaching the individual at their level and supporting them in the process of finding the answers themselves has a strong connection to the SI leaders' understanding of the purpose and intention of the guidance. They describe their own role as a learning support: "You should in a way pull the strings a bit … you ask the right person the right questions at the right time in the right way" (Edward). The SI leaders experience that guidance under the SI programme is related to learning and that through it, they help the students to develop a different academic understanding: "It emerged at some point when I talked a bit about *why* things are like this and that in the different assignments. That you develop an understanding instead of just 'you should know this, you need to revise this'" (Chris).

The SI leaders express a clear understanding of roles, where their job is to provide guidance: "We're not supposed to have a teacher role, but we should have a role where we bring students together and motivate without teaching, in a way" (Edward). They also find it beneficial that there are two SI leaders at the sessions. This enables them to support each other in their roles and work together as a team.

> We can support each other, help each other and avoid having to stand there by ourselves really. It's easier when there are two of you. I think it works better for me at least than if I'd been stood there by myself. I don't know what I would have done if I couldn't, well if I got completely stuck or something, or got really thrown off. I don't think that would've gone that well. (Andrew)

The SI leaders feel that SI is a positive learning support for the students. They perceive the guidance they provide as contributing to student understanding and sense of academic confidence. As such, they feel that the students gradually contribute more to the discussions. They do not always perceive the students as feeling confident initially, but they in any case grow from their participation in SI. "You see that they are proud, in a way. They become a bit more enthusiastic about taking part in the teaching and talk and say what they think" (George). The SI leaders believe that SI gives the students self-confidence, both academically and personally. The students also develop independence through SI, and, in this way, the guidance contributes to a self-development process. Contributing to student development is the SI leaders' main motivation. They also see that this is a two-way job and contribution. "When you see that it works, that's a bonus in itself. That's what's fun. When I can help them to understand it and that we both make it work from our different positions" (Andrew).

The SI leaders themselves find it motivating when they experience that their guidance supports learning.

> When you're there working with them and trying to get them to reach a higher level and they actually do, that's a good feeling. (George)

> I'm really happy about the time we noticed that the level was far too much for them. That we then divided them into groups. There were no questions, we just did it really. And then everyone got the help they needed. I think they really appreciated that. It seemed that way at least, and I think it was good to see that they seemed happy and were enjoying it. They said afterwards that they got a lot out of it. I think that was really good at least. (Andrew)

This is also related to their interpersonal skills and understanding.

> If you want people to have common sense and good attitudes, you need to treat people as people" (Edward).

> I think that praising what is good can quickly pay off. … Pat on the back, in a way, when it seems like everyone has gained an understanding. (Chris)

In this way, the SI leaders express an understanding that is in line with Carl Rogers' principles of congruence, empathy, and a positive fundamental attitude in communication and relations work. That communication is congruent means that it is genuine and unambiguous. When our feelings, words and actions are in accordance with each other, our communication becomes congruent. Rogers emphasises the importance of the guidance being genuine. Empathy is also only meaningful to the degree it is genuine (C. Rogers, 2012).

> Being able to be there for others I think is great. I think it's a good way of doing things. It's a bit grown-up in some way or another. It's not like "I know everything, they don't know anything." It's more like, "I show them the door, they have to walk through it." I think that's interesting. (Edward)

5. Implications and Further Research

Guidance always concerns other people and will always contain an ethical dimension. It is important to be aware of this ethical dimension, and that each person has an awareness of the various ethical aspects of guidance. SI involves a guidance relationship between students, but there is currently little research on the ethical aspects of this relationship.

In this study, I have looked at SI leader understandings and experiences of providing guidance under the SI programme. It would also be interesting to investigate SI participant experiences of the guidance they receive. A natural continuation of the study would also be to observe SI sessions to look at how the guidance process takes place and what happens in the interaction between SI participants and SI leaders.

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4. A Comparative Study of Supplemental Instruction and Small Group Teaching

Per Sigurd Hundeland & Petter Pettersen

Abstract: The development of supplemental instruction started in 1973 at the University of Missouri–Kansas City. At the same time at Agder College in Kristiansand in Norway (now University of Agder), small group teaching (SGT) was born as a teaching method. At Nord University, the students at the driving instructor education use SI in service courses in law and physics. The students at the Business school use SGT in service courses in mathematics and statistics. In this chapter, we present a comparative study of these two teaching methods. The research question that directed the study was what significant differences can be identified between SI and SGT.

We investigated this question both from literature studies and from written responses from students from both groups. From the written response we identified similarities and differences in the two student groups with respect to the following aspects: The preferred learning arena, the students' own descriptions of the organisation of the sessions, how the students characterize the collaborating process, whether they gain insight in any learning strategies, and the role of the senior student that is responsible for the sessions.

From our results, we have identified many similarities between the two principles for collaborative learning. The main conclusion is that the two methods can learn from each other. The SGT method will benefit if the teacher assistants that are responsible for SGT get a formal training similar to the training given to the SI leaders. The availability of small group room areas in SI sessions will increase the cooperative learning between students since the groups then can work together without interruption from other students.

1. Introduction

There is a lot of documentation on students dropping out or failing to pass on exams in higher education (Hurley & Gilbert, 2008). This is problematic and costly both for society and for the students. It is important to try to reduce the dropout and failure rate by increasing the quality of education. In this chapter, we present a study concerning two principles of collaborative learning that can be used to increase the quality of education. The development of supplemental instruction can be traced back to 1973 at the University of Missouri–Kansas City in the US. At the same time Agder College in Kristiansand, Norway (now University of Agder), established small group teaching (SGT) in their study programmes in mathematics. In this chapter, we present a comparative study of these two methods, which both emphasise student collaboration and senior students in important supervision roles. The authors have

first-hand experience with SGT both as instructors and as students who participated in small group sessions during their student days.

At Nord University, the driving instructor education programme uses SI in service courses in law and physics. The students at the Business school use SGT in service courses in mathematics and statistics. By using written questions, we asked a limited number of informants from the two student groups about their benefit of the teaching method they were given. We focus on the mathematics course at the business school and the physics course at the driving instructor education. By analysing the response from the informants in addition to research reports from SI studies and studies in general on group work in mathematics teaching, we present insight concerning strengths and weaknesses of both SI and SGT and discuss similarities and differences between the two teaching approaches.

Most studies on SI emphasise the difference in student performance according to whether or not they participate in SI sessions during their study, as in Malm, Bryngfors, and Mörner (2011). It is difficult to state whether the SI or SGT have direct causal influences on students results. Therefore, through our research approach, we will try to uncover factors that may explain how students may benefit from participation in the two different teaching settings. Almost all studies about SI are performed by researchers that are involved in it themselves. However, the authors of this chapter were entirely unfamiliar with the method until this work started. We are therefore not biased about SI, which may be considered as a strength for this study.

The authors studied mathematics at the University of Agder in the period 1993–1996. A key part of the service for the mathematics students was SGT, and the authors experienced this method from the student's perspective. Later, both authors practised SGT in their own teaching of mathematics, both for business students and in the teacher education programme.

2. Research Questions

In this chapter, we focus on the following question:

What significant differences and similarities can be identified between SI and SGT?

The question may be thrown light on from different perspectives. We have studied literature presenting both methods, SI and SGT. We have analysed written responses from students from both groups, and we have related informant statements to the requirements stated in the literature for how these methods are recommended to be organised. We have also drawn on our own experienced as mathematics teachers.

3. Research on Supplemental Instruction and Small Group Teaching

In this section, we report from some studies about the two teaching methods. At the end of the section, we state the similarities and differences between the two methods.

3.1 Supplemental Instruction

According to Hurley and Gilbert, Supplemental Instruction emerged in 1973 at the University of Missouri in order to decrease the attrition rate among students (Hurley & Gilbert, 2008). Later, the SI model expanded worldwide. In this section, we briefly outline some of the characteristics of the SI model.

The SI model is recommended to be an appropriate approach to teaching in so-called high-risk courses. This includes for example courses with large content, complicated or advanced textbooks, courses that demand high cognitive skills, and courses where students, to a great extent, are left to themselves to acquire the learning outcome. In opposite to lecture-based teaching, the SI model emphasises a student-centred model, which, as in the name of the model, supplement the ongoing teaching in large classes.

In comparison, in an ordinary class, the students may feel that there are limited possibilities to ask the professor to elaborate on difficult issues or offer an argument for a claim in an alternative way. A large class consisting of many students does not necessarily offer a secure environment for exposing one's own lack of understanding. In the SI sessions, students meet in smaller groups than in lectures, where there is an opportunity to feel comfortable with the situation.

In every SI group, a senior student named SI leader organises the sessions. One important task for the SI leader is to facilitate the students to discuss and grapple with difficult concepts and solve complex problems. Hurley and Gilbert emphasise that "the SI leader guides students in learning appropriate applications of study strategies such as note taking, graphic organizers (visual learning aids such as concept map or matrices), questioning techniques, vocabulary acquisition, and test preparation" (Hurley & Gilbert, 2008).

One important aspect concerning the organisation of the SI sessions is that the focus should not be to achieve learning through drill and memorization (Hurley & Gilbert, 2008). The SI leader should rather give priority to develop students' understanding of the key concepts in the course curriculum. One way the SI leader can achieve this is by asking open questions or "why-questions" in order to facilitate the students to reorganise their thinking and inspire them to discuss with each other.

Hurley and Gilbert address a few success factors that have been identified through decades of running SI around the world (Hurley & Gilbert 2008). They state that SI does not work well in courses that are perceived by the students as being easy. Neither does it work well if the course instructor ignores to support the programme or does not encourage the students to take part in the SI session. A part of this picture seems

to be that it is important that the SI leaders and the instructor collaborate, and that the SI leaders should attend the lectures so that he or she has up-to-date knowledge about the content and possible difficulties the students will meet in the course.

3.2 Small Group Teaching

In this study, we use the term SGT as described in Dahl (1994, 1995). These two papers can be viewed as documentation on the SGT method. Unlike SI, the SGT method is not a method used worldwide, and it lacks the enormous documentation and research community built up around SI. In Dahl, the history of the start of SGT in Agder College is outlined as an emergency solution when the only available location for teaching 140 students was a former hotel in the 1970s (Dahl, 1994). The students worked in small groups in hotel rooms because the university lacked available classrooms. The instructors soon observed that the students enjoyed working in these rooms where the instructor was not present at all times. Separate rooms implied that the student groups did not disturb each other, which has been emphasised as an important aspect of SGT.

Dahl recommended group rooms with tables and chairs in the middle of the room, where the students were sitting face to face. An essential tool in the room is a blackboard, which may serve as a mediator for discussions between the students. As a practical sign to indicate that the group needed supervision, the garbage bin put out in the corridor served as a call for help from the instructor or TA. According to Dahl, the ideal group size is between five and eight students, and a recommendation of seven is given when the students form groups. One teacher can provide service to about seven groups. If there are more students participating in the course, additional teachers or TAs are hired. Dahl recommended TAs because they communicate very well with the students because of their own recent experience from the course. The experience is also that TAs that have had successful group teaching themselves do not need much instruction for the TA job. The TA job with SGT is not a well-paid job, but Dahl says that it is a popular job among senior students because they get the opportunity to practice their competence.

Dahl emphasises that SGT increased student motivation, learning outcomes and results in a positive way, and is an efficient use of teaching resources (Dahl, 1995). In this paper, he also gives more detailed instructions on how to manage SGT. In Dahl, there is an overview of the small group room facilities at the University of Agder in 1994. At this point, they had left the hotel, and the newly built campus had acquired areas suitable for small group teaching (Dahl, 1994).

Researchers in mathematics education at the University of Agder have done a lot of research on SGT. Borgersen, Cestari, and Bjuland provide an overview (2010). Examples from this research with emphasis on mathematics are developing suitable mathematics problems for SGT and developing problem-solving skills in mathematics during SGT. In addition, there have also been studies with a more general focus on communication and education.

3.3 Similarities and Differences Between SI and SGT

We start with a bullet list of similarities between SI and SGT based on the literature:

- Both methods build on the assumption that collaborative learning among students, so-called peer-learning, promotes learning in a better way than one-way communication from the lecturer.
- The SI leaders are recruited among students who previously have taken the course with an excellent grade. This is quite similar to the recruitment of TAs to SGT.
- At the SI sessions and the SGT sessions, learning by collaboration between students and supervision by an SI leader or a TA are important aspects.

There are also a lot of differences between SI and SGT. The most relevant differences for our study are given in the following table.

Tab. 1: Some differences between SI and SGT

SI	SGT
• The SI sessions do not have requirements of a particular group size or that the sessions should be held in a particular type of room. The SI method gives guidelines on how the SI leader should give supervision to the students.	• The students work in groups consisting of 4–7 students in group rooms and call for supervision from the TAs when it is needed. The SGT method does not recommend a particular supervision style to the TA.
• The SI leader is not a faculty. The lecturer is not a part of SI, but it is important that the lecturer holds a positive attitude toward the SI model.	• The lecturer participates in the SGT, but the SGT is often served by TAs, which are senior students that have previously taken the course. The lecturer hires the TAs.
• SI is a supplement to the ordinary service given to the students.	• SGT is a core part of student time schedules.
• SI sessions are given in high-risk courses. These are courses with high failure rate, high withdrawal rate etc.	• SGT is given in all courses at a bachelor's programme in mathematics.
• An SI leader goes through a certified training programme.	• There are no formal claims to become a TA on SGT.
• The activities in SI sessions are not exclusively limited to the subject matters but also concern general study strategies.	• In SGT, the focus is on solving problems and understanding concepts.

SI	SGT
• The SI leader should attend the lectures of the course in order to have up-to-date information about the course content and to be a role model for other students.	• The TAs are not involved in the lectures. They receive information in advance about which exercises the students are engaged in from the course instructor. They prepare for their supervision and supervise the groups that call for assistance.
• SI sessions do not require special building facilities.	• In SGT, the availability of small group rooms at the campus is essential.
• SI has been adopted by a lot of universities worldwide. It has become an enormous teaching and research community.	• SGT with group room and the garbage bin to call for help is still something special for the University of Agder and has only been adopted by a few other universities, as in Nord University.
• The SI leader both participate in the lectures and run the SI sessions and must be paid for both. This is also time-consuming for the SI leader.	• The TAs are only paid for the SGT sessions; thus, it is more effective with respect to costs and time.

4. Implementations at Nord University

In this study, we report from implementation of SI at the driving instructor education and SGT at the business school, both at Nord University in Norway. Here we explain what implementations and interpretations of the SI and SGT methods have been made.

4.1 Supplemental Instruction

At the faculty of the driving instructor education, they follow the standards of SI except that every SI session starts with two SI leaders, and then they split the group in two if necessary. They run four sessions every week, and a session lasts for two hours. The students do not need to sign up for the sessions. Between 5 and 25 students show up at each session. At the SI sessions, the students can make subgroups, either as a result of supervision from the SI leaders or by the student's own decision.

The lecturer at the driving instructor education is very passionate with SI as a teaching method. For a while, he was the only one at the driving instructor education that used SI, and he was probably the first in Norway that started with the method. Then more instructors at the driving instructor education followed, and in recent times more universities in Norway have started with SI.

4.2 Small Group Teaching

P. Pettersen, one of the authors of this chapter, is a mathematics lecturer at the business school. He benefits from SGT as a student and is also passionate that his students should have the same positive benefit from SGT as a core part of the mathematics education. The implementation of SGT at the business school at Nord university is as follows. The recruiting of TAs takes place among the students that have excellent grades in mathematics and statistics and are motivated for the job. The students at the business school are educated in mathematics and statistics in their first year of the bachelor's degree. The TAs are second-year students or older students. Most of the TAs keep their job through the bachelor's degree and the master's degree if they also take the master programme at the business school. Then the new TAs can learn from the experiences from the more experienced TAs.

Nord university always emphasises to have gender equality among the TAs. The students appreciate that TAs are of both genders. The working conditions among the TAs also benefit from gender equality. The job as a TA is popular among the students, and recruiting qualified TAs is never a problem. To have a TA job on the CV and a letter of recommendation with a description of their work as a TA is valuable for a student when heading for the job market.

In the course, there are scheduled two SGT sessions that each lasts two hours every week, and it is recommended that students participate in one of these sessions. Many students find the work at SGT so fruitful that they participate in both sessions.

We use a part of the teaching areas that consists of group rooms. Every group room contains a maximum of 8–10 students, and almost all group rooms have a blackboard. In Dahl, we learn that the availability of enough group rooms is essential to make SGT with high quality (Dahl, 1994). The author (P. Pettersen) experienced the importance of the availability of group rooms when he arrived as a lecturer at Nord University in Bodø in 1998. The buildings where the students were taught lacked small group rooms. He tried to organise SGT in an ordinary classroom with small groups in each corner of the classroom. The problem arose when the groups got stuck with problems. Some students then consulted the other groups instead of focusing on the problem-solving process in their own group. The idea of placing each group of students in separate small group rooms is crucial for SGT in order to facilitate genuine collaboration between students. In 1999, Nord University started planning new buildings, and P. Pettersen strongly advocated to give priority to space for group rooms. At the campus in Bodø, there are now areas that are well-made for SGT.

Dahl says that one teacher can help seven groups where every group consists of between five and eight students, totalling approximately 45 students (Dahl, 1995). For the service courses at the business school, we have increased the number of teachers so that there is one TA for every 30 students.

Sometimes the instructor also participates in the SGT, depending on the instructor's teaching load the semester in question. Hurley and Gilbert state that one of the strengths of SI is that the instructor does not participate in the SI sessions (Hurley &

Gilbert, 2008). The students then feel freer to ask questions and can be sure that it does not affect their grades. Our experience from SGT is that the students appreciate that the instructor participates in SGT. Perhaps the Norwegian system with anonymous exam papers and almost always an external grader at the exam makes the Norwegian students feel free to ask both instructors and TAs. From the literature on SGT, we also see the advice about anonymous grading in order to prevent that students try to hide their lack of understanding when they receive supervision by the instructor in the setting of small groups (Dahl, 1994).

5. Methods

Initially, we planned a survey for all the students in both groups, the SI students and the students that were undertaken regular group teaching in the mathematics course (SGT). Our plan was that the students were going to take a survey as a part of a teaching session. Due to the coronavirus crisis, we had to adjust the data collection to a voluntary survey for those of the students that found it interesting to share their thoughts about their experience by working in groups with other students, either in SGT or in SI.

Following this track, we identify our study to be close to a comparative case study, in which we study two contrasting cases (Bryman, 2008). According to Bryman, a comparative case study may include examining particular issues or phenomena by using the same research instruments in both cases. He states that "the aim may be to seek explanations for similarities and differences or to gain a greater awareness and a deeper understanding" (Bryman, 2008, p. 72).

In this study, we see the SI student as a representative or typical case for students participating in SI sessions in general. In that way, we think our study may generate knowledge of general value about how students learn and develop learning strategies by participating in such SI sessions. This knowledge is compared to another type of case, the student group, which is offered SGT teaching as described above. The SGT students were asked the same questions as the SI students. Our interpretations from the data are mainly related to the informants' qualitative statements. Our data set will, therefore, to a great extent, be treated as written interviews carried out for two different cases.

Our two cases deal with two different ways of organising collaboration and group work among students, and our intention is to identify differences and similarities between these two cases. The digital questionnaire, from now on called the digital interviews, consisted of mainly two types of questions; closed and open questions. The closed questions concern facts as gender, number of years the student has studied, how many students that they collaborated with and their judgement on a Likert scale concerning to what degree the students gained from the teaching and collaboration with mates and TA/SI leaders. We also asked the informants to point out one learning situation that they evaluated as the most fruitful in order to achieve their learning

goals. They were given the choice of lectures, small groups/SI sessions, study alone, study in disorganised groups with mates and others. In our analysis, we have been very careful when using these values due to the limited number of informants and the lack of representativity.

We also posed questions of a more qualitative nature to the informants in order to give them the opportunity to elaborate on their experiences from their own study situations. These questions were articulated in order to cover the central characteristics of the two different approaches found in literature and experienced by the authors. We asked the informants to describe the collaboration in the groups with respect to what sort of support they got from their fellow students and from the SI leader/TA. We asked them to describe how they organised the group work and challenged them to articulate to what extent they learned learning strategies through their participation in the group.

Our analysis was guided by an a priori hypothesis, based on literature describing the SI programme and the authors' general experience from organising group work in general in mathematics education. When trying to give answers to our main research question, "What significant differences and similarities can be identified between SI and SGT?" we were particularly interested in how the students described the SI leaders and their efforts in order to facilitate the students' learning process. It was of interest to us to investigate to what extent learning strategies was on the agenda since these items are emphasized in the literature as important aspects of SI. These aspects separate the SI method from SGT, and we found it interesting to see if these differences were also visible in practice.

A weakness of our method is that we missed the opportunity to ask follow-up questions to the informants in order to get a deeper insight into student experiences. We did not do physical observations of how the two methods were carried out in practice. On the other hand, our open questions gave the informants the freedom to offer their own perspectives. The detailed literature that describes SI and the authors' own experience by running SGT over several years served us with a useful reference frame for our analysis.

6. Results and Discussions

In this study, we aimed to study two groups of students at Nord University in Norway according to their views on working in groups with other students. Students from the business school, taking a mathematics course, were compared with students at the driving instructor programme, reading physics. The students at the business school are served by SGT, and the students at the driving instructor programme are served by SI. In section 4 of this chapter, you can read about the implementations of these two methods at Nord University.

From each of the groups, volunteers were invited to a written interview form which both included questions with Likert scale and open-ended questions. This study

mainly emphasises to give attention to student experiences and perspectives. In this report, our priority is therefore the student responses to the open-ended questions.

6.1 Preferred Learning Arena

We asked the two student groups about which learning arena they gained the best learning outcome from. The alternatives were: SI sessions/SGT sessions, lectures, self-study, unorganized group work with study mates and others. We found that the majority of the SI students emphasised the SI sessions as the best learning arena; meanwhile, the majority of the SGT students emphasised the lectures as the best learning arena. Among the SI students, seven out of ten (70%) claimed that they achieved the best learning outcome through their participation in the SI sessions. For the students participating in SGT, only four out of 23 (17%) claimed that the SGT gave them most learning gain and almost half of our informants hold the lectures as the learning arena that gives the most gain.

How important do the students think their participation in SI/SGT sessions is for their learning outcome? We asked the students, and five out of ten (50%) in the SI group emphasised that they related their participation in the group as important with respect to their result in the course examination. In the SGT group, ten out of 23 (43%) regarded the work in the SGT-sessions as important for their performance in the course.

In both groups, a lot of students claimed that the SI/SGT sessions were important for their results. This is quite similar for the two groups. For the group that has SI, a majority reported that the SI sessions gave the best learning outcome, but for the group served by SGT, only a small fraction claimed that the SGT sessions gave the best learning outcome. Here we find a difference between the two groups. How can we explain this?

When a student participates in an SI/SGT session, the student experiences the strength of collaborative learning, and this is of course important for the result in the course. The two student groups differ in their experience, which we think can be related to the different quality of service given in the two courses. From our informants, we can see an important difference in how the students evaluate the senior students that are responsible for the SI/SGT sessions: Among the students participating in the SI sessions, nobody was dissatisfied with the SI leaders, and many of the students praised the SI leaders' skilfulness. When studying the students participating in SGT, somebody said that not all TAs had the expected knowledge as teachers, but there were also students that expressed satisfaction with the TAs. This difference is most likely because SI leaders have a formal education as SI leaders. SI leaders have taken a course where they have been trained in proactive learning and study strategies (Hurley & Gilbert, 2008). The tradition in SGT is that senior students who have experienced successful SGT do not need much training (Dahl, 1994). At the Business School at Nord University, we follow this tradition. New TAs are given a short pep talk with the instructor and a short list of "dos and don'ts," and then they start the job with the

advice that new TAs should learn from more experienced TAs. The TAs in SGT have achieved excellence in their subject matter (mathematics) and are interested in the job, but they have not been offered any training in supervision or study techniques in order to serve as TAs.

6.2 Organisation of the Sessions

With respect to how the SI and SGT sessions were organised, our findings suggest that the SGT sessions are strictly organised in groups of 4–6 students who called for help when needed. The SI sessions mainly took place in a room with up to 20 students, but there were also reported that some students gathered in a separate group room and returned to the main room when they needed help.

We asked the students to describe a typical SI/SG session. We start with the SI group:

The SI sessions were organised in groups of approximately 20 students. Our informants reported that the turnout varied from time to time, with 10 to 20 students. Only one of the informants reported that he participated in all SI sessions; meanwhile, four participated in nearly all sessions. The rest of the informants participated in approximately half of the sessions.

Their descriptions coincide in that sense that they described the sessions to be centred around solving mathematics (the students call it mathematics, but it is physics) exercises. The aim of the activity was to work with weekly exercises. The focus was not to work with the concepts. The aim of the activity from session to session seemed to be to fulfil the exercises in a proper way.

When asking the SGT-group the same question we find that the most common group size among our informants was 4–5 students in each group room, which is a smaller size than the recommended size of seven (Dahl, 1994). A huge majority (68%) of our informants always or almost-always participated in the weekly SGT session.

When we asked about how they work when they attend the SGT session, almost all of them claimed that the main activity was to solve the weekly exercises. The exercises were given by the lecturer as recommended exercises which covered the content of the lectures the current week. Some of the students collaborated very strictly, they decided what exercises to do, and then they worked through the exercises together. Another student said that they worked on their own and asked the other students in the group when they got stuck. If they did not have resources in the group to find the solution to the problem, they asked the TAs for help. Some of the students also reported that they worked individually without interaction with other students and only asked the TAs for help when needed. Some of the students reported that they had also focused on the mathematics concepts and discussed them in the group session.

Both groups focus mainly on working with exercises and fulfil the exercise schedule. The mathematics course at the business school and the physic course at the driver instructor school are service courses that should help the students to better understand the core subject matters in their education. With the fact that mathematics is

not a core subject matter for the business students and physics is not a core subject matter for the driver instructor students, it makes sense that student priorities are to finish the homework. But of course, their outcome of the courses will increase if they also focus on the concepts in the course's reading list.

6.3 The Students' Way of Collaborating

We found that in both groups, students collaborated and assisted each other in the process of solving exercises. A common feature between the two groups was that the activity was centred around solving predetermined exercises in opposite to, for example, work with and discuss key concepts in the course. Half of the students in the SI group claimed that they had assisted their fellow students during the SI session. We asked them to elaborate in what way this was done. Their answers confirm our impression that there is a high emphasis among the students to obtain a successful solution to the given exercises. Common answers from students were:

- The help consists of assisting the calculation.
- Show how to do it, picture the situation, so that the task became understandable.
- Referring to earlier exercises that I had mastered before.
- Turn formulas, inform about the answer I had calculated myself.
- Yes, I have helped many.

For the SGT students, our informants gave similar descriptions of how they collaborated and helped each other:

- To give good examples
- Visualization of the contexts
- Help fellow students with the interpretation of the solutions
- Look at a problem with another view
- Explain with different words
- How to think in particular situations
- Recommend which formula to use
- How to understand the stuff, before trying to solve the problem

Both in SI and SGT, our data suggest that the students to a large extent collaborated when working with exercises at the SI/SGT sessions. Here, both SI and SGT fulfil the requirements of the method, namely, to increase the collaboration between students.

6.4 Learning Strategies

Developing learning strategies is emphasised as an important element in the SI program (Hurley & Gilbert, 2008). We did not find an explicit emphasis on developing learning strategies in SGT literature, but we asked both student groups to share their learning experience concerning learning strategies developed through participating

in the SI/SGT sessions. Our findings suggest that the SI students we interviewed were not able to concretise learning strategies gained from the SI sessions. The SGT students were able to list many learning strategies directly linked to working with mathematics. We asked our informants specifically to evaluate on a Likert scale from 1 to 5 to what extent they had gained insight into learning strategies. The mean of informant responses in the SI group was 3.6, which indicates that they had developed some knowledge of learning strategies.

However, when we asked the SI students to tell about specific learning strategies which they had learned through the SI sessions, no explicit strategies were mentioned. One of the informants suggested that the SI sessions underpin the importance of working together with other students. Particularly in this course, it was necessary to work with others in order to understand the content of the course. This argument is in line with Arendale who suggest that SI works best in "high-risk courses," meaning courses that demand a high cognitive level (Arendale, 1994). One informant claimed that "in mathematics [but it was really physics], it was repeated training that works, therefore learning strategies are not so important." Other students were in line with this point of view and stressed that working with a lot of exercises is important in order to succeed. One informant gave attention to advice concerning sketching the mathematical situation as a tool in order to better understand how to solve the exercises.

We also asked the SGT students whether they had achieved knowledge about learning strategies through their participation in the SGT sessions. As for the SI group, we asked on a Likert scale from 1 to 5 on their gain of insight in learning strategies through the SGT sessions. The mean was 3.1 of the 23 informants that responded. Even if the development of learning strategies is not a significant part of the SGT method, it is easy to find evidence that supports the claim that many of the students developed some important skills during their participation in the SGT. The students reported important learning strategies they had learned, such as:

- How to organize notes. One example is to have a separate notebook for important concepts and formulas.
- To work with the course content on a regular basis and the importance of never giving up a problem.
- It is effective to collaborate with fellow students. There is a lot of learning in explaining and teaching fellow students. In addition, it gives a valuable review for themselves when they help fellow students with stuff that they learned some time ago.
- Learning by memorizing and doing things several times.

The three first strategies are strategies that may be regarded as fruitful in courses that require a high level of cognitive skills. The last strategies may be associated with traditional, outdated pedagogy.

When we focus on study strategies, we find that the SGT students tell us about more fruitful strategies they use than the SI students, although study techniques are

an important part of SI. This means that even if one meets all of the requirements of the SI method, there is no guarantee that all the objectives of the SI method are met.

6.5 The Role of the SI Leader/TA

Our findings suggest that the SI leader was perceived to be a useful resource who mainly assisted individuals with concrete problems concerning work on exercises. He/she also offered plenary sessions when several students had common challenges where they needed assistance. The TA in SGT was more on distance from the students and contributed only when called on.

Several of the informants emphasised that the SI leader assisted them to fulfil their solutions to different exercises. The informants emphasised that the SI leader's explanations helped them understand how to solve different exercises. What the students did not mention was also of interest to us. No one referred to discussions or elaboration of concepts or theory as part of the group work. All activities were related to solving exercises.

From the statements from our informants, we interpret a potential for more interaction between the students and between students and the SI leaders. To release this potential, the SI session should enlarge its content to be about more than just work with exercises.

Since the SGT students work in separate group rooms, they called for help by putting the garbage bin outside the door. It was only if they were unable to solve the exercises with the resources available inside the group room that they asked the TAs for help. Here we see the effect of increased collaboration by working in a small group room, without the TA present all the time.

As we already have mentioned, many of the students in the SGT groups expressed dissatisfaction with the TAs qualifications, but they still supported the view that the organisation with small group areas facilitated valuable collaboration and learning opportunities between the students. On the other side, the SI students mainly worked in a large room, and the students reported that they worked more individually and got help from the SI leader on a more individual basis than in the SGT environment. As we read in Arendale, the SI leader should "facilitate a process of collaborative learning, an important strategy since it helps students to empower themselves rather than remain dependent as they might in traditional tutoring" (Arendale, 1994, p. 14).

Through the statements from the SI informants, this role of the SI leader is not emphasised or described in detail. But for the SGT group, we assume that the reported success of collaboration may be related to two facts that occurred in our data. First, the physical environment with small group rooms containing blackboard facilitates the students to work together. Second, the fact that the TA was outside the room and had to be actively called for, making it practical to try to solve the problems inside the room to a greater extent than if the TA was in immediate closeness to the students.

6.6 One Important Observation

One of the students from the SI group claimed that the most effective was that a group of students went to a group room and then worked together without disruptions. When they needed help, they contacted the SI leader. This is quite similar to the SGT principle. Students working without disruptions is important in order to develop collaboration between the students. Dahl reported that they tried to make a bigger space for small group teaching by dividing a room with a movable wall (Dahl, 1994). The experience was that even with such a wall, the groups disturbed each other. One of the students from the SGT group emphasised the quality of the group rooms at the university as well suited for SGT. Thus the emergency situation in 1973, when the staff at University of Agder only had a former hotel as available locations for teaching and the students used the hotel rooms as group rooms, gave a valuable teaching method where the physical room is important for the learning process.

6.7 Similarities and Differences Between the Two Groups

We have identified several similarities between SI and SGT. In both approaches, there is an explicit focus on peer learning. In SI, the SI leaders supervise the students during the SI sessions. In SGT, the TAs supervise the students in group rooms when they are called for. The SI leaders and TAs are always senior students that on an earlier stage have fulfilled the course with excellent grades.

Here is a list of similarities in what the informants tell us about their experiences of SI/SGT-sessions:

- The majorities of students in both groups claim that SI/SGT played an important role in their achievements in the course.
- The main focus in both the SI and SGT sessions was to solve and fulfil exercises.
- In both groups, we found evidence that indicated that working together in small group rooms gave benefits due to fewer disruptions compared by being placed in an ordinary classroom.

Our informants also give evidence to some important differences between SI and SGT, which is outlined in Table 2.

6.8 Further Research

Use of a separate small group room for collaboration without disruptions is an essential characteristic of the SGT method. Some of the students that participated in SI sessions stated that they prefer to work without disruptions in a small group room instead of participating in the SI session with the whole group in an ordinary classroom. We think that the availability of small group rooms in an SI session will increase the collaboration between the students and thereby increase the learning outcome from it. As soon as possible, we will get the necessary education to make SI an option

Tab. 2: Some differences between SI and SGT according to statements from students from the two courses in our study

SI	SGT
• The formal training of the SI leader secured high quality of the supervision given by the SI leader.	• Due to the lack of formal training of the TAs the supervising from the TAs is experienced as being of variable quality.
• A huge part of the students claims that SI sessions gives the most learning outcome compared to other ways to organise teaching.	• Many students think that other ways of organising teaching give better learning outcome than by participation in SGT.
• It is difficult to detect the development of fruitful learning strategies even if that is emphasised to be important in the requirements of the SI method.	• The informants reported that they learned a lot of learning strategies, most of them valuable even if learning strategies were not included in the formal content of the SGT.
• In this study, we show that the SI leader gave ordinary tutoring to the students in a classroom. This may be argued to be in opposition to the described methods of SI.	• The small group rooms facilitate the process of collaborative learning between the students without supervision by the TA.
• In our study of SI, the students mainly work in a group of 10–20 students in one room. Our study shows that this is not ideal for stimulating cooperating between students. In the documentation on the SI method, there are not any requirements on what rooms to be used.	• SGT in areas with a lot of small group rooms available facilitates cooperation between the students.

Note. These are findings from our study and are not necessarily equal to the descriptions of the methods in the documentation.

at the business school at Nord University. Then we will make two random groups of students participating in an SI session. One with only a classroom available and one with enough small group rooms available. Then we can measure the effect of having small group rooms available.

7. Why Introduce SI at the Business School?

At the Business School at Nord University, the students in mathematics are served by SGT. It is a high-risk course with a huge failure rate and withdrawal rate. Are there any arguments for also giving SI? Since SI is a supplemental service, it must be given in addition to the regular lectures and SGT sessions that are the main service we give to the students. It is clear that SI has some strengths in the standardised education of SI leaders and access to an enormous teaching and research community.

SI can also be viewed as a leadership development programme, as explained in Helde and Suzen (Helde & Suzen, 2019). A lot of students at the business school head for jobs as leaders; thus, the use of SI will be spot on for the students. To have a certificate as an SI leader, and having worked as SI leaders during their study, will be valuable on student CVs. In addition, SI can be used as a retraining tool for staff due to rapid technological changes. Then all students with first-hand experiences from SI can benefit from this when they are job seekers.

These perspectives on SI are enough to introduce SI as a tool to the students in mathematics at the business school.

8. Conclusion

The literature review of SI and SGT shows that there are a lot of similarities, but also differences, between the two methods. Both emphasise to start learning processes between students, so-called peer learning. In SI, the SI leaders supervise the students during the SI sessions, and in SGT, the TAs supervise the students. The SI leaders and TAs are always older students who have taken the course in question with excellent grades. When analysing informant thoughts about their experiences with the method they participate in, we found confirmation of many of the typical characteristics of the methods but also lack of typical features. The training of SI leaders ensures that no students were in doubt of the SI leaders' qualifications, but for the TAs in SGT, some students were critical of the TAs' qualifications. Even if learning strategies are very important in SI, it was easier to find that SGT has developed participants' learning strategies. Our informants show a lack of development of fruitful study techniques in the SI group.

This study shows that the main strengths of SI over SGT are the formal education of the SI leaders and the benefit of a worldwide education and research community. But our study also shows that even if SI focuses on learning strategies, our informants do not develop such strategies through participation in SI sessions. This is a weakness of SI. Even if SI is used, it is not guaranteed that all claimed benefits will be achieved. Perhaps our comparative study and the detection of weaknesses of the two methods show the necessity of fine-tuning a teaching method to the course and student group in question.

In the end, we want to claim that both SI and SGT can increase the quality of the service given by learning from each other. The SGT method will benefit a lot from giving formal training to the TAs as a requirement for all hired TAs. We also claim that there should be more research in the SI community by using small group rooms. The systematic use of small group rooms may increase cooperation between students. Systematic research on using small group rooms can be a fruitful finetuning of the SI method.

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5. A Reflection on Using Two Models of Supplemental Instruction in Teaching Mathematics for Engineers

Galina Nilsson and Elena Luchinskaya

Abstract: This chapter presents the authors' reflection on introducing different Supplemental Instruction (SI) models in teaching maths-based modules on a range of programmes at University West, Sweden. We share our experience of using a traditional "near-peer" SI model, where senior students act as learning facilitators and a less common "same-peer" model, where learning facilitators come from the same cohort of students.

We discuss our views and research on the benefits and drawbacks of each model in achieving a range of objectives that vary from improving students' motivation in learning maths to providing support to students studying maths. The main focus of our reflection is on the students' experience of attending the SI sessions, the SI leaders' experience in running SI sessions and the role of module convenors for successful SI implementation.

The SI approach was first used at University West, Sweden in 2009–10 on the "Algebra and Calculus I for engineers" module in the BSc Land Surveyors programme for one year. Its objectives were to improve students' motivation, develop their competences and independent learning. Student learning facilitators were selected from the same cohort acted as the student learners. In recent years, for a number of reasons, the exam failure rate on this and other maths-based modules started to increase, and SI has been used since to counteract this. In these cases, senior students acted as learning facilitators and provided additional maths support for students.

The authors used a qualitative approach to evaluate the impact of SI on the students' experience. Analysis of over one hundred students' feedback questionnaires found a positive evaluation of both SI models. The SI group leaders' feedback and interview data provided an insight into how they benefitted from participating in the SI sessions. The interviews with academic staff demonstrated the importance of a close interaction between the course convenor and the SI leaders in achieving successful results in learning maths.

The analysis of the collected data enabled the authors to draw up recommendations on how best to use the two SI models and in which contexts. The authors recommend that the same-peer SI model could be better placed to help students with standalone problems, whereas the near-peer model, where senior students are involved, is better suited to help students bridge specific gaps in their maths knowledge.

1. Introduction

The chapter presents the authors' reflection on using different Supplemental Instruction models in teaching maths-based modules on a range of programmes at University West, Sweden. We focus on two models here: a traditional model, where senior students act as SI leaders – we will refer to it as a *near-peer* model; and a less common model, where SI leaders come from the same cohort of students – we will refer to it as a *same-peer* model. We discuss our research and our views on the benefits of using each model in achieving a range of objectives that vary from improving student motivation to providing support to students studying maths. We reflect on student experiences of attending the SI sessions, SI leader experiences in running SI sessions and the role of module convenors for successful SI implementation. Based on the evaluation of our experience, we propose some recommendations on using these two models in achieving particular objectives.

As educators interested in using non-traditional teaching methods in teaching maths to develop conceptual understanding, competencies and independent learning, we are keen to use new methods in our teaching practice. We started our collaboration about fifteen years ago because both of us were interested in exploring the impact of peer learning on the learning experience. In the beginning, we looked at problem-based and project-based learning (e.g., Luchinskaya & Nilsson, 2007; Luchinskaya, Luchinskaya, Nilsson, & Kristiansson, 2010; Luchinskaya & Kristiansson, 2013) and a few years later we broadened our interest to include SI as a way of achieving our objectives (e.g., Luchinskaya & Nilsson, 2009; Luchinskaya, Nilsson, & Kristiansson, 2015, 2016; Luchinskaya & Nilsson, 2017, 2018, 2019).

Our reflection here covers our experience of using SI since we piloted it for one year at University West, Sweden, in 2009–2010 on the Algebra and Calculus I for Engineers course (then part of the BSc Land Surveyors programme). The objectives of this pilot were to improve student motivation and to develop competencies and independent learning. We used a same-peer SI model in which the SI leaders were selected from the same cohort as the student learners. A few years later, in 2014–2015, we participated together with the other course leaders in another pilot, implementing a near-peer SI model on a few "high-risk" courses at University West. The objective of using SI was to improve student academic performance and facilitate their transition into the second year of study. We used the SI method on the same course as in 2009–2010, however, this time the course formed part of two programmes, the BSc Land Surveyors and BSc Industrial Economics programmes. From 2017–2018, the near-peer SI model has been centrally adopted by University West as an approach for enhancing the learning experience. We used this opportunity to continue implementing SI on the same course because we have already experienced the positive impact of SI on enhancing maths knowledge (e.g., Luchinskaya and Nilsson, 2009).

As with any new method, we have been keen to evaluate the impact of SI on the learning experience to gain valuable insight into what works well and what needs improvement or change when the SI method is used in teaching maths. What makes

our experience rather interesting and valuable is that we are in a position to analyse and compare two different SI models.

We reflect on the results of our qualitative analysis of using SI in teaching maths that we have collected over the years using questionnaires and interviews with students and staff. We designed and distributed the questionnaires to the students who took part in the SI sessions and to the SI leaders. We also conducted interviews with the course leader and some of the SI leaders.

Over the years of working with the SI method, we have analysed over one hundred student feedback questionnaires. We found that students positively evaluated both the same-peer and near-peer SI models. The students liked the friendly environment, the adjustable pace of the sessions and collaboration with peers, aspects of the SI method that are very well known from the literature (e.g., Arendale, 1998, Dawson, Van der Meer, Skalicky, & Cowley, 2014). SI leader feedback demonstrated the benefits of their participation in the SI projects for developing their subject knowledge and transferable skills, outcomes that are well supported by existing research (e.g., Giles, Zacharopoulou, & Condell, 2016; Johnson, Robbins, & Loui, 2015; Lozada, 2017; Podolsky, 2018; Roscoe & Chi, 2008). The analysis of academic staff interviews showed that staff thought that the students benefited from both SI models because the students learned how to formulate, present, and discuss problems with peers, thereby becoming more engaged with the learning process.

Overall, the analysis demonstrated that close collaboration between the course leader and the SI leaders was important in achieving successful results in learning maths.

The chapter is organised as follows. First, we discuss our research and our views on the benefits of each model in achieving a range of objectives that vary from improving student motivation to providing support to students studying maths. Then we reflect on the student experiences of attending the SI sessions, the SI leader experiences in running SI sessions and the role of the course leader for successful SI implementation. Based on our reflections of our experience and research, we draw up key recommendations on when it might be best to use each type of SI model. We recommend that the same-peer SI model is better placed to help students who have standalone problems, whereas the near-peer SI model is better suited to help students bridge gaps in their maths knowledge.

2. Background

2.1 Supplemental Instruction

Peer-facilitated learning has become integral to the student learning process in higher education. It takes different shapes and forms ranging from peer tutoring on high-risk or difficult courses providing subject-specific support to students (for deeper subject learning), through to supporting students lacking required maths knowledge (for remedial support). Peer facilitated learning includes peer mentoring schemes where

peers provide a more pastoral type of support to students. A growing body of literature demonstrates the effectiveness of peer-facilitated learning in every aspect of its application. In this chapter, we reflect on our experience of using a very popular model of peer-facilitated learning, Supplemental Instruction (SI).

SI originated in the US in 1973 (Martin & Arendale, 1992) and has different names in different countries: peer-assisted learning (PAL) in the UK and peer-assisted study sessions (PASS) in Australia (e.g., Dawson et al., 2014). The SI method is underpinned by constructivist theories of learning (e.g., Piaget & Inhelder, 2013; Vygotsky, 1935/1978; Wertsch, 1985). According to these theories, knowledge is constructed through social interaction between people. This social interaction helps the learner move through the layers of understanding, and it is through the learner's participation in the social context that the learning process occurs.

Originally, SI aimed to decrease drop-out rates, improve student performance on high-risk courses and develop competencies and skills (e.g., Bowles, McCoy, & Bates, 2008; Hurley, Jacobs, & Gilbert, 2006; Malm, Bryngfors, & Mörner, 2016; Ning & Downing, 2010; Spedding, Hawkes, & Burgess, 2017). SI has become widely used in the higher education environment and beyond (e.g., Birkett, Neff, & Deschamps, 2017; Dawson et al., 2014; Malm, Mörner, Bryngfors, Edman, & Gustafsson, 2012; Martin, Arendale, & Hall, 1992; Topping, 2005). There is an increasing volume of evidence that demonstrates the benefits of the SI method in a broad range of subjects.

The SI method is delivered through sessions that are led by student peers who act as facilitators in the learning process. SI leaders can be chosen from students studying on the same programme a year or two above (near-peer SI model), or they can be chosen from the same student cohort (same-peer model). SI sessions can focus on a subject-specific area or on a certain learning-related topic as motivation, time management etc. In this chapter, we focus on the former: SI related to the provision of subject-specific support. The vast volume of literature on SI indicates that when peers act as facilitators in the learning process, it creates an informal collaborative learning environment where students feel that it is easier for them to ask questions or seek more in-depth clarifications. Working together with other peers also creates a motivating and stimulating environment where students are more engaged and in control of their learning processes (e.g., Arendale, 1998; Blanc, DeBuhr, & Martin, 1983; Dion, Fuchs, & Fuchs, 2007; Falchikov, 2001; McGuire, 2006; Ogden, Thompson, Russell, & Simons, 2003; Skoglund, Wall, & Kiene, 2018).

SI has been increasingly used within programmes for science, technology, engineering, and maths (STEM) disciplines (e.g., Achat-Mendes, Anfuso, Johnson, & Shepler, 2020; Buth & Hasbun, 2017; Cheng & Johnston, 2017; Fayowski & MacMillan, 2008; Hensen & Shelley, 2003; Jimenez, 2018; Malm, Bryngfors, & Mörner, 2016; Malm, Bryngfors, & Fredriksson, 2018; Musah & Ford, 2017; Parkinson, 2009; Peterfreund, Rath, Xenos, & Bayliss, 2008; Power & Dunphy, 2010; Spaniol-Matthews, Letourneau, & Rice, 2016; Tennyson, Casteele, & Morena, 2018) to enhance student knowledge and improve performance.

Over the past two decades, more and more students entering universities have a very diverse level of maths knowledge, which is often below university requirements. University teaching staff have been facing a challenging task of teaching big and diverse classes. Students lack motivation and skills; those with insufficient maths knowledge tend to struggle with content matter and encounter an increased probability of dropping out. In the case of Sweden, this could be partly explained by the reform of the upper secondary education in 2011. Some of the maths topics had been moved from the upper secondary school curriculum to a more advanced maths syllabus which was not part of the entry requirements for Algebra and Calculus I for Engineers course.

As educators, we were keen to explore the potential of SI; however, there was not much research comparing the use of different SI models in teaching STEM. With the exception of some discussion of using the same-peer model in medical education (e.g., Tai, Molloy, Haines, & Canny, 2016), the vast majority of literature on SI is dedicated to the near-peer model. There is even less research on the relationship between the SI design or model and the outcomes. We consider that we have a unique opportunity to reflect on and share our experience of using SI in our teaching practice and suitability of different models of SI for achieving a range of objectives. Our experience is even more out of ordinary because one of the authors of this chapter, Dr. G. Nilsson, has been a course leader on the Algebra and Calculus I for Engineer" course since 2002. This experience enables us to analyse more diverse and tailored applications of the SI models from a longer perspective.

2.2 Becoming Familiar With SI

We started using SI back in 2009, when it was a rather new method of student learning support in Swedish higher education and in maths-based subjects. Our interest in this method was initiated by our previous research in using non-traditional teaching methods in developing competencies and skills. We understood that using a range of student-centred teaching methods would cater better for the diverse student learning styles in achieving this goal.

Having read around about the benefits of using SI in improving grades, engagement, motivation, responsibility, and social skills in a variety of settings, we were motivated to integrate SI into an existing first-year course. At the start of our journey of using SI, we aimed to enhance conceptual understanding of the subject and to develop their competencies and skills to achieve higher employability.

Why were we so keen to introduce a more student-centred and interactive approach to learning into the course delivery? From our experience of teaching and supporting learning in maths, and on the basis of student questions, feedback forms, and exam results, we can say that many students lack maths understanding at the conceptual level. In tutorials, we often observed that many students wanted to be shown the solution, the recipe for how to solve the question, without developing an understanding of why they need to undertake those steps. This reflects the current situation with teaching maths as a subject. Teaching maths is based mainly on using

algorithmic procedures (e.g., Lithner, 2011). These procedures can be learned by rote without conceptual understanding, which might be an efficient approach in the short run; however, in the long run, this approach has many disadvantages. Without conceptual understanding, students are not able to generalise their knowledge and apply it in a different context. As a result, students do not develop a more holistic approach to problem-solving tasks. The SI approach provided an opportunity for developing conceptual understanding in maths.

From the start of our journey, we were interested in exploring how different SI models work when applied to maths-based courses, how this impacts students and SI leader experiences, and what are the roles of course and SI leaders in this process.

3. Method

3.1 SI Pilot 2009–2010

We first introduced the SI method at University West in 2009–2010 on Algebra and Calculus I for Engineers module on BSc Land Surveyors programme as a pilot project aimed at improving student motivation and engagement and developing their competencies and independent learning. The length of the course was eight weeks with three traditional two-hour lectures and two two-hour tutorials each week. The SI sessions were incorporated into the existing course and replaced tutorials. There were sixteen SI sessions in total, all of which were compulsory to attend.

We decided to implement the same-peer SI model, where the SI leaders were from the same student cohort. We recruited SI leaders by sending round an email asking for volunteers. Ten students came forward, and nine stayed on. Our main requirement was that the students had to have a good knowledge of maths and had to have studied mathematics at a higher level than was required for enrolment on this course. Forty-three first-year students enrolled on Algebra and Calculus I for Engineers participated in this study, including the SI leaders. For the SI sessions, the students were randomly divided into groups of five and an SI leader was assigned to each group. The course leader was available during these SI sessions to provide additional support if needed. In the beginning of the course, all the students were given a list of questions they had to prepare for every SI session.

At the start of the course, all students were informed about the new SI element in the programme delivery. The SI leaders were briefed by the course leader before the start of the activity and then had meetings before each SI session. During these meetings, the course leader went through the questions the SI leaders had to prepare for the following SI sessions, highlighting the areas that were often causing problems for students. For example, the students often had difficulties with trigonometric functions, e.g., solving trigonometric equations, finding solutions of the trigonometric equations on a certain interval, differentiation of trigonometric functions, and finding the equation of the tangent to the curve. Some students were struggling with solving applied word problems.

To evaluate the SI learner experience, the students were asked to complete a questionnaire about the perceived usefulness of the SI sessions, the performance of the SI leaders and the competencies they thought they had developed. All 34 student learners attending the SI sessions filled in the questionnaire. The SI leaders were interviewed about their experience and how it had impacted their maths knowledge, confidence development, and communication and leadership skills.

Responses related to the perceived usefulness of the SI sessions were measured on a five-point scale ranging from one being *not at all useful* to five being *very useful*. Overall, the students were satisfied with the SI activity. Over half of those 34 students (57%) evaluated the SI method as useful and valuable, giving it mark 4 or 5. The students highly rated collaboration with peers and commented that it was a positive experience being able to discuss difficult questions with other students. The students also pointed out that it was easier to ask questions during the SI questions and receive support and explanation than during traditional tutorials. About half of the respondents felt that they improved their subject understanding. About 40% of respondents thought that SI stimulated them to actively participate in group work and to put in more effort into their self-study and preparation for tutorials. The students felt that they were more in control of their learning process and found it more enjoyable. On the basis of our analysis, we concluded that the student evaluations of the same-peer SI method supported the previous research on the benefits and challenges of using SI.

The students were also asked what competencies they gained during this activity. Around 60% of respondents thought that they developed their problem-solving skills and ability to adapt to new situations. Almost half (45%) of respondents believed that they improved their time management skills. About a third of respondents commented that they developed such skills as formulating tasks in oral and written form, ability to explain problems to others as well as the ability to construct logical arguments and formulate problems using mathematical tools. Improving maths confidence is a very valuable outcome, because maths is often seen as a difficult subject, and it is common that students lack confidence when studying maths. It is also important to develop this confidence from the start of the study as students will become more motivated in learning.

Overall, the evaluation of the SI programme demonstrated that the majority of students were satisfied with the SI programme. In addition to being more engaged with the learning process, they felt that they had developed key skills crucial for their further study and future professional career. The SI leaders were interviewed. The SI leaders highlighted that being in the role of SI leader "helped them understand how challenging this role was." This was a test of "how well they knew the subject," "how well they could explain maths concepts," and "how well they were communicating with the students." The SI leaders also appreciated that they developed their leadership skills.

In the 2009–2010 pilot evaluation, we also asked the students to evaluate their SI leaders' performance on a scale of one to five based at a set of given criteria. Overall, the students positively evaluated SI leader performance. Around 80% of respondents

were very satisfied (i.e., marks 4 and 5) with their preparedness, and 70% of respondents gave them mark 4 for their competence in the subject area. Around 40% of respondents highly appreciate their enthusiasm giving them mark 5. However, 60% gave them only mark 3 for their ability to explain well and their management and leadership skills. Some of the students commented that "the SI leaders should prepare the topics in more depth." This feedback demonstrated that the SI leaders chosen from the same student cohort were not always able to meet the expectations of their peers throughout the duration of the course. Sometimes the SI leaders did not have themselves sufficient depth in understanding maths concepts.

Having conducted the evaluation of using the same-peer SI model in teaching maths, we were looking into continuing using this method the following year on Algebra and Calculus I for Engineers and to start using SI on the consecutive course, Algebra and Calculus II for Engineers. However, we decided not to implement the same-peer model on Algebra and Calculus II for Engineers, because we thought that it would be too challenging for the SI leaders. Many topics on that course were not part of the school curriculum and new to all students. At that time, we were mainly focussed on developing student motivation, competencies, and skills and had already successfully implemented problem-based learning in teaching maths in achieving these goals (Luchinskaya & Nilsson, 2007). As problem-based learning was well-received by the students and was easier to manage, we decided not to run the SI sessions in the following year.

3.2 SI Projects 2014–2015

As a result of the upper secondary curriculum reform in Sweden in 2011, between 2010 and 2011 there was a 56% increase in the number of students choosing the Technology and Engineering programme and a 42% increase in the number of students in the Science programme at the upper secondary school. Students got an opportunity to study STEM disciplines at the university level with a non-STEM upper secondary background (e.g., Mellander, 2017). We observed that a higher proportion of students enrolled on the Algebra and Calculus I for Engineers course after 2011 had insufficient maths knowledge to cope with course demand and struggled to progress in year two.

In 2014–2015 the class size was nearly twice the size of that of 2009, because Algebra and Calculus I for Engineers formed part of two programmes, BSc Land Surveyors and BSc Industrial Economics. In the preceding years, students on this high-risk course were struggling to progress onto the second year. The exam results of the first-year students on this course indicated that the students were having problems with understanding certain concepts taught on the course, such as the trigonometry concepts and applications of differentiation and integration. Although some maths support provision (drop-in sessions) was already in place at University West, we felt that that was not sufficient to address the problem at hand. After some discussion, discussion, the university administration decided to implement the SI method in addition to the existing maths drop-ins.

As a result, in 2014–2015 (four years after we ran the first pilot) we offered the SI sessions again on the Algebra and Calculus I for Engineers course. This time, we participated in the pilot together with other course leaders. All course leaders adopted the popular near-peer model of peer learning, where senior students acted as SI leaders.

However, this was not the only change that we had introduced compared to the earlier SI pilot. The objectives for implementing the SI method had changed as well. If, in the first pilot in 2009–2010, our focus was on increasing student responsibility for their own learning and developing students' study skills and competencies, the objectives of the 2014–2015 pilot were more about bridging the gap between the maths knowledge of school leavers and university requirements and reducing the drop-out rate from a "high risk" course. Table 1 shows the main features of the two SI models that were used on the Algebra and Calculus I for Engineers course.

Tab. 1: The description of the two SI models used in 2009–2010 and 2014–2015

	SI pilot 2009–2010	SI pilot 2014–2015
SI model	Same-peer	Near-peer
SI objectives	• Developing a deeper understanding of the subject, improving motivation, competence development	• Bridging gaps in maths knowledge, improving retention and academic performance
Mode	Compulsory attendance	Optional attendance
Timetabling SI sessions	Yes	No
SI leader participation	Voluntary, unpaid	Voluntary, paid
Selection	• Interview, higher level of school maths than the requirement, high exam grades	• Interview, completion of the Algebra and Calculus I for Engineers course, good understanding of the subject
Training	• Training or briefing provided by the course leader	• Training provided by the European SI Centre
Admin support	No	Yes
SI group size	5	8–15
Student cohort	43	88

As our near-peer SI method received the support of the university administration and was simultaneously introduced on a few other courses at the University West, an SI administrator was appointed on a part-time basis to assist with the SI implementation. The SI administrator was involved in the SI marketing and SI leader recruitment campaigns. As we were looking to recruit SI leaders from among the senior students, we made announcements in the lectures and emailed the students who received high grades in the course exam in the previous years. There was a small fund available to pay SI leaders; the SI leaders were paid 120 SEK/h.

During the recruitment process, we explained the purpose of the SI sessions to potential SI leader candidates and the benefits of becoming SI leaders. In the end, we chose ten (seven stayed on) students from among the second and third years to act as SI leaders. The selected students attended three compulsory half-day training sessions organised by the SI administrator and provided by the European SI Centre based at Lund University, Sweden. These sessions addressed the role of SI leaders in preparing and delivering successful SI sessions. Some aspects of these sessions were dedicated to the pedagogical aspects of group work.

The SI support programme that we designed followed the course curriculum and covered the topics that the students struggled with the most. This time, the SI support was optional as it was recommended in the SI guidelines (e.g., Arendale, 1994), but all students taking Algebra and Calculus I course were encouraged to attend.

The SI leaders ran three-hour SI sessions once a week for eight weeks. Student groups were limited to 7–8 students to enable effective interaction and to facilitate learning. Sometimes, the SI leaders preferred to work in pairs and deal with a bigger group of students. They felt that such an arrangement helped them to feel more confident when dealing with student questions.

At the end of the course, we asked the students to fill in a questionnaire about their experience. Out of 88 students registered on the course, 72 students returned the questionnaire (an 82% response rate). Out of those students who responded, 18 students (25%) did not attend the SI sessions, 9 students (12.5%) attended one or two SI sessions, and the rest (45 students, 62.5%) attended three or more sessions. The main reasons for low attendance of the SI sessions were the lack of time due to other commitments and the student perceptions that they did not feel they needed extra maths support because they thought that the course was rather easy.

All 45 students who attended more than two SI sessions thought that this activity was *very beneficial* or *somewhat beneficial*. They felt that they improved their performance, became more confident in solving problems, improved their subject knowledge, and achieved deeper subject understanding. The students realised that studying together could be more motivating as well as rewarding commenting that they "had a better chance of understanding difficult maths problems" and "had an opportunity to discuss problems with other students and do through a range of examples." They learned to discuss problems with their peers and at the same time disagree with the peers and defend their opinions. Some of the students mentioned that they valued "an opportunity to get help and help other students at the same time," "a chance to see that [they] could explain problems to others," and "a relaxed environment with more time for reflection."

Some students got a better view of the whole programme through communication with their SI leaders. The students mentioned that the SI sessions helped them to better understand the requirements of their assessments and facilitated their transition into the university environment. The students felt more confident and more engaged in the learning process. The majority of students commented that the best thing about the SI sessions was the individual-level support provided.

3.3 Projects in 2017–2019

After receiving the positive student evaluations of the SI pilot in the 2014–2015 academic year, we felt that it was worth embedding the SI sessions into the course delivery in the following few years, but we could not start it again until 2017.

This time, the University West administration decided to implement the SI method for supporting students across a wide range of courses and subject disciplines as the SI method was gaining its popularity in Sweden. The near-peer SI model was adopted once more. Three SI administrators were recruited on a part-time basis to facilitate the SI marketing campaign, training, communication, and meetings with the SI leaders across all the courses. All the SI leaders attended the training sessions, and no additional subject-specific training was provided.

Fifty-nine students were enrolled on the course in 2017–2018, and 51 students were enrolled in the following year. Table 2 demonstrates the number of students who attended the SI sessions between 2014–2015 and 2018–2019 and the exam pass rate. We can see that the exam pass rate was lower in the years when no SI support was available – 65% compared to 78% when the SI sessions were running. The exam pass rate improved by 13%. While we cannot say for certain that the SI sessions had a causal effect on the exam pass rate, we consider that there is a positive association between running the SI sessions and student exam performance. The SI attendance in 2018–2019 was higher than in 2017–2018, which can be attributed to the fact that the maths drop-ins did not run in 2018–2019.

Tab. 2: The number of students who attended the SI sessions and the exam pass rate

	Number of students enrolled on Algebra and Calculus I for Engineers	Number of students attended SI sessions	SI session attendance (% of enrolled)	Average exam pass rate
2014–2015	88	54	61%	67%
2015–2016	60	No SI sessions		65%
2016–2017	61	No SI sessions		65%
2017–2018	59	16	27%	78%
2018–2019	51	24	47%	78%

Figure 1 demonstrates the Algebra and Calculus I for Engineers exam results between the 2015–2016 and 2018–2019 academic years. The exam results show that there was a higher exam pass rate among the students who had attended the SI sessions: In 2017–2018, out of 16 students who attended the SI sessions, 13 students (81%) passed the exam compared to 33 out of 43 students (77%) who passed the exam and did not attend the sessions. In the following year, all but one student (23 out of 24) who attended the SI sessions passed the exam (96% pass rate), and only 17 out of 27 students (59%) who did not attend the SI sessions passed the exam.

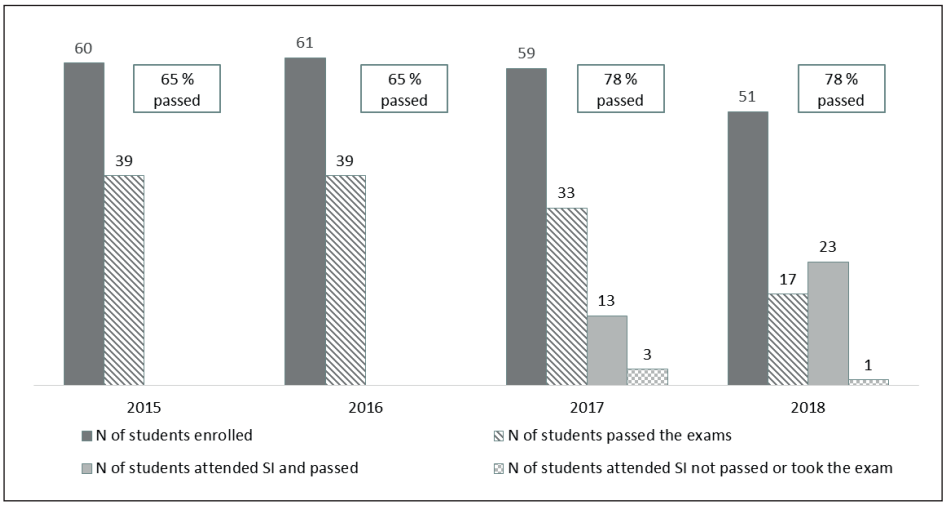

Fig. 1: Algebra and Calculus I exam results. Note: There were no SI sessions in 2015–2016 and 2016–2017.

The results presented in Figure 1 demonstrate a positive association between the SI sessions attendance and academic performance.

3.4 The Role of the SI Leaders

To have a better insight into the SI leaders' experience of participating in the 2017–2019 near-peer SI projects, the challenges they faced, and how they benefited from being SI leaders, we asked them to fill in a questionnaire and interviewed some of them. We also decided to approach the SI leaders who ran the SI sessions on the first-year Linear Algebra, Linear Algebra and Differentiation, and Maths and Drug Calculations courses. In the end, we collected questionnaire responses from thirteen SI leaders, and six of them were interviewed.

It was clear from SI leader feedback that their participation in the SI programme was a very valuable experience for them. They felt that they developed a range of important skills such as the ability to explain things to others in a variety of ways, to formulate and reformulate problems, to clarify questions and develop a good contact with students to ensure that they understand the explained material, to lead group work and encouraged discussions. The SI leaders also stated that they improved their subject knowledge because knowing that they were helping other students with maths made them more responsible for their own studies and preparation for the SI sessions. All the SI leaders said that they were reading the textbook or lecture notes to refresh their knowledge. One of the SI leaders wrote: "I have had [an] overwhelmingly positive experience. During the project my understanding of the subject has increased."

However, sometimes some of the SI leaders felt that they did not have enough knowledge to help their peers. They also commented that at the beginning they lacked

confidence, but that this improved dramatically by the end of the programme. The SI leaders also highly appreciated the leadership, problem-solving, and communication skills that they had developed. We believe that all these transferable skills will be beneficial for their future employment and career development.

The SI leaders emphasised the importance of training for running successful SI sessions. They reflected how learning about different learning styles helped them with planning the sessions and activities, how being flexible and able to adapt to new situations facilitated their immediate response to changing learning environment, and how their acquired knowledge of group work and group dynamics enabled them to encourage students to work collaboratively. However, many of the SI leaders felt that "there could be more (subject-specific) preparatory courses for the new SI leaders."

At the same time, the SI leaders critically assessed the challenges they faced. They pointed out that "it takes time to understand students' needs, thoughts, and questions," that "it takes time to prepare for the SI sessions," and that "it takes time to fine-tune the preparatory work to address the needs of the students." More fundamentally, the SI leaders met another challenge – the students wanted to know the answers, not the concepts. How to handle this? The SI leaders' approach was: "When the students are stuck in solving the question, I help discuss the questions, and if necessary, give directions" and: "I ask the students to help each other."

In the end, the SI leaders shared some ideas on how to improve the SI implementation. They pointed out that they spent a lot of time preparing for the sessions. They suggested that it could have been avoided if the SI leaders had more contact with the course leaders who could advise them on the subject related issues. However, the distinguishing feature of the 2017–2019 projects was that the SI implementation was much more centralised than in 2014–2015 and, as a result, the SI leaders were mainly in contact with the SI administrators who had weekly meetings with them. At the meetings, the SI leaders reflected on how successful the sessions went, the challenges they encountered and the questions the students raised.

There was not much communication with the course leaders because they often did not have time to oversee the SI implementation. Some of the SI leaders emphasised that did not receive enough subject-specific support from the SI administrators who did not have maths qualifications. As the SI leaders had to spend much more time preparing for the SI sessions than originally planned, this, in turn, affected their own studies and, as a result, a few SI leaders dropped out from the project.

What we noticed from the SI evaluations was that the SI sessions attendance varied considerably year on year. For example, the attendance in 2018–2019 academic year was higher than in the previous year (see Table 2). We could partly foresee this as there were no maths drop-in sessions that provided additional maths support to the University West students available in 2017–2018. We also understood that it was not easy to find the time when both the students and the SI leaders were available. Very often, the only option was to run the SI sessions in the evenings to avoid clashes in the timetable; however, some students and SI leaders were not available due to their commitments.

We also observed the situations when there was a high demand for the SI sessions run by one SI leader and low attendance of the other sessions. To address this high demand, the SI leader ran two SI sessions per week which also increased pressure on that student. This confirmed our beliefs that having a good level of maths knowledge is not enough for becoming a good SI leader. What we think is even more important, is the SI candidate ability to demonstrate a person-centred approach (Rogers, 1951/2012), which allows to look at the problem from the student's perspective and see what stands in the way of student understanding and learning.

3.5 The Role of the Course Leader

Having analysed the feedback from the SI leaders and the interviews with the course leader, we can see that both the student-learners and the SI leaders benefit from participating in SI sessions. However, at times, the preparation and running SI sessions put high demand on the SI leaders. Therefore, the role of the course leader becomes crucial in ensuring a successful implementation of the SI method. This argument is supported by the evidence that we have collected during our involvement with the SI starting from the SI pilot (2009–2010) where the same-peer model was used. There were regular weekly meetings between the course leader and the SI leaders. The SI leaders had constant support with the course content and session planning provided by the course leader. This close collaboration ensured a smooth running of the SI sessions. The student learners who participated in the 2009–2010 SI pilot valued this well-structured approach to the running of the SI sessions.

At the same time, from the SI literature (e.g., Birkett et al., 2017), we can see that it is a common practice that the SI leaders have regular meetings only with the SI administrators. This approach was implemented in the 2014–2015 SI project when the dedicated SI administrator was appointed. The SI leaders did not have regular meetings and discussion with the course leader but had regular meetings with the SI administrator instead.

In the beginning, in 2014–2015, we followed a widely adopted approach that students should lead the way that SI sessions are run. We did not set up the SI session topics in advance. Instead, we encouraged students to propose the topics they wanted to discuss. The SI leaders did not receive any advice from the course leader regarding what issues should be addressed, common misunderstandings or session planning. This situation caused some confusion among the students and SI leaders alike. Two weeks into the SI support programme, we decided to introduce some control into the running of the SI sessions. Having discussed the situation with the SI administrator and the SI leaders, we developed a list of topics for each SI session and announced them in advance. The course leader provided the SI leaders with a plan for each session and suggested that the sessions should include a summary of the topic, practical exercises, and discussion. This had a positive impact on the learning experience; the SI sessions were well attended – 61% of the student cohort attended more than two sessions. The collaboration between the course leader and the SI leaders is the impor-

tant link that ensures that objectives of the SI implementation will have been achieved. Regular meetings with the SI administrator are not sufficient, as SI leaders themselves need support with the maths content and advice on how to explain maths to students.

Here we arrive at the importance of considering the didactic aspects of teaching maths when implementing the SI method. Maths is a difficult subject, and the SI leaders often need to explain key steps in solving problems or to answer questions students have or to explain why a certain approach is chosen. From our experience, we can see that the SI leaders need to develop some knowledge of maths didactics to achieve a positive outcome of the SI sessions. As the SI leader training does not normally cover subject-specific aspects of running SI sessions, the understanding of maths didactics by the SI leaders can only be achieved through the close collaboration with the course leader. It is important that the latter discusses and demonstrates the didactic aspects of teaching maths concepts and their applications in the regular meetings with the SI leaders.

The interviews with the course leader gave an interesting perspective on the relationship between the application of different SI models and outcomes. The course leader indicated that the objectives for using SI could shape the way the SI is implemented.

4. Discussion

In the course of our reflective journey, we looked at the changing role of subject-specific SI in the learning process and the application of two different SI models in teaching maths. At first, we used the SI method to enhance student engagement with the learning process, develop their conceptual understanding, confidence, and skills. Later we used SI to support the students enrolled on a high-risk course with a high maths content. We discussed the benefits the students and SI leaders alike have from participating in the SI sessions. Overall, we have collected and analysed a large volume of data that helped to shape our understanding of successful SI implementation.

Having used different SI models, we have gained a better understanding of their potential and challenges. This gives us an ability to develop flexible course designs with embedded SI elements which are tailored to meet certain learning objectives.

The same-peer SI model is more straight forward to set up than the near-peer SI model. It does not require substantial administrative support or centrally organised training for SI leaders, and it is easy to find times when the students are available. The number of sessions offered can also vary depending on students' preparedness for the course. The course leader can identify the topics that are difficult for students to grasp and works closely with the SI leaders in designing and planning the sessions.

If the SI leaders are first-year students, they might not have enough experience of working with peers or might not be knowledgeable enough in detecting the underlying causes of why students have problems with understanding the material and may need to advance their skills of explaining course content to peers. That is why we

recommend the use of the same-peer SI model as a learning resource when teaching large classes and in achieving targeted improvements in student understanding of the subject; e.g., the course leader wants to focus on more challenging and stand-alone topics and problems. In this case, some scheduled tutorials or time during a tutorial can be allocated to an SI session. It is also possible that preparation for SI sessions can take a long time, and SI leaders could feel under pressure which, in turn, impacts the range of the same-peer SI model application.

The near-peer SI model is better suited than the same-peer model when supporting students on high-risk courses or students with big gaps in their maths knowledge when they need this support for the whole duration of the course. At the same time, in the near-peer SI model, the SI leaders' experience, skills, and confidence create an opportunity for them to become role models for the first-year students. The students commented in their feedback that they received a better view of the whole programme, developed a better understanding of what it means to study at the university level and became more motivated in and more responsible for their own studies after attending the SI sessions. This outcome is very important, because following a role model could have a positive impact on the learning experience. However, first-year students who act as SI leaders in the same-peer SI project are not able to act as role models as they are lacking the experience of studying at the university level.

The implementation of the near-peer SI model requires more advanced planning as well as dedicated administrative staff and organisational support for recruiting SI leaders, organising their training, and hiring administrative staff. The SI sessions should be run during the whole duration of the course as students need extra support with learning maths as they have big gaps in their knowledge. This demands a certain commitment from the SI leaders as they need to be involved in the SI sessions during this time. We also recommend timetabling SI sessions in advance to ensure that there are no clashes in year one and senior-year student timetables; this will have a positive effect on SI session attendance.

Having dealt with many SI leaders during our involvement with the SI method, we recommend overrecruiting SI leaders to account for unplanned situations that may arise. SI leaders may drop out from SI projects, sometimes without giving advanced notice. We experienced a situation where an enthusiastic student who was chosen as an SI leader unexpectedly refused to participate in the SI activity at short notice. Although these situations do not happen often, we need to plan for them. Even when SI leaders do not show a lack of confidence and know the course material quite well, they could be under pressure with their own study or other commitments. In any case, it is key that the SI leaders are in close communication with the course leader or with the SI administrator to help mitigate and avoid unexpected situations and to ensure that the SI sessions run smoothly.

Since 2017, the near-peer SI method has been implemented on a wide range of courses at the University West. It has proven to be a successful and valuable experience for the students. We believe that our reflection will be useful for other educators

who are thinking to embark on this interesting and challenging journey of using SI in their teaching.

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6. An Essay on the Effects of Web-Based Platforms and Supplemental Instruction in Accounting Education

Mehtap Aldogan Eklund, Andreas Eklund & Birgit Leick

Abstract: During the uncharted time, such as the coronavirus (COVID-19) pandemic, e-learning has become more important than ever. Drawing on the tenet of the connectivism learning theory, this chapter discusses digital transition and Supplemental Instruction in education, especially in accounting education. A printed questionnaire was administered to the students who enrolled in introductory accounting courses at one of the American public universities. Descriptive statistics, independent *t*-test, and ANOVA were employed to examine student perceptions of the *web-based platform* (WBP) – a digital homework platform – and SI and to test the differences between the groups. In line with prior research, although 49% of the students perceive SI as a helpful service, voluntary participation in SI is low (30%). 20% out of this 30% attended the SI maximum of three times during the semester. Even though 52% find WBPs time-consuming activity, 59% prefer WBPs to traditional paper-and-pencil homework, and 87% find WBPs helpful. In simpler terms, students have a positive perception of WBPs but a neutral perception of SI. For the independent *t*-test and ANOVA, it is found that there is no significant difference between the groups' mean values. It indicates that respondent age, gender, class standing, and prior accounting knowledge do not create any significant perception difference. Even though the results are not generalizable for all blended accounting education, the study still contributes to the online education literature by exploring and investigating the status quo in the undergraduate introductory accounting courses at one of the American higher institutions. Thus, it opens the door to generalizable future research on digital learning and SI in the accounting discipline. The results also serve as a foundation for continuous theoretical advancement and decision base for instructors and policymakers in higher education.

1. Introduction

Contemporary society teaching is mostly based on face-to-face, visual, and verbal presentations (Clarke, Flaherty, & Yankey, 2006). However, as we know, the world has changed dramatically due to the coronavirus (COVID-19) pandemic. It has heaped change in daily life and activities around the world. Higher education is no exemption. Universities around the globe have moved their education to the digital space during this extraordinary time. Despite the challenges of distance learning that we all have

faced during the pandemic, it is not new to our lives. Distance learning initiated with radios and TVs in the 1930s (Cuban, 1986), and it has moved to web-based platforms.

During the unprecedented times, it has been noted that more knowledge is inquired on digital teaching and student perceptions of *web-based platforms* (WBPs). Digital transformation or digital platforms in education can be exemplified as online learning (management) systems, such as Moodle, Canvas, Massive Open Online Course (MOOC), and web-based assignment and assessment platforms or *online homework software* (OHS), such as Connect and MyLab. In this chapter, digital transformation is observed via a WBP, in other words, via OHS.

Supplemental instruction, or peer tutoring, means students collaborating with other, senior students who can guide the new students in learning.

This study aims to discuss and investigate the digital transformation and SI in accounting education from the tenet of the connectivism learning theory. Connectivism learning theory posits that the internet-based technologies are created new opportunities for students to enhance their learning and to share this knowledge with their peers (Joksimović et al., 2017; Siemens, 2005). More specifically, this chapter explores voluntary student participation in SI and student perceptions of WBPs and SI, and it investigates whether WBPs and SI enhance learning and improve academic performance.

It is noted that in the literature, there are conflicting results on the benefits of digital learning in technical subjects and high-risk courses, which is the gap in the literature. A *high-risk* course means a course with a failure rate (D or F) of more than 30%. Introductory accounting courses are considered high-risk courses in the literature (Etter, Burmeister, & Elder, 2000). Hence, this chapter aims to fill the gap in accounting and online education literature by contributing to conflicting results and opening the door to future research.

Our sample is the students who enrolled in introductory accounting courses (financial accounting and managerial accounting) at one of the American public universities. Introductory accounting courses are selected to explore this phenomenon because of the gap in the literature and the high-risk course requirements of SI (Goldstein, Sauer, & O'Donnell, 2014). Generally, SI is an essential part of the introductory or first accounting courses in the United States, and unfortunately, when it is voluntary, the participation rate is very low, approximately 27% in the prior research (Jones & Fields, 2001). The research is scarce on this topic, which investigates student perceptions and explores the reasons for the low participation rate in SI. Thus, this chapter aims to fill this gap in the literature by analyzing the issue in a sample size of 191 students in one higher education institution in the USA. This study cannot be generalized for the whole American education system, which is a limitation of the study, but it still sheds the lights on the phenomenon, provides the scholars with a fundamental understanding of student expectations and perceptions of SI, and motivates the scholars to conduct generalizable research on this topic.

This chapter provides the descriptive statistics on student perceptions of WBPs and SI and the voluntary participation rate of the students in SI. In addition to the

descriptive statistics, it seeks out differences between groups by examining and testing student perception of WBP and SI. The results point to interesting areas for future investigations, which will aid scholars and instructors to overcome barriers and challenges when planning and designing for teaching in WBP and supplying SI.

The remainder of this chapter is structured as follows. Firstly, the connectivism learning theory and the literature on digital learning and Supplemental Instruction are presented. Secondly, the sample and method are discussed. Thirdly, the results and conclusions are presented. It is followed by limitations and future research.

2. Theoretical Background

The framework of the study is illustrated in Figure 1. Figure 1 demonstrates student perceptions of SI and WBP, the impact of SI and WBP on learning and academic performance in accounting education.

The accounting education is limited to the introductory (first) accounting courses, Principles of Accounting I (Financial Accounting) and Principles of Accounting II (Managerial Accounting). Only the introductory accounting classes are investigated in this study because, in general, introductory accounting classes have extremely high attrition and failure rates (usually 30% or greater), which makes these courses as high-risk courses, for which SI sessions are organized (Etter et al., 2000). In the forthcoming paragraphs, first, each concept of the framework, including relevant theory and prior research, is discussed, and then, the research questions and hypotheses are formulated.

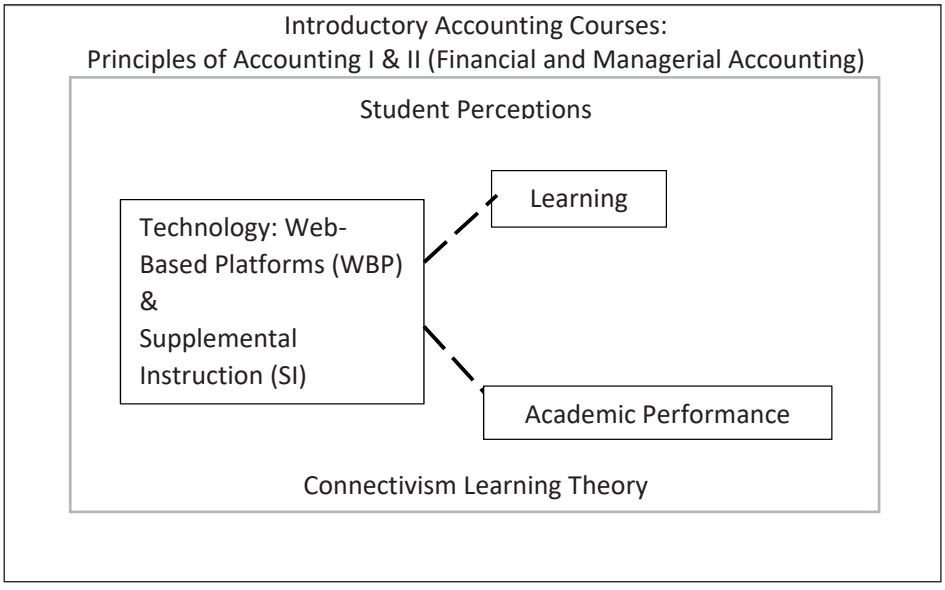

Fig. 1: The framework of the chapter. Source: The authors

2.1 Connectivism Learning Theory

Connectivism, which views learning as a network phenomenon influenced by technology and socialization, is one of the prominent learning theories for the digital age and e-learning. It defines learning as "technological enabled networks" (Goldie, 2016). Connectivism is emerging learning theory and includes networked relationships. Networks are connections among learners, instructors, tutors, databases, blogs, and websites. Thus, learning is the "ability to construct and traverse those networks. Its successful pedagogical strategy requires that during the learning process, instructors *facilitate* students to identify, navigate, and evaluate information from their learning networks" (Transue, 2013, p. 185).

In 2005, George Siemens coined the term *connectivism* to explain learning networks, and it has been developed by Stephen Downes, a Canadian researcher (Downes, 2012; Goldie, 2016; Siemens, 2005). Siemens (2005) has formulated the principles of connectivism and described learning as a continual process that lasts for a lifetime. Technology is a tool for altering our brains and shaping our thinking, so our cognitive information processing (learning) should be supported by technology. George Siemens, the founder, and Stephen Downes, the developer of the connectivism theory, stated that due to the innovation, technological changes, information explosion in the current age, learners should unlearn what they have learned in the past, and they have to learn how to learn in a digital environment, evaluate, critically analyze, and synthesize the information. Now learning resides in machines. Machines (i.e., digital environments) guide the learner through the learning process while they are interacting with them (Anderson, 2008).

In short, connectivism learning theory posits that the internet-based technologies have created new opportunities for students to enhance their learning and to share this knowledge with their peers (Joksimović et al., 2017; Siemens, 2005). Connectivism theory is a respected and prevalent theory for digitalized or e-learning environment, which also sets the theoretical framework of this chapter.

2.2 Change in Traditional Education

The United States Commissioner of Education defined education in 1931 as follows: "education is a process of individual growth and development, beginning with birth and ending with death" (Cooper, 1931, p. 324). Besides, Strømmen-Bakhtiar (2020, p. 215) has described education as "the act or process of imparting or acquiring particular knowledge or skills, as for a profession," and stated that "education is supposed to develop critical thinking, analysis, exploration, and be a gateway to immense opportunities."

As the technologies advanced, it changed the way of doing business and traditional education. Businesses have started looking for tech-skill employees (Strømmen-Bakhtiar, 2020). Hence, universities had to respond to technological change and modify the inflexible and teacher-oriented traditional teaching methods by creating

new learning landscapes. For instance, the traditional teaching method using blackboard has changed to face to face teaching supported by digital platforms, blended learning, and student-oriented and flexible online learning. Consistent with the principles of the connectivism theory, learner and teacher roles have also changed in the digital age. Student engagement has increased, and they have taken a more active role in learning. Teachers' and professors' roles have changed to *facilitator*. In other words, the landscape of traditional education is changed to self-learning facilitated by instructors (Anderson, 2008).

Similarly, the new challenges in the world, such as globalization (global market conditions and global competition) and technological innovations, have caused substantial changes in corporate and public accounting, and so in accounting education and curriculum (Celik & Ecer, 2009; Stout & Schweikart, 1989). To serve the needs of students who will take the Certified Public Accountant (CPA) and the Certified Management Accountant (CMA) exams, the accountancy programs have started digitalized. Accounting curricula are merged with data analytics, big data, information systems, business intelligence (accounting intelligence), blockchain, and artificial intelligence courses, such as a master of accounting with a data analytics program, bachelor of accounting with information systems (Drew, 2018; Fajardo, 2014; Johnston, 2018).

In other words, in every discipline, including accountancy, networked information technology has become a significant part of the learning process. In the modern society and modern learning environment, student use of technology has turned become a knowledge creation process, and students are not only consuming the information anymore. Instead, they synthesize information and create knowledge by means of their improved information and tech-skills (Dunaway, 2011).

In contrast to a traditional learning environment with learner–instructor interaction, the modern learning environment has increased the level of interactions: learner–instructor, learner–learner, learner–context, and learner–machine. The design of high-quality web-based learning environment combines three generations of pedagogy: (a) behaviorist strategies – teaching *what* (i.e., the fact); (b) cognitive strategies – teaching *how* (i.e., process and principles); and (c) constructivist strategies – teaching *why* (i.e, promoting higher-level thinking, personal learning, and contextual learning; Anderson, 2008; Anderson & Dron, 2011).

2.3 Technology in Education

"Technology in education" is a broad term and is used commonly for online education, distance education, digital learning, blended education, face-to-face education supported by web-based platforms, e-learning, network learning, web-based learning, virtual learning, computer-assistant learning, distance learning, and mobile learning. Technology in education has no generic definition, but all of the terms above imply that education is either blended with technology or provided at a distance through

some form of technology to access learning materials and to interact with other learners and instructors (Anderson, 2008).

The history of distance education started first with radio and then television (TV) in the 1930s. By 1938, 225 cities in the US broadcasted educational programs for public schools (Cuban, 1986; Tyson, 1936). It is transformed from radio and TV to online platforms. As the Oracle corporation stated, the net has changed everything, even education (Anderson, 2008). The prevalent example of net-based digital learning is the *MOOC*. It is an effort of creating e-learning communities and started in 2008 (Downes, 2012). From 2008 to 2015, more than 58 million students enrolled in almost 7,000 MOOCs that were offered by 700 universities. *Net-generation* students have opted for *a next-generation* learning environment that is an informal, computer-mediated (networked), digital, and dynamic educational setting (Joksimović et al., 2017). During the COVID-19 pandemic, the vast majority of the schools, colleges, and universities are closed and moved to online distance learning through web-based platforms, such as Adobe Connect, Blackboard Collaborate Ultra, Elluminate Live, Zoom, Teams, Google classrooms, and Webex. The unprecedented times illustrated the significance of technology in education.

This section summarizes the findings of prior research on technology in education and its impact on student's skills, learning, and academic performance. Aksal, Gazi, and Bahcelerli (2013) implemented connectivism learning theory into their internship courses because the realm of the digital age and computer-based communication requires a collaborative, interactive learning process and socio-contextual learning experience. They have noted that their design of a modern learning environment supported by an online social networking site (Facebook) provided students with the opportunity to interact and self-learn from their peers with self-discipline, which enhanced self-leadership, team-skills, decision making, reflection skills. Sitti, Sopeerak, and Sompong (2013) interviewed ten experts and collected their opinions and experiences on the web-based instructional model that was developed based on connectivism theory. They found that web-based learning enhanced student problem-solving and ICT skills and improved their learning efficacy. It is also realized that students perceive the lectures adopting advanced technology are integral to effective teaching and learning in South Africa (Marais, 2011). Michael (2012) identified the student and instructor experiences with the online learning pilot project using Elluminate Live over 12 months in higher education in Australia. The advantages of online learning were flexibility, cost reduction, student engagement, and visual literacy skill. On the other hand, disadvantages were technical challenges, low broadband speed, and resistance to change.

Some scholars compared the efficiency and effectiveness of online and hybrid (blended) classes to face-to-face classes. In line with the US Department of Education's statement, Mulig and Rhame (2012) discovered that online or hybrid modules were more effective. On the other hand, for the efficiency, students mentioned that they needed to dedicate more time and engage in learning more in online classes, and instructors emphasized that designing online classes required more time, compared

to face to face. It shows that online courses may not be as efficient as face to face courses.

In contrast to social and humanities subjects, scholars have contradicting results for the benefits of online teaching of technical classes, such as accounting, finance, mathematics, and statistics (Kwak, 2015). For online instruction, Kwak (2015) conducted an empirical study on the online college-level managerial accounting courses at the University of Nebraska, USA. It is discovered that motivated and hard-working students performed well regardless of the course design (online or face to face), but non-highly motivated students struggled, and they had high failure rates in the online managerial accounting courses. It was also noted that online students underperformed on web-based assignments, compared to in-class students. Besides, accounting educators should be aware of the pros and cons of teaching accounting online because the things that work in the face to face accounting education may not work in the online setting. The successful design of online accounting courses increases the effectiveness of online delivery and enhances learning and academic performance (Dusing, Hosler, & Ragan, 2012). Similarly, Cole, Shelley, and Swartz (2014) mentioned that positive interaction with the instructor and with fellow students is the prerequisite for student satisfaction in online instruction. Fajardo (2014) prefers online education to traditional instruction, and he argued that the best practice of teaching accounting courses is online because e-learning provides the students with a flexible, self-paced, active learning environment.

For hybrid education, Vernadakis, Giannousi, Derri, Michalopoulos, and Kioumourtzoglou (2012) conducted empirical research on blended learning in accounting courses in Greece. The blended learning environment, also called hybrid learning, includes some of the convenience of online courses without the complete loss of face-to-face advantages. They found that students who attended blended accounting instruction had higher academic scores than those who attended traditional accounting instruction. This result was explained by the format of the blended learning that requires more student engagement and active learning because students become more responsible for learning content on their own time. Arbaugh (2010) defined accounting as a "hard" discipline in business schools. He argues that graduate-level accounting courses are amenable to e-learning because students should gain self-learning, self-discipline, self-leadership, decision making, interaction, presenting, and teaming skills. However, he suggested blended learning for the under-graduate level accounting courses.

For online assignments in WBPs or OHS, students stated that practice and problem-solving activities using interactive spreadsheets helped them increase their grades in the exam. In other words, WBP had a positive impact on academic performance (Bertheussen & Myrland, 2016). Research shows that students taking finance, physics, and mathematics courses, especially the undergraduate and introductory courses, prefer OHS to *paper-and-pencil homework* (PPH; Bonham, Beichner, & Deardorff, 2001; Burch & Kuo, 2010; Humphrey & Beard, 2014; Olson & Wisher, 2002; Smolira, 2008). Students perceive OHS as a useful tool for enhancing learning and performance, because OHS provides each student with immediate feedback and individual

(algorithmic) questions, and it increases student understanding of the course material. On the other hand, they reported that OHS is more time-consuming than PPH, with an average of 30 minutes to an hour more spent on OHS than on PPH.

In short, as noted, some scholars prefer e-learning, but others argue that hybrid instruction is preferable to online instruction for the accounting courses considered as technical, hard-subject in business schools. Moreover, the research on OHS or WBP in the accounting discipline is scarce. Prior research focused mainly on physics, mathematics, and finance courses. Thus, it motivates scholars, including us, to investigate this issue in the introductory accounting courses.

2.4 Supplemental Instruction

Supplemental instruction is also used for peer-assisted study sessions (PASS), peer tutoring, peer-assisted learning (PAL), peer assistance academic program, and peer-led review sessions (Hizer, Schultz, & Bray, 2017; Paloyo, Rogan, & Siminski, 2016). SI, a cooperative learning model, was first created for certain courses in the medical school program at the University of Missouri–Kansas City in 1973 (Arendale, 2002; Goldstein et al., 2014). SI means instructional support provided through senior peers or peer-led group sessions outside the classroom. SI has four characteristics: (a) SI is provided for high-risk courses, and mostly for introductory-level courses. The high-risk course can be defined as one-third of the students receiving low grades; (b) the tutor of the SI (SI leader) should be a student who has completed courses; (c) SI sessions should be conducted outside of the class; and (d) SI leader should not re-lecture but only answer the student questions regarding course content (Goldstein et al., 2014). SI sessions can be organized in a voluntary or mandatory setting and online or face-to-face setting. That is, there is no specific requirement for the setting of the SI sessions, except being outside the classroom (Kilpatrick, Savage, & Wilburn, 2013).

In the literature, a low (voluntary) participation rate in SI sessions and the benefits of SI to student skills, success, learning, and retention have been discussed for various disciplines. Tsuei (2012) found that if students are paired with peers having a different level of ability (peer tutoring), they can develop reasoning skills, enhance their learning, and promote positive self-concepts. The research on the SI programs at California State University San Marcos has also presented that both the online and traditional SI participating students had higher course grades and lower fail rates in science and math courses as compared to students who participated in neither forms of SI (Hizer et al., 2017). Other studies (Bowles, McCoy, & Bates, 2008; Goldstein et al., 2014; Hizer et al., 2017; Jones, 2013; Kochenour et al., 1997; Ning & Downing, 2010; Paloyo et al., 2016) also argued that SI has a positive effect on student development, critical thinking skills, study skills, learning, academic grades, and timely graduation, and SI has decreased the failure rates across many higher institutions.

The following paragraph discusses the findings of the research conducted only for the accounting discipline. Accounting Education Change Commission (AECC) states that SI emphasizes "learning to learn, and is a proactive educational intervention pro-

gram that employs collaborative learning techniques and critical thinking skills (Jones & Fields, 2001).

Goldstein et al. (2014) have revealed that SI has a positive effect on students learning in introductory accounting courses; however, the participation rate in SI sessions is low. Other influences, e.g., parents, friends, classmates, and instructors, can affect and motivate students to participate in SI sessions. Jones and Fields (2001) observed a low participation rate in SI sessions, which was an average participation rate of 27%. Etter et al. (2000) have reported that SI has a positive impact on student's learning, retention rate, and academic performance in the introductory accounting courses. A similar result was presented for intermediate accounting courses. SI participation increased the intermediate accounting grades. It was found that SI active attendance (five or more SI sessions) and SI moderate attendance (three to four sessions) improved the accounting student GPAs by 0.74 and 0.41, respectively, compared to those who did not attend any sessions (Kilpatrick et al., 2013).

After introducing the relevant theory, concepts, and prior research above, it is time now to formulate the research questions and hypotheses. The following research questions (RQs) are established to explore student perceptions of WBPs and SI.

- *RQ1: What are student perceptions of the web-based assignment and assessment platform (WBP)?*
- *RQ2: What are student perceptions of the WBP's impact on the learning in accounting courses?*
- *RQ3: What are student perceptions of the WBP's impact on academic performance in accounting courses?*
- *RQ4: What are student perceptions of Supplemental Instruction?*
- *RQ5: What are student perceptions of SI's impact on learning in accounting courses?*
- *RQ6: What are student perceptions of SI's impact on academic performance in accounting courses?*

The following hypotheses are formulated to compare the mean differences between the groups.

- *H1: There is a significant difference in the mean WBP scores for males and females.*
- *H2: There is a significant difference in mean SI scores of males and females.*
- *H3: There is a significant difference in mean WBP scores for groups with and without prior accounting knowledge.*
- *H4: There is a significant difference in mean SI scores for groups with and without prior accounting knowledge.*
- *H5: There is any difference in WBP scores for class standing.* (*Class standing* group means freshman, sophomore, junior, and senior students.)
- *H6: There is any difference in SI scores for class standing.*
- *H7: There is any difference in WBP scores for different age groups.* (Group 1 includes ages 19 and under; Group 2 is 20 years old, and Group 3 is 21 years and above.)
- *H8: There is any difference in SI scores for different age groups.*

3. Sample, Survey, and Method

3.1 Sample and Survey

Sample

A total of 191 responses were compiled from students enrolled in the introductory (first) accounting classes (financial accounting or managerial accounting) at one of the American public universities.

Concerning the respondent demographics, 67% (n = 128) of the population sample are male and 33% (n = 63) are female. From the perspective of class standing, a majority of the respondents (n = 103, 54%) are sophomore, followed by juniors (n = 83, 43%) and few seniors (n = 5, 3%). Most respondent majors stemmed from marketing (n = 44, 23%), followed by finance (n = 42, 22%), and accounting (n =38, 20%). Other majors included management (n = 24, 13%), international business (n = 10, 5%), information systems (n = 6, 3%), economics (n = 5, 3%), and others (n = 22, 12%). Moreover, 60% (n = 114) of the respondents had prior accounting knowledge, while 40% (n =77) had no prior knowledge. Lastly, respondent ages ranged from 18 to 27 years, with an average age of approximately 20 years.

Survey

The questionnaire includes three sections. The first part is about respondent demographics. The second and third sections are regarding WBP and SI, respectively. A five-point Likert scale is used to measure the student perceptions of WBP and SI. It consists of two extreme poles and neutral. Neutral is coded as 3, which is *neither agree nor disagree*, 5 and 4 mean *strongly agree* and *agree*, respectively, 2 indicates *disagree*, and 1 means *strongly disagree*.

Following Ooko (2017), a WBP is operationalized by automatically graded assignments owned by a respected book publisher in the USA. SI is operationalized as peer tutoring by senior students, which is located in the library and organized by the accountancy department. Similarly, to measure student perceptions of WBPs and SI, the following aspects are investigated in the survey questions: whether WBPs and SI are helpful or troublesome and time-consuming. These variables are addressed in the survey through Questions 7–10 for WBPs (RQ1) and Questions 22–24 for SI (RQ4), as illustrated in Tables 1 and 2 in the Results section.

In line with the literature (Hung, Liu, Lin, & Lee, 2016; Kuh & Ewell, 2010; Ooko, 2017; Ozdamli, 2011), the abstract concept of *learning outcomes* (the result of student learning) is measured by the cognitive change (i.e., higher brain functions, such as memory and reasoning); gaining specialized knowledge; understanding the concepts; gaining critical and analytical thinking skills; gaining problem-solving, social interaction, and technological skills; and increased engagement. In line with previous research, in this chapter, these stated variables are used to measure the impact of WBPs and SI on students learning. These variables are addressed in the survey through

Questions 11–17 for WBPs (RQ2) and Question 25–31 for SI (RQ5), as illustrated in Tables 1 and 2 in the Results section.

Academic performance is assessed in terms of *course complete*, *pass*, or *fail*, and a higher course grade, consistent with the approaches of Joksimović et al. (2017) and Munzur (2017). By the same token, in this chapter, the aforementioned variables are used to scrutinize the impact of WBPs and SI on academic performance. These variables are addressed in the survey through Questions 18–20 for WBP (RQ3) and Questions 32–34 for SI (RQ6), as illustrated in Tables 1 and 2.

3.2 Method

Descriptive statistics addressed to explore and respond to RQ1–RQ6 regarding the student perceptions of WBPs and SI. Moreover, independent *t*-test and ANOVA analyses were used to compare the differences between the groups (H1–H8). The independent *t*-test (H1–H4) was utilized to compare only two group means, and ANOVA (H5–H8) was used to compare more than two group means (Hair, Black, Babin, & Anderson, 2010).

4. Results

4.1 Descriptive Results

Descriptive Statistics for the Web-Based Platform

Ahead of examining the relationships, the items included in the questionnaire were assessed to assert normal and symmetric distribution. The overall mean values of the WBP items ranged between 2.32 and 4.09. Closer observations regarding research questions 1–3 are discussed with the help of Table 1. Regarding RQ1, 87% of the respondents consider WBPs helpful, with a mean value of 4.09 (Q7), 66% do not find it more troublesome than PPH, and only 9% agree that the WBP is a troublesome tool (mean = 2.32 in Q8). It is found that 59% of the respondents strongly prefer and prefer WBPs to PPH (mean value of preference of PPH= 2.39 in Q10), although 52% *strongly agree* or *agree* that the WBP is time-consuming (mean = 3.47 in Q9).

With regard to RQ2, 71% of the students *agree* or *strongly agree* that the WBP helped them understand the concepts and gain specialized knowledge (Q11, mean = 3.74); 52% of the respondents stated that the WBP helped them to experience cognitive change (Q12, mean = 3.43). A majority of the students believe and strongly believe that the WBP helped them develop problem-solving (63%), critical thinking (61%), analytical (62%), and technical (63%) skills (Q13–Q16, mean range between 3.56 and 3.63); 69% believe that the WBP increased their engagement in the course (Q17, mean = 3.71). Concerning RQ3, 85% *believe* or *strongly believe* that WBP helped them to complete the course (Q18, mean = 4.04); 69% and 74% of the students mentioned that WBP helped them pass the course (Q19, mean = 3.83) and increase their academic performance in the course (Q20, mean = 3.95), respectively.

Tab. 1: Descriptive results distribution of the web-based platform

RQ	Q in survey	Min.	Max.	Mean	Std. error	Variance	Skewness	Kurtosis
RQ1	Q7	1	5	4.09	.05	.52	-1.17	3.37
	Q8	1	4	2.32	.06	.64	.50	-.09
	Q9	1	5	3.47	.07	.86	-.31	-.36
	Q10	1	5	2.39	.07	.98	.51	-.15
RQ2	Q11	1	5	3.74	.06	.63	-.80	.72
	Q12	1	5	3.43	.06	.79	-.40	-.23
	Q13	1	5	3.63	.05	.56	-.63	.49
	Q14	1	5	3.56	.06	.59	-.70	.24
	Q15	1	5	3.58	.06	.59	-.67	.29
	Q16	1	5	3.57	.07	.86	-.65	-.13
	Q17	1	5	3.71	.06	.79	-.80	.50
RQ3	Q18	1	5	4.04	.06	.57	-1.19	2.91
	Q19	1	5	3.83	.07	.90	-.71	.18
	Q20	1	5	3.95	.06	.71	-.66	.30

Descriptive Statistics for the Supplemental Instruction

Similar to the research of Jones and Fields (2001), it is found that voluntary participation in SI is low (30%). Out of this 30%, 20% attended the SI maximum of three times during the semester. Table 2 shows the descriptive statistics for the research questions 4 to 6. Overall, the mean values of the SI items vary between 2.37 and 3.60. The majority of student responses to SI questions were neutral (*neither agree nor disagree*), which can be explained by the low participation rate in SI. For instance, regarding RQ4, only 49% believe that SI is a helpful service (Q22, mean = 3.60); 42% and 50% *neither agree nor disagree* that SI is troublesome and time-consuming service (Q23–Q24, mean = 2.37 and 3.17), respectively. Concerning RQ5, the analysis of the questions 25 to 31 showed that the majority of the responses are neutral, with the average mean of 3.28. It is the same with RQ6 (average mean = 3.18). Approximately 65% neither agree nor disagree that SI helped them to complete the course, pass the course, and increase the grade in the course.

In Table 2, *skewness* and *kurtosis* indicate the symmetry and "peakedness" of the distribution, respectively. According to Pituch and Stevens (2015), as a rule of thumb, if skewness and kurtosis are less than -2 or greater than 2, the distribution is asymmetric. In Tables 1 and 2, most of the skewness and kurtosis scores are between -2 and +2, so no major asymmetric distribution problem is noted. Moreover, standard error ranges between 0.05 and 0.07, a smaller standard error is better, because smaller standard errors provide the likely accuracy of the sample mean as compared with the population mean (Hair et al., 2010). In other words, our descriptive results are reliable for all research questions.

Tab. 2: Descriptive results distribution of the Supplemental Instruction

RQ	Question in survey	Min.	Max.	Mean	Std. error	Variance	Skewness	Kurtosis
RQ4	22	2	5	3.60	.06	.76	.19	-.47
	23	1	4	2.37	.06	.83	-.25	-.77
	24	1	5	3.17	.06	.76	-.30	.52
RQ5	25	1	5	3.39	.05	.66	.48	.89
	26	1	5	3.30	.05	.64	.79	1.62
	27	1	5	3.29	.05	.63	.65	1.56
	28	1	5	3.24	.05	.63	.71	1.85
	29	1	5	3.28	.05	.60	.77	2.00
	30	1	5	3.32	.05	.68	.40	1.55
	31	1	5	3.20	.05	.66	.83	1.99
RQ6	32	1	5	3.16	.05	.72	.30	2.11
	33	1	5	3.15	.05	.68	.14	2.55
	34	1	5	3.23	.05	.72	.36	2.20

4.2 Independent *t*-Tests

As depicted in Table 3, the independent *t*-tests compare the scores between groups for gender and accounting knowledge in WBPs and SI. The first independent-samples *t*-test compares the WBP scores for females and males. The results (H1) show no significant differences in scores for females (M = 48.97, SD = 5.78) and males (M = 48.60, SD = 5.02; t (188) = .45, p = .66, 2-tailed). The magnitude of the difference (mean difference = .37, 95% CI: -1.25 to 1.98) was .07, considered a moderate effect (Cohen, 1988).

A second independent-samples *t*-test compares SI score for gender. Results (H2) demonstrate that there is no significant difference between females (M = 39.82, SD = 11.28) and males (M = 39.28, SD = 11.44; t (187) = .10, p = .92, 2-tailed). The magnitude of the difference (mean difference = .18, 95% CI: -3.32 to 3.67) was .05, considered a moderate effect (Cohen, 1988).

Another independent-samples *t*-test compares the WBP scores on accounting knowledge. The analysis (H3) does not prove a statistical difference in scores for those with no prior accounting knowledge (M = 49.27, SD = 5.60) and those with prior accounting knowledge (M = 48.35, SD = 5.03; t (188) = 1.19, p = .24, 2-tailed) knowledge. The magnitude of the difference (mean difference = .93, 95% CI: -.61 to 2.46) was .17, seen as a large effect (Cohen, 1988).

Lastly, an independent-samples *t*-test was employed for SI scores on accounting knowledge. The results (H4) demonstrate there is no significant difference between those with no prior accounting knowledge (M = 39.2, SD = 12.65) and those with prior accounting knowledge (M = 39.99, SD = 10.43; t (188) = -.43, p = .67, 2-tailed) skills.

Tab. 3: Independent sample t-tests for H1–H4

	Levene's test for equality of variances		*t*-test for equality of means						
	F	Sig.	*t*	df	Sig. (2-tailed)	Mean difference	Std. error difference	Lower	Upper
Gender in WBP (H1)									
Equal variance assumed	.12	.72	0.4	188	.66	.37	0.82	-1.25	1.98
Equal variance not assumed			0.43	106.85	.67	.37	0.86	-1.34	2.07
Gender in SI (H2)									
Equal variance assumed	.00	.96	0.10	187	.92	.18	1.77	-3.32	3.67
Equal variance not assumed			0.10	119.65	.92	.18	1.76	-3.31	3.67
Accounting knowledge in WBP (H3)									
Equal variance assumed	.67	.42	1.19	188	.24	.93	0.78	-0.61	2.46
Equal variance not assumed			1.17	151.66	.24	.93	0.79	-0.64	2.50
Accounting knowledge in SI (H4)									
Equal variance assumed	.85	.36	-0.43	187	.67	-.72	1.69	-4.04	2.61
Equal variance not assumed			-0.41	142.30	.68	-.72	1.75	-4.17	2.73

The magnitude of the difference was .06 (mean difference = -.72, 95% CI: -4.04 to 2.61), thus having a moderate effect (Cohen, 1988).

In simpler terms, H1 to H4 are rejected. This result means that the groups having different gender categories and levels of accounting knowledge do not have significantly different perceptions of WBPs and SI.

4.3 ANOVA Analysis

One-way between-groups analyses of variance examined the impact of class standing and age regarding WBPs and SI. Class standing – freshman, sophomore, junior, and senior – was used as a criterion to build groups. Participants were divided into three age groups (Group 1: 19 years and under; Group 2: 20 years; and Group 3: 21 years and above).

Tab. 4: One-way analysis of variance (ANOVA) for H5–H8

	Sum of squares	df	Mean square	*F*	Sig.
	Class standing in WBP (H5)				
Between groups	32.88	2	16.44	0.59	.56
Within groups	5215.34	187	27.90		
Total	5248.22	189			
	Class standing in SI (H6)				
Between groups	324.70	2	162.35	1.26	.29
Within groups	23933.11	186	128.67		
Total	24257.81	188			
	Age in WBP (H7)				
Between groups	9.42	2	4.71	0.17	.85
Within groups	5238.80	187	28.02		
Total	5248.23	189			
	Age in SI (H8)				
Between groups	521.19	2	260.60	2.04	.13
Within groups	23736.62	186	127.62		
Total	24257.81	188			

As reported in Table 4, the first comparison between groups (H5) shows no statistically significant difference at the $p < .05$ level in class standing regarding WBPs: F (2, 187) = .59, p = .56. The second comparison between groups was class standing on SI. The analysis (H6) shows there is not a statistical difference between the groups: F (2, 186) = .1.26, p = .29. Moreover, a comparison between the aforementioned age groups was tested. The result for age in WBP (H7) shows there is not a statistical difference between the groups: F (2, 187) = .17, p = .85. Lastly, a comparison between age groups in SI was examined. The result (H8) demonstrates no statistically significant differences between the age groups in SI: F (2, 186) = 2.04, p = .13.

Altogether, H5–H8 are rejected: The groups having different ages and class standings do not have significantly different perceptions of WBPs and SI.

5. Discussion and Conclusion

This chapter contributes to the understanding of student perceptions of WBP and SI by departing from connectivism learning theory. Overall, the descriptive statistics show that students have a positive perception of WBP and a neutral perception of SI.

Regarding Research Question 1, students perceive WBPs as time-consuming but still helpful and useful tools, preferred over PPH. Concerning Research Questions 2 and 3 regarding learning and academic performance, all of the mean statistics are above neutral (average mean values = 3.60 and 3.94), which means that students have

positive perceptions of a WPB's impact on learning and academic performance. They strongly believe that the WBP is a helpful tool for understanding the concepts, gaining specialized knowledge, completing the course, and increasing their academic performance. They further agree that the WBP helps them increase cognitive activity, develop problem-solving skills, enhance critical thinking, improve technological skills, become more engaged in, and pass the course.

Even though almost half of the respondents perceive SI as helpful and useful, voluntary participation in SI is low (30%). This can be explained by student beliefs that SI is time-consuming. Although the mean values of SI are lower than those of WBPs, they are still neutral or slightly above neutral. For instance, the average mean statistics of SI's impact on learning and academic performance, encapsulated in Research Questions 5 and 6, are 3.29 and 3.18, respectively. This indicates a neutral student perception of the SI in being helpful in understanding concepts, gaining knowledge, increasing the cognitive activity, developing problem-solving skills, enhancing critical thinking, improving technological skills, getting engaged in the course, completing and passing the course, and increasing the academic performance in the course.

Moreover, the chapter tests the difference between the group perceptions of WBPs and SI. It was expected to find a significant difference between the groups' mean values, but the *t*-test and ANOVA results show no mean value differences between the groups. It indicates that respondent age, gender, class standing, and prior accounting knowledge do not create any significant perception difference. A possible explanation for this may be found in the sample size, because the majority of the sample is male-sophomore students with prior accounting knowledge at one American university. However, the results posit that more attention is needed to explore, examine, and test the eclectic tenet of connectivism learning theory regarding WBP and SI to provide scholars, teachers, and policymakers with more clarity. The necessity and importance of WBPs and SIs cannot be overlooked in the recent era.

6. Limitation and Future Research

Although this chapter showed the necessity and importance of WBPs and SI, it has some limitations, which point towards the topics to be addressed in future research. The first limitation is the population sample. The present chapter uses data compiled from one university, so the sample is not homogenous. Future research is encouraged to examine and test WBPs and SI with a broader, homogenous population sample, which could include several universities and a range of accounting courses.

The second limitation is that only student perceptions are explored, not instructor perspectives. Hence, it is suggested that future research explores instructor perceptions of WBPs and SI to understand both sides of the issue. This would provide policymakers and service providers with a holistic picture to improve WBPs and SI for all beneficial actors. Finally, the goal of the study was to measure student perceptions of learning outcomes and academic performance; actual learning outcomes and

academic performance were not investigated. This may motivate scholars to conduct future comparative research to measure the gap between the actual and perceived outcomes and to identify how to foster reflective and critical thinkers, problem solvers, and self-leaders who are prepared for ambiguous challenges in unprecedented times.

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7. SI-PASS in a Belgian University: A Pilot Showcase

Dominique Verpoorten, Emmanuelle Parlascino & Catherine Colaux

Abstract: In recent years, the University of Liège (Belgium), like many other institutions, has been coping with an ever-increasing number of first-year students, not compensated by an equivalent increase of supervisory capacities. This situation has resulted in both a rather impersonal first-year experience for freshmen and a worrisome level of drop-out and failure, especially in difficult entry courses. To tackle these two issues, the Faculty of bioengineering (Gembloux Agro-Bio Tech, https://www.gembloux.uliege.be/cms/c_4039827/en/gembloux-agro-bio-tech) has decided to run the pilot of an SI-PASS peer tutoring scheme. This article reports on the practical aspects of this dry-run and provides participant data about its perceived effects.

1. Introduction

Topping (1996, p. 322) gives two definitions of *peer tutoring*. The first one has long been equated to "more able students helping less able students to learn in co-operative working peers or small groups carefully organized by a professional teacher." Today's definition has moved beyond this dichotomy between high and low performers to a broader definition that does not stigmatize students within the group. The commonly accepted definition is therefore "people from similar social groupings who are not professional teachers helping each other to learn and learning themselves by teaching."

This general definition may cover very different realities as there are so many factors that can influence the instantiation of this tutoring. Thus, Topping (1996, p. 322), following a meta-analysis, built a typology of peer tutoring based on ten dimensions.[1] In the next section, we use Topping's framework to describe and qualify our Belgian SI-PASS case study. To this end, the next section dispatches Topping's ten dimensions according to the typical information breakdown found in any regular Method section, giving for each theoretical dimension how it was practically implemented in the pilot.

1 Besides Topping's typology, Andrews and Clark (2011) define a seven-fold descriptive tool of peer-tutoring set-ups. There is no real overlap between the two conceptual tools because they locate at different granularity level. However, if we try to use the Andrews and Clark framework, the Liège's SI-PASS scheme falls the most appropriately under the type "One-to-group longer term peer mentoring" (p. 21).

2. Method

2.1 The Course

Topping's Dimension 1: "Curriculum Content – which may be knowledge or skills orientated, or a combination. The scope of peer tutoring is very wide, and projects are reported in the literature in virtually every imaginable subject."

According to a regular SI-PASS scheme (Martin & Arendale, 1992), the pilot was focused on a challenging course. The syllabus of the course General Physics: Thermodynamics can be found here: https://www.programmes.uliege.be/cocoon/20192020/en/cours/PHYS3024-1.html

2.2 Participants

Topping's Dimension 2: "Contact Constellation – some projects operate with one tutor working with a group of tutees, but the size of group can vary from two to thirty or more. Sometimes two tutors take a group of tutees together. Less traditional, and more intensive, is peer tutoring in pairs (dyads)." In our case, all first-year students were dispatched at random in 17 groups of about 15 participants guided by one tutor, called *leader* (standard vocabulary in SI-PASS schemes).

Topping's Dimension 3: "Year of Study – tutors and tutees may be from the same or different years of study." In this case, tutors were second- or third-year students.

Topping's Dimension 4: "Ability – while many projects operate on a cross-ability basis (even if they are same-year), there is increasing interest in same-ability tutoring (where the tutor has superior mastery of only a very small portion of the curriculum, or a pair are of equal ability but working towards a shared, deeper and hopefully correct understanding)."

We are aware of this growing interest in same-ability and same-year peer tutoring (Thalluri, O'Flaherty, & Shepherd, 2014). However, this dimension does not apply to conventional SI-PASS programs, favouring tutoring by students who succeeded in the targeted course.

Topping's Dimension 8: "Tutee Characteristics – projects may be for all students or a targeted subgroup, e.g., the especially able or gifted, those considered at risk of under-achievement, failure or dropout, and those from ethnic, religious and other minorities."

SI-PASS defines itself – and it is a hallmark – as "non-remedial" (Principle 6 of the "21 SI-PASS principles," European Centre for SI-PASS, 2018, p. 13). This means that the participants do not come because they "have a problem" (*deficit pedagogy*, as in Lawrence, 2002) but because they want to make progress together and each at their own level in the mastery of the course. So, it can be said that in our case, there is deliberately no tutee characteristics defined.

Topping's Dimension 9: "Tutor Characteristics – the traditional assumption was that tutors should be the 'best students' (i.e., those most like the professional teachers). However, very large differentials in ability can prove under-stimulating for the tutor. If

tutors are students who are merely average (or even less), both tutor and tutee should find some cognitive challenge in their joint activities. Although tutee gain may not be so great, the aggregate gain of both combined may be greater. Many projects in schools have deployed students with learning and behavior difficulties as tutors, to the benefit of the tutors themselves."

Tutors were recruited on a voluntary basis. The inclusion conditions were to have passed the course with success, to be willing to help freshmen (as expressed in a motivation letter), and to attend the two-day training – Bachelet (2010) puts emphasis on such training. Tutors were paid at the university student job rate for 30 hours, including training time, session time (one per week during one semester) and preparation time of these sessions. They also engaged in filling a feedback questionnaire at the end. The data presented hereunder come from this instrument. Beyond the initial two-day training, a "mini-cursus" was offered to leaders. It was composed of three hours scattered in the semester. During this "leader continuous training," a debriefing took place, and some new facilitation techniques were provided for the sessions.

2.3 Organisation and Schedule

Topping's Dimension 5: "Role Continuity – especially in same-ability tutoring, the roles of tutor and tutee need not be permanent. Structured switching of roles at strategic moments (reciprocal tutoring) can have the advantage of involving greater novelty and a wider boost to self-esteem, in that all participants get to be tutors."

Strictly speaking, there is no switch of role in SI-PASS. However, if we focus on the second part of Topping's description, SI-PASS encourages mutual explanations by participants during the sessions, the group leader playing then a role of activator (Hattie, 2009). Moreover, reinforced self-esteem is also a benefit observed for leaders in some SI-PASS programs. This side-effect will not be investigated in this chapter which mostly targets data from freshmen in SI-PASS sessions.

Topping's Dimension 6: "Place – Peer tutoring may vary enormously in location of operation."

The instruction to leaders has been to organize the SI-PASS sessions in university tenements. To book available rooms (classes or spots in the library), they could rely on the help of the Faculty's pedagogical advisor.

Topping's Dimension 7: "Time – Peer tutoring may be scheduled in regular class contact time, outside of this, or in a combination of both, depending on the extent to which it is substitutional or supplementary."

Leaders were free to fix the best timeslot for their groups, but it was asked to make this choice as inclusive as possible, excluding therefore evening' meetings because some participants leaving at some distance of the campus would have been obliged to come back just for the sessions. Leaders were asked to organize their meetings once a week.

2.4 Goals and Achievement Measurements

Topping's Dimension 10: "Objectives – projects may target intellectual gains, formal academic achievement, affective and attitudinal gains, social and emotional gains, self-image and self-concept gains, or any combination. Organisational objectives might include reducing dropout, increasing access, etc."

The pilot results from discussions within our teaching and learning centre, with the university vice-chancellor and with protagonists in the different faculties/departments having volunteered for participation. From these discussions, the following goals have been assigned to the SI-PASS scheme:

1. Contribute to improve student performance in the selected high-risk course;
2. Contribute to reduce the number of drop-outs;
3. Facilitate the intellectual transition from secondary to higher education;
4. Facilitate the social integration of new students into the university environment;
5. Improve students' study strategies;
6. Foster collaboration among students and the creation of partnership networks for learning purposes;
7. Train students to argue and justify their ideas/views.

During their training (Bird, 2019), leaders were taught these goals but also informed about priority levels. Ultimately SI-PASS schemes target better performance in the selected course. The scheme is therefore primarily focused on academic integration. That does not mean that SI-PASS is deprived of other types of benefits, but these are more seen here as nice to have but as by-products anyway. This list of seven goals is important for the remainder of this chapter, as it is used as a guide to present the results.

2.5 Instruments and Data Sources

At the end of the SI-PASS scheme, we administered a feedback questionnaire to both leaders and participants. It clearly means that the displayed results are based solely on self-reported data. It is also needed to point out that no congruent information could be collected concerning the seventh goal relating to the training of argumentation and the justification of their ideas. It was planned to record some sessions to possibly see this targeted skill at work, but the first iteration of the scheme eventually did not allow this. Therefore, we will not discuss this goal further in the results. Regarding the first objective of performance improvement in the challenging course, we acknowledge that the natural expectation would be to look at students' scores at the exam. However, this was not applied for the following reasons: (a) scores at the exam, and especially the non-anonymized scores needed here to associate performance and SI-PASS attendance are protected by laws on personal data, (b) we have favoured a survey that preserves the anonymity of the students, which makes it impossible to link the participation in the SI-PASS meetings to the results obtained in the examination of the

course particularly worked on, (c) in human sciences, any effort to precisely trace the influence of any type of learning support back to a final note is fraught with problems as one knows that this note is the result of many non-controlled variables, starting with the level of the individual students at baseline.

3. Results

The results are organized so that readers can make up their mind about the achievement of the seven goals defined just above for the program.

Before displaying the results related to the purposes assigned to the SI-PASS scheme, a look at the overall attendance is needed as student participation rate is, besides perception and performance (see the "3P" in Verpoorten et al., 2017, p. 39), a global indicator of the value granted to any student support action (Verpoorten et al., 2019). During the first semester of the 2019–2020 academic year, 279 freshmen were offered to take part in SI-PASS sessions. Out of this number, the attendance reports filled each week by the leaders indicate that 129 students (46%) attended at least one meeting. The participation rate is broken down in Table 1. Figure 1 relates the participation rate to the 81 respondents.

Tab. 1: Breakdown of students by the number of sessions attended

	No participation	Between 1 and 5 meetings	Between 5 and 10 meetings	More than 10 meetings
Number of students	150	85	36	8

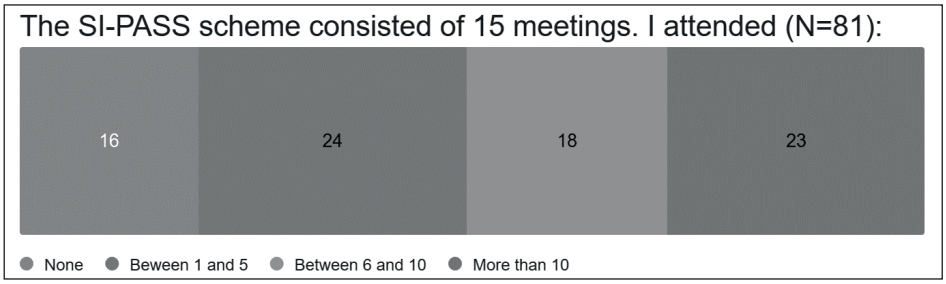

Fig. 1: The data comprises all levels of commitment to the SI-PASS scheme[2]

Each participant could mention three reasons for participation, and 39 students cited at least one. Of these, the most frequently mentioned were the following:

2 The respondents who did not attend any SI-PASS meetings were guided, after three questions about their reasons for non-participation, towards the end of the survey. If all respondents had answered to everything, we would have a N of 65 for all questions. Unfortunately, respondents regularly, and without any satisfying explanation, bypass questions so that the N mostly revolves around 50.

- Improve understanding of the course (22 occurrences)
- Rework the course or subject (14)
- Get help or answers to their questions (11)
- Study collectively and regularly (10)
- Getting together as students (10)
- Wanting to help others with what the student understood from the course (5)
- Approaching the material from a different angle/with different explanations (5)
- Get advice/explanations from the leader (4)
- Hear questions from others (4)
- Discover a different methodology (4)
- Just curiosity (4)

What we find interesting about these responses is that they reflect both concerns for additional help and concerns for self-assessment and possible confirmation of one's own understanding of the material in this reputedly difficult course. Here starts the systematic presentation of the results according to the goals assigned to the pilot.

3.1 Goal: "Contribute to Improve Student Performance in the Selected High-Risk Course"

For the reasons mentioned hereunder, this goal will be examined, like all the others, through the prism of the effects and perceptions reported by the students in the survey.

Table 2 suggests an association between this perception and attendance. The more students participate in the SI-PASS sessions; the more virtues they attribute to the scheme concerning the success of the exam. In fact, when the student has participated in more than ten meetings, there are no responses that disagree with the proposal and this link between SI-PASS and exam success is more popular than in the other categories of participation in these meetings.

Other data in the survey corroborate these views on improving student performance. Three germane questions in particular have been singled out.

When we break down student responses to the question "the SI-PASS provided me with many opportunities to learn about the thermodynamics course" according to their participation in the organized meetings, we get Table 3.

Here too, the students who take part in more than ten meetings express no disagreement on this link between SI-PASS and learning and more opinions in agreement with the proposal. Based on what students are saying, the SI-PASS scheme thus seems to have achieved this goal of improving performance, and it would appear that regular participation in the scheme further improves student performance or, at the very least, their sense of being able to do better.

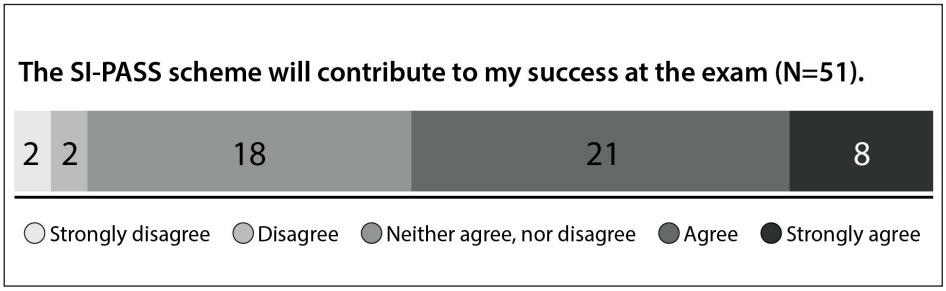

Fig. 2: Half of the respondents stated that the SI-PASS scheme would have a positive influence on the likelihood of passing the exam

Tab. 2: Decomposition of the reported effects of SI-PASS on exam success based on the number of meetings the student attended.

	I disagree completely.	Somewhat disagree	Neither agree nor disagree	Pretty much agree	I couldn't agree more.
Between 1 and 5 meetings (13)	2	1	6	4	0
Between 5 and 10 meetings (16)	0	1	7	6	2
More than 10 meetings (22)	0	0	5	11	6

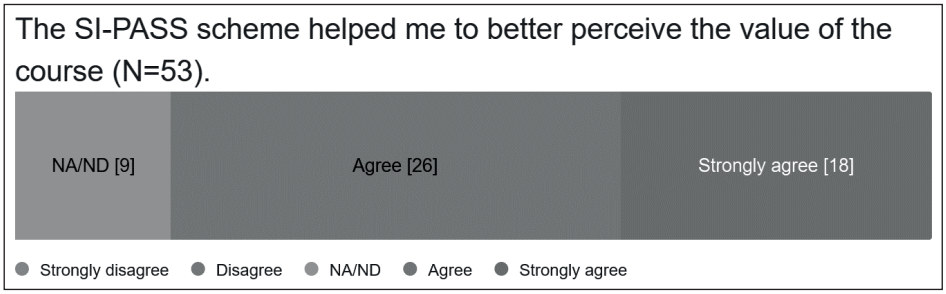

Fig. 3: A large majority of respondents report gains in the understanding of the course relevance

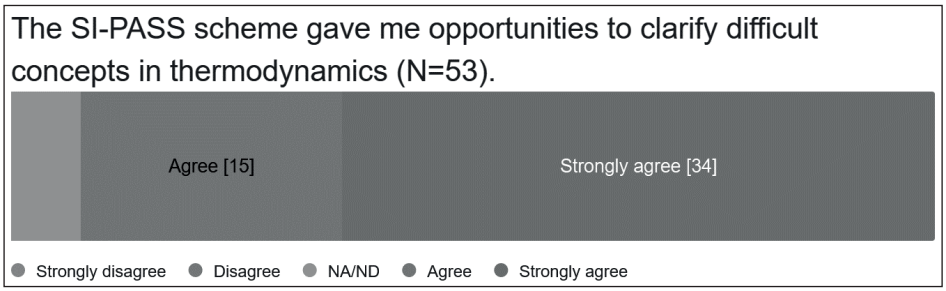

Fig: 4: Participants credit the SI-PASS scheme of helping them to grapple with learning bottlenecks in the course

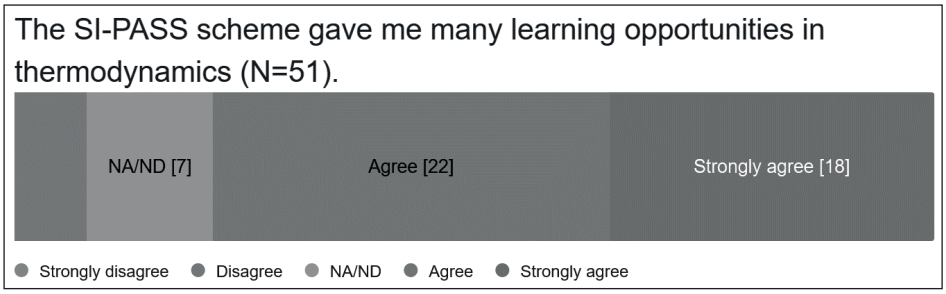

Fig: 5: The SI-PASS scheme is overall considered as providing extra learning opportunities

Tab. 3: Breakdown of perceptions of SI-PASS as a place to learn by number of attended meetings

	I disagree completely.	Somewhat disagree	Neither agree nor disagree	Pretty much agree	I couldn't agree more.
Between 1 and 5 meetings (13)	0	2	5	6	0
Between 5 and 10 meetings (16)	0	2	0	7	7
More than 10 meetings (22)	0	0	2	9	11

3.2 Goal: "Contribute to Reduce the Number of Drop-Outs"

Although such an impact on reducing first-year student dropouts is suggested in the literature (Malm, Bryngfors, & Mörner, 2011; Malm, Bryngfors, & Frederiksson, 2018; Dawson, Van der Meer, Skalicky, & Cowley, 2014), we reluctantly included questions thereabout because it seemed oversized to us. Indeed, we did not exclude the possibility of some indirect influence but not a reporting of a straight one.

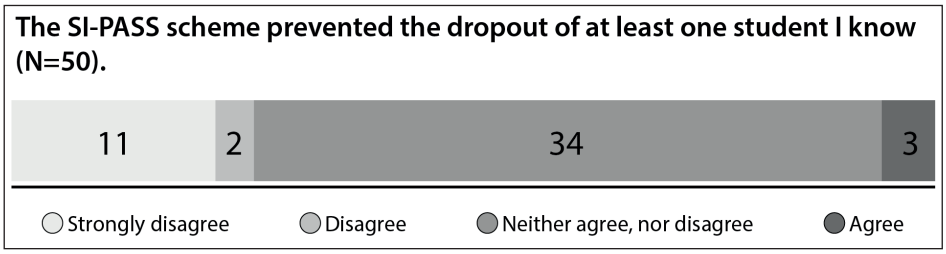

Fig. 6: Against all odds, three respondents report a direct impact on drop-out prevention

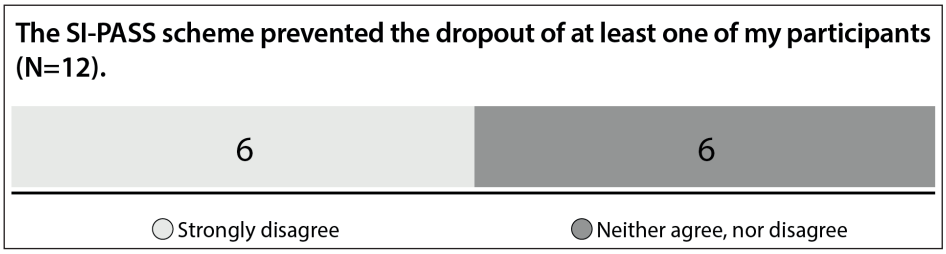

Fig. 7: Leaders do not report influence on retention for their participants

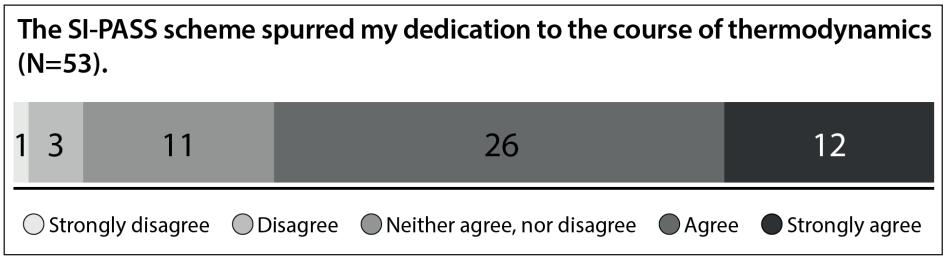

Fig. 8: The SI-PASS scheme is perceived as having a positive effect on the academic commitment to the course

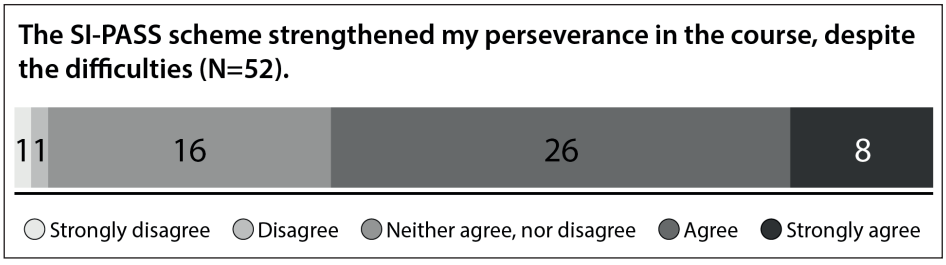

Fig. 9: Whilst effects of drop-out prevention is not demonstrated, students might express a lighter but genuine benefit of the SI-PASS scheme on retention through a help to hang in

Is this naïve or flawed with social desirability? Maybe. In any effect, no leader reported such an effect on their own students (Figure 7).

Regarding Objective 2, the data we have leaves us lopsided. It must also be noted that the surveys were submitted to the students (both leaders and freshmen) before the first exam session of the academic year. As a result, it may be difficult for the students to make up their mind on whether or not their classmates were tempted to quit. We can note, however, that, while there is no conclusive result on the decrease in dropouts, the responses regarding student perseverance (see Figures 8–9) in the course are more telling.

The results given in this section do not mean that, in the end, students are not going to give up, but it does show – at the self-report level – that the SI-PASS scheme has, at a minimum, made them want to work harder on the course.

3.3 Goal: "Facilitate the Intellectual Transition From Secondary to Higher Education"

There is a fairly broad consensus that the transition from secondary to higher education is paved with challenges and difficulties (Tinto, 1993; Romainville & Michaut, 2012), tied among others to changes in the study habits. There was therefore reason to believe that an SI-PASS scheme could help in this way. Unfortunately, this aspect was not largely expressed by the students.

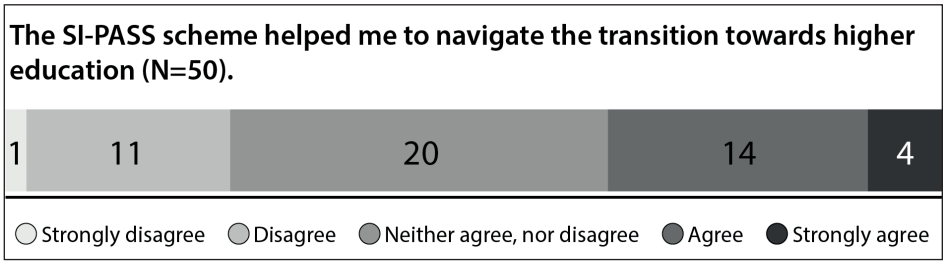

Fig. 10: Respondents judging that the SI-PASS scheme is supportive of the transition from secondary to university education are a modicum

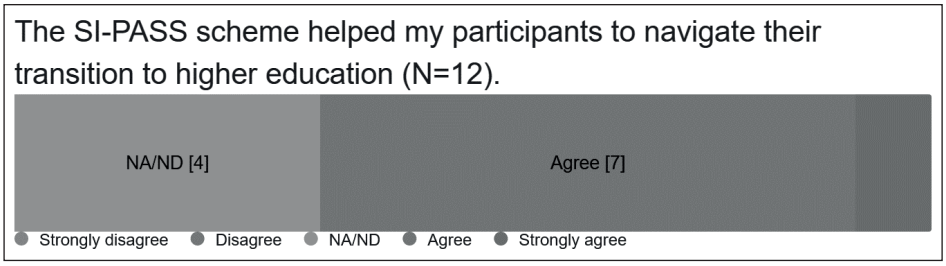

Fig. 11: SI-PASS leaders do see a contribution of the scheme to the transition to higher education

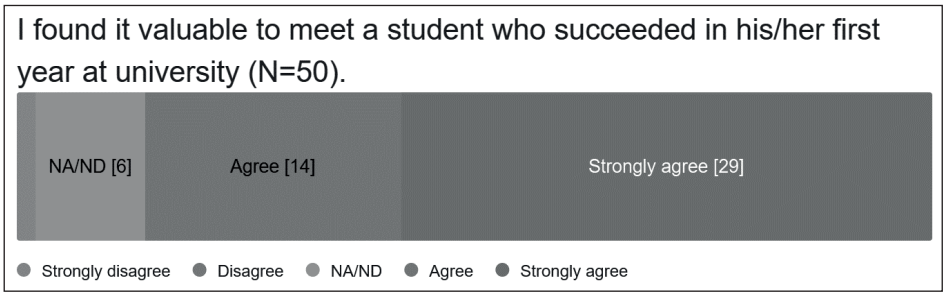

Fig. 12: Meeting a more advanced peer (the leader) through the SI-PASS scheme was appreciated

It is surprising that the benefits of this SI-PASS on this transition from secondary to higher education are not perceived in the same way by the freshmen and by the leaders. Indeed, the latter took a much more positive view on the achievement of this objective (see Figure 11).

Participant answers about transition could also be tempered with another aspect of this SI-PASS scheme: putting young first-year students in contact with a peer who has just passed his first year has been perceived quite positively by the students (see Figure 12). We do not pretend that this means that transition was alleviated. However, some benefits for the transition might flow from the vicarious learning that results from these meetings with more advanced students who share a fairly similar profile.

3.4 Goal: "Facilitate the Social Integration of New Students Into the University Environment"

Going through one's transition from secondary to university education is one thing. Feeling like members of one's new institution is a second one. We had the wish that the SI-PASS scheme would facilitate this social integration and this sense of belonging to a community (Pittman & Richmond, 2008).

Only 46% of students take a positive view of the effect of SI-PASS on their university membership. Two other indicators reveal a largely positive effect on the image of the university that the peer tutoring scheme induced.

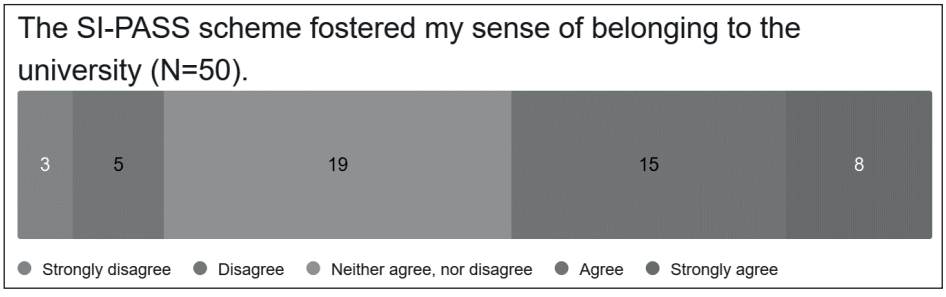

Fig. 13: The SI-PASS scheme is not strong on the reinforcement of affiliation

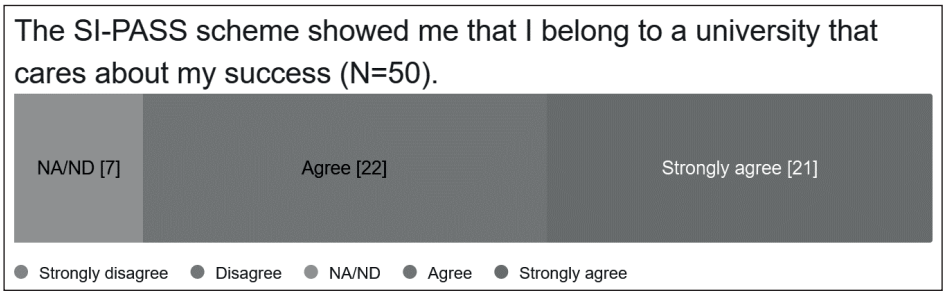

Fig. 14: Most freshmen have received the SI-PASS scheme as a welcome package from the institution

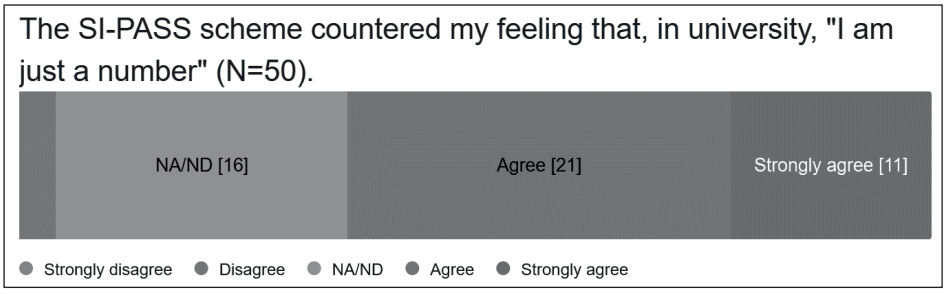

Fig. 15: A majority of freshmen see the SI-PASS scheme as a worthwhile way to diminish feeling of impersonality sometimes attributed to university

86% of the students feel that their university cares about their success, and 64% that they are more than just a number to their University. These positive opinions about their school could be understood in the following way: if, as students, they are positive about the school where they learn, that school has, at least in part, included them in its midst and they feel good there. The SI-PASS scheme is not irrefutable proof of inclusion, but it is perceived as an "institutionally-stamped" catalyst, among others.

3.5 Goal: "Improve Students' Study Strategies"

While SI-PASS programs are firstly dedicated to improving student performance in high-risk courses, they also trigger study strategies and effective methodologies to get the most of one's study efforts. In the survey, we explored these study strategies dimensions through three parameters: workload management, course preparation, and exam preparation.

A cross-reference of these questions with the attendance rate at the SI-PASS meetings was not conclusive: we found the same number of students agreeing or disagreeing regardless of the number of meetings they had attended.

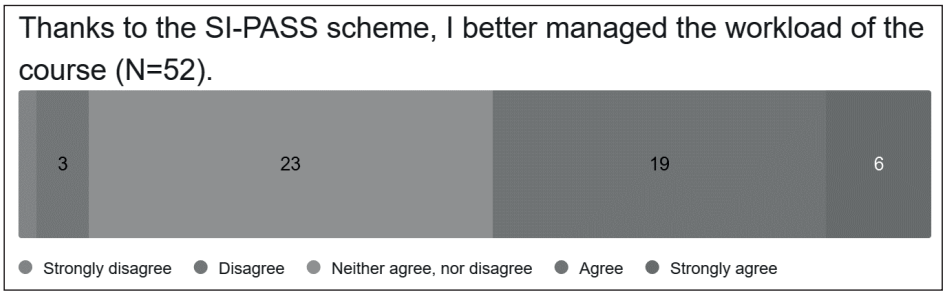

Fig. 16: SI-PASS scheme is claimed to be helpful regarding workload management

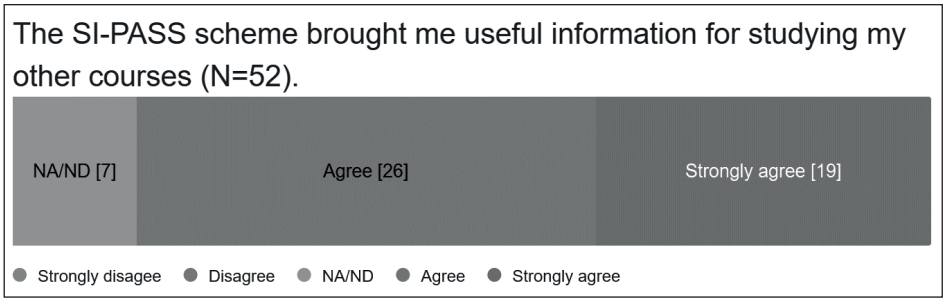

Fig. 17: The data contains indications of transfer benefits to other courses

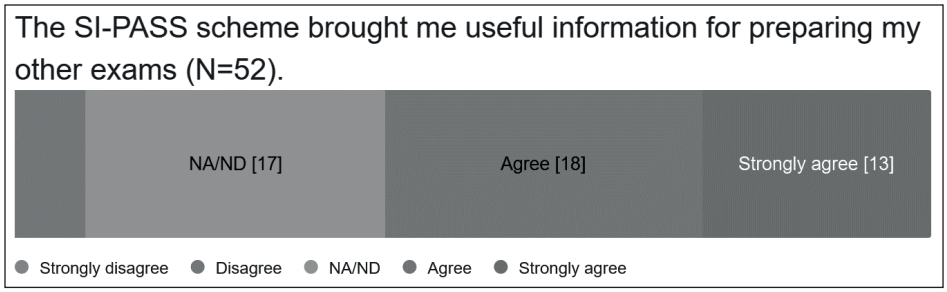

Fig. 18: Students' answers point at transversal benefits of the SI-PASS scheme regarding exam preparation.

3.6 Goal: "Foster Collaboration Among Students and the Creation of Partnership Networks for Learning Purposes"

SI-PASS programs mainly rely on interactions between peers as catalysts for learning. Collaboration, also seen as a generic skill to train, is therefore of the utmost importance in such peer-tutoring schemes. This objective seems to have been met, based on the students' statements, in the two dimensions envisaged.

These results are corroborated by what respondents express regarding their underpinning motivation to attend the SI-PASS meetings:

- Benefit from the emulation of the group (cited 9 times)
- Getting help (11) and helping others (4)
- Hear questions from others (4)

Fig. 19: Offered at the start of the first semester, the SI-PASS scheme seems to have extended the social network of the attendees

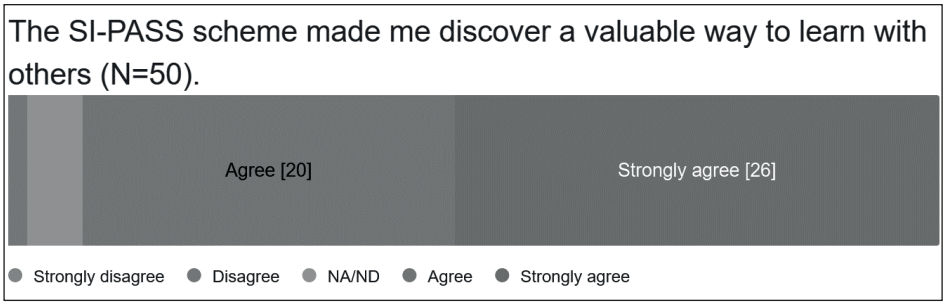

Fig. 20: Besides the pure social integration effect, the SI-PASS helps freshmen to envision collective ways to practice learning

Students verbatims from open questions put emphasis on reciprocity, alternating roles of giver and receiver or teacher and student (Annis, 1983), and mutual benefits of learning together: "Teaching a subject to a peer makes it possible to integrate the subject in question better than if the student merely reads it for personal knowledge," "Listening to other people's questions is a good way to see if you know how to answer other people's questions," "Learning how to formulate correct answers and explanations," or "It's super interesting to hear other people's questions and participate in the answer."

4. Discussion

This first implementation of an SI-PASS scheme in a French-speaking university is instructive. Although we deplore an overall lack of student participation, those who participated report to have benefited from this action, particularly in terms of performance (Figures 2–5) and study strategies (Figures 16–18). This SI-PASS was also

experienced as a way of creating links with students from the same year (Figure 19) and next year (Figure 12) and as a way of learning differently (in contrast to individual learning or learning with teachers or TA, Figure 20). The SI-PASS scheme also had a beneficial effect on students' visions of their university (Figures 13–15). This survey therefore gives us good encouraging indications as to the continuation of this peer-tutoring program, while inviting us to draw lessons from this experience and regulate it so that it brings additional benefits to students. The most prominent regulation that we draw from the findings is a renewed attention to the attendance in SI-PASS sessions and the best conditions to promote this attendance, knowing however that it was a pilot and that it probably takes time to establish the reputation of a program in the student population.

In attempting to move from the local context of this case study to more general statements, three observations are worthy of reflection:

1) The SI-PASS in Liège is the first ever to be organized in a French-speaking country. Despite this different cultural context, the opinions obtained from the participants provide indications of effects found in other contexts (see Dawson et al.'s systematic review, 2014), especially in terms of general satisfaction and well-being, enhanced social relationships, study strategies and techniques or student persistence. The convergence goes even further since, in Belgium too, if we trust the self-reported effects, these effects seem to increase with SI-PASS attendance. This array of effects is no trifle, particularly if it is related to the funding needed for an SI-PASS program. If the literature does not currently provide any information about this financial aspect, SI-PASS efficiency ratios would be worth investigating compared to other student-support programs.
2) Theoretically, whilst Topping's typology of peer tutoring (1996) caters for valuable parameters allowing to depict an SI-PASS scheme like the one implemented at our university, we nevertheless found that this conceptual tool would deserve some updates and refinements, especially with regard to the definition of the ten dimensions. We noticed, for instance, that the typology does not easily express the fact that the SI-PASS leaders can be paid, or not, for the job. Both options do exist worldwide in SI-PASS schemes. Furthermore, Topping's proposal, while sometimes splitting dimensions which are strongly interrelated in the daily logistics of an SI-PASS scheme might also be forgetful of some of them. This is the case, we think, of the grounding of an SI-PASS scheme in the disciplinary context of a faculty. In Liège, for instance, relying on an active resource-person working locally in the bioengineering faculty turned out to be of great support for the Teaching & Learning Center of the university that assumed leader training and general coordination. Such a collaboration between a transversal body and a local contact has proved to work efficiently in other student-support actions (Verpoorten et al. 2019; Huart, Verpoorten, & Leduc, 2019). Lastly, Topping's theoretical proposal could be questioned regarding the granularity level where it stands. Of course, any typology, to be useful, must convey a certain level of generality. However, in the

case of an SI-PASS scheme, the way learning is driven in the very sessions (e.g., specific techniques and principles and climates, deliberate efforts to avoid "teaching," refusal to present as "remedial," and the overarching spirits of leaders' teams) can make a strong difference that the ten dimensions, if not enough unfold and elaborated, might miss.

3) The major limitation of the case study, for the reasons mentioned earlier, is that it can only draw an indirect link between participant opinions on the SI-PASS scheme and contribution to academic success. Although succeeding at the test is not the only measurement of learning (Boud, 1990), although stakeholders might wish to improve people's capacities as learners or other dimensions of satisfaction and affiliation, it would reasonably be expected that performance gains result from student-support actions. Further work should then be carried out in the line of the efforts by Malm et al. (2011, 2018) who managed to sharpen investigations around SI-PASS programs and to consolidate them through appropriate performance-related measurements.

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8. An Essay: PAL Training and Future Use in One's Career

Gita Sedghi & Gina Washbourn

Abstract: The transition between school and university is a longstanding issue in higher education (HE) due to significant differences between the two educational environments. The lack of extra support to ease the transition for students results in poor retention in HE institutions. Various provisions are introduced at universities to support students with adapting to the new educational environment. One of the means of tackling this issue is peer-assisted learning (PAL), a student-led scheme in which higher year students, called leaders, provide lower year students with subject support through facilitating discussions in small groups. Several benefits of PAL, to both student participants and higher year students, are reported in the literature. There are also many reports about leader training, what it covers and how it is delivered. However, there is not much in the literature about how, when and where the acquired skills are articulated in one's career.

In this chapter, we will explain the details and structure of initial and ongoing leader training, in supporting students to not only gain various skills through PAL leadership but also reflect on and articulate the skills to future studies or employment. Different PAL leadership roles and progression pathways will be explained as a means to enhance employability. We will reflect on one's journey from becoming a leader to a lecturer, and how the gained skills through PAL leadership are mapped to the globally-recognised framework, for benchmarking success within HE teaching and learning.

1. Introduction

The transition between school and university is complicated for new students, involving several stakeholders, as well as strategies to support students in bridging the gap between the two different educational environments (Ferreira, 2018). Social support, self-esteem and stress are identified as some of the contributors to students' academic, social and emotional adjustment to university (Friedlander, Reid, Shupak, & Cribbie, 2007). Systematic university support, including engagement with peers and lecturers and high-quality curriculum (Kiessling, Schubert, Scheffner, & Burger, 2004), as well as providing students with opportunities to understand the expectations of studying at university (Murtagh, 2012), including independent learning and assessment (Pennington, Bates, Kaye, & Bolam, 2017), reduce first-year students' stress and ensure a smooth transition between school and university.

Peer-assisted learning (PAL) is a student-to-student academic support scheme, which has been implemented in higher education (HE) institutions to overcome the issues arising from this changeover. PAL is an informal learning environment, in which more senior year students called *leaders* facilitate study sessions for lower-year

students. The literature shows that PAL has a positive impact on student progression and confidence, which results in improved retention (Congos, 1998).

PAL was implemented in the Department of Chemistry in September 2012, after much research on various schemes in different higher education institutions, both in the UK and internationally. The aim was to develop a suitable plan to support first-year undergraduate students in adjusting to university life in general, whilst also providing help with a specific maths module, which is regarded as one of the most challenging and essential subjects in a Chemistry degree programme. Furthermore, PAL was intended to support direct entry Year 2 international students. Currently, the scheme covers most Year 1 modules, in addition to the revision sessions for a couple of Year 2 modules, introductory courses to practical chemistry and scientific writing for international students.

Our evaluations of the scheme during the past eight years have shown a positive impact on the student experience. Informal group discussions on challenging subjects and sharing higher-year student experiences of studying the same topics have enhanced the lower-year student confidence and academic performance. Leaders' employability skills (Jones, Torezani, & Luca, 2012), critical thinking, transferrable (Micari, Knife Gould, & Lainez, 2010) and leadership skills (West, Jenkins, & Hill, 2017) have been significantly improved, which is a result of reflecting on their own learning and their practice on different ways of explaining the subject material to lower year students (Lockie & Van Lanen 2008). We have published the impact of PAL on participants in a peer-reviewed journal (Sedghi & Lunt, 2015). Also, Sedghi (2019) provides HE institutions with practical and adaptable strategies to design and implement PAL, as well as tailoring it to the requirements of their programmes. The scheme has already been adopted by some departments at the University of Liverpool and other HE institutions.

In this chapter, we will focus on leader training to acquire and articulate various skills, as well as the application of these skills in future studies and employment. Over the years, we have established and improved our PAL leadership training to make sure that we provide leaders with the essential tools to gain and articulate well-developed employability skills. Our leaders receive ongoing support and supervision from staff and student coordinators. They also provide our leaders with initial training, alongside the university's Career and Employability services.

There are many studies about leader training, different PAL schemes and the skills gained when becoming a PAL leader; these include evaluative judgement, teaching and collaborative skills (Sevenhuysen, Haines, Kiegaldie, & Molloy, 2016). The impact of training on PAL leader skills and academic performance has also been evaluated in previous studies (Tai, Molloy, Haines, & Canny, 2016). However, there is not much in the literature about how, when and where the acquired skills are articulated in one's career.

My former student, Gina, and I have co-authored this chapter. Gina, who was a PAL leader, promoted to subject leader and then coordinator, will write about our scheme and its impact on one's career from a leader's point of view. Gina, who is cur-

rently a lecturer at our university, will reflect on her journey to becoming a leader, by writing about her experiences and how it shaped her interest in teaching. As a result, Gina has had a significant contribution to our teaching and learning during her PhD and lectureship. I will write about and reflect on my experiences in my role as the staff coordinator, who has established the scheme and supported students to take this journey.

2. PAL Leader Recruitment and Training

The term *leader*, which encompasses many skills and attributes, has been given many definitions in the literature. Bush (2007) links leadership with change and describes leaders as people who influence others by shaping their goals, motivations and actions. Leadership is different from management, which effectively focuses on maintaining the integrity of a current system. In PAL, we require people to develop their leadership traits and desire leaders who promote and assist students in achieving their learning goals. PAL leaders must be prepared to adapt to change, to improve the scheme and enhance the student experience. However, as academics, we are committed to providing potential leaders with resources and tools to develop their leadership and consequently, employability skills.

Leadership training is an ongoing process in our department which is not limited to the formal training taking place before starting the leadership role. This happens in various formats: formal and informal, as well as before, during, and on the job. The training aims to equip leaders with the essential skills to run a PAL scheme for lower year students; these aptitudes enhance leaders' employability.

There are several skills and attributes which the students gain as a PAL leader; however, our experience shows that leaders are not particularly aware of their abilities, unless they have been provided with the opportunities to reflect (Carr, Evans-Locke, Abu-Saif, Boucher, & Douglas, 2018). While reflection is a key element in writing job applications and personal statements, often graduates only start thinking about their gained skills when applying for jobs. Some universities deliver PAL training to enhance confidence, inter-personal skills, presentation style, body language, eye contact, understanding group dynamics, personal organisation, problem-solving, session planning, reflection, employability and identifying graduate attributes (West et al., 2017). However, the lack of information in the literature about how this training benefits students in their future career is evident. Efficient training supports leaders, to not only gain and refine their skills but also to reflect on and articulate the aptitudes continuously throughout their undergraduate studies.

2.1 PAL Application and Recruitment

The recruitment process is part of leadership training, where students experience writing an application to show their interest and suitability for the role. Writing a

professional and appropriate job application is the first stage of getting into one's ideal career. Filling out the leader application is the first opportunity for most students to showcase their skills effectively during their degree. As an academic coordinator, our job is to set out and communicate the criteria, so that students would be able to evaluate their potential of becoming a leader and whether they apply for the role.

We release explicit information about PAL and what the leadership involves in the second semester of Year 1. At this time, students are settled in the new educational environment and adapted to university life, but it is still early enough to explore the role specification they apply for in order to make an informed decision. The information is communicated via emails, posters and short lectures, given by both academic and student coordinators. We encourage all students to apply for the PAL leader role but suggest those struggling academically to focus on improving their studies and consider applying for PAL the year after.

It is crucial to communicate the pros and cons of being in the scheme to students. While we inform them of the numerous advantages of the scheme, they should be aware of the time commitment to prepare and deliver the sessions. We emphasise the importance of having enough knowledge of subject materials, as well as being keen and committed to supporting lower year students through collaborative learning. Since leaders have been provided with sufficient information during the application process, to make an informed decision whether or not to contribute to the scheme, most of the applications are successful. While 30% of Year 1 students apply for the leadership role every year, only 3% of the applications are not successful, and 1% of leaders opt out from the scheme in either Year 3 or Year 4. This shows the efficiency of the approach taken to employ and retain suitable leaders.

The recruitment process is held in two stages: shortlisting applicants based on their academic performance in their subjects of interest (including mathematics and core chemistry modules) and reviewing the written applications. The application involves three main areas: why to apply, relevant attributes and skills, and the selection of the modules. It is vital to allow students to apply for the modules in which they are most confident and comfortable to support Year 1 students.

2.2 PAL Leadership Recognition and Promotion Pathway

To train students on all aspects of employability, leaders have the opportunity to be promoted from a leader to a subject leader and subsequently to a student coordinator. Developing from a leader to a subject leader and coordinator gives students an experience similar to career progression in their future jobs. Furthermore, having different job roles in the scheme keeps ambitious students motivated to progress from one role to another, which leads to improvement of the PAL scheme overall. The promotion pathway and role profiles are shown in Figure 1. The Academic Coordinator oversees the scheme without direct involvement in the day to day duties.

Subject leaders are experienced Year 3 graduates, who organise the preparation of session plans and liaise with PAL coordinators regularly, while they continue deliv-

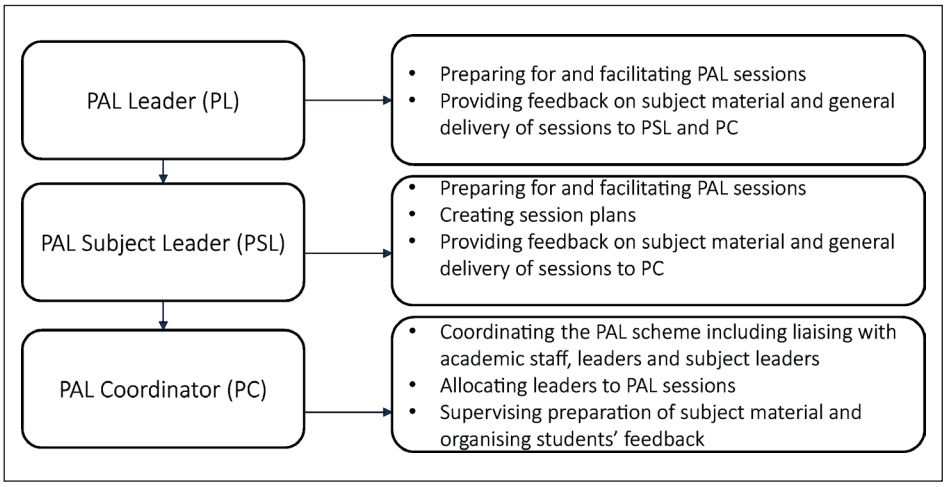

Fig. 1: PAL leadership progression pathway and role profiles

ering and facilitating the sessions. Every year we employ a pair of competent subject leaders for each module to create session plans. The leaders who are interested in the role, apply for a particular area of chemistry which they have expertise in. Subject leaders are selected based on their academic ability and commitment to the delivery of sessions to enhance student learning.

PAL coordinators are experienced subject leaders, who coordinate the scheme in their Year 4 studies. They liaise with the academic coordinator, leaders, subject leaders and participants to organise PAL sessions. For each session they: assign one or two subjects (depending on weekly demand and impending assignment deadlines or assessments), allocate leaders, ensure preparing session plans, observe PAL sessions and collect attendance data for both leaders and student participants.

The two-stage recruitment process for PAL coordinators consists of an application form and an interview. The application form requires applicants to explain their suitability for the role. At the same time, the interview expands on this by asking potential coordinators to identify any areas for improvement or development in the scheme. Clear development ideas show the interviewee's commitment and vision to lead the scheme and make improvements to enhance student learning.

Throughout the delivery of sessions, leaders enhance their confidence, leadership, communication and hence employability skills. Consequently, they receive excellent reference letters from academics to apply for further studies or employment. Since student participation in PAL is voluntary, their activities are included in their Higher Education Achievement Record (HEAR) within three separate profiles: PAL coordinator, subject leader and leader (Figure 1). HEAR supports UK graduate applications for employment and further study, by providing a comprehensive record of student achievement, including co- and extra-curricular activities that they take part in during their studies.

2.3 PAL Training

The purpose of PAL sessions, which are different from the standard university lectures, is to provide a platform for students to seek help and ask questions about topics they find challenging. Students often have more confidence discussing scientific principles with a peer from a higher year group, rather than a lecturer. Although participants are encouraged to ask questions of leaders, a backup plan is in place to initiate discussion over a challenging topic, should the students remain quiet. PAL leaders use effective questioning techniques to promote further discussion and inspire participants to ask questions.

Leaders are trained to use their experiences of studying previous year modules and suitable techniques, to develop strategic approaches to facilitate discussions for a small group of students, providing them with strategies about how to approach problems from different angles (West et al., 2017). It is noteworthy that leaders do not "teach"; they instead guide students towards correct answers through targeted questioning, adding an extra layer of peer-to-peer learning to the chemistry programmes.

Training for new leaders, which is delivered by PAL coordinators and the staff from the university's Career & Employability services in Welcome Week, equips students with essential skills and knowledge, as well as sufficient confidence to deliver their first PAL session. Moreover, training for experienced leaders is delivered by PAL coordinators, to recap the leadership skills and attributes, as well as sharing good practice. Ongoing training throughout the scheme is vital to keep leaders motivated and allows continuous reflection on the acquired skills. Our experience shows that although students are aware of their abilities, they find the articulation of their expertise to employers challenging; The University's Career & Employability services organise skills audits in which leaders learn how to identify and articulate their leadership skills to future employers.

In addition, PAL leaders are provided with various opportunities to learn new skills by engaging in departmental and university activities to enhance further employability. To familiarise leaders with pedagogy, we ask them to participate in focus groups and when experienced, to facilitate one. They can choose to enhance their presentation skills by giving short lectures to promote the scheme to new students, inside or outside the Department of Chemistry. Experienced leaders are employed on Open Days to help us with promotion and recruitment activities. In this role, they utilise their communications skills to provide prospective students with information about the chemistry programmes, department and university.

3. PAL Leadership Skills and Attributes

In this section, we will focus on the skills and attributes acquired by leaders through different role categories. A summary of the details as to how and when these skills are developed is shown in Figure 2. It is noteworthy that leaders are trained to either learn new skills or improve their existing abilities during PAL.

3.1 PAL Leader

Several skills and attributes are reported for PAL leaders in the literature, including leadership (Rehman, Siddiqi, & Alam, 2018). There are not many opportunities during an undergraduate degree to develop student leadership skills; PAL provides leaders with an excellent opportunity to cultivate leadership abilities, which influences their future career greatly.

Year 1 students are not usually confident in asking questions from tutors in teaching classes, especially in large cohorts. PAL leaders exhibit and develop a welcoming attitude and approachable demeanour, to encourage participants to ask their questions in a friendly and informal environment. Also, PAL enhances leaders' confidence in their abilities significantly. During the course of the programme, we have seen several quiet, or rather, shy, leaders who gradually built up their confidence. They became more engaged in various departmental activities and even took on the subject leader or coordinator roles.

Trained leaders develop excellent facilitation skills, allowing them to initiate and assist discussions in a small group, passing on the relevant information to participants. Some leaders are inspired to progress into a teaching career in either secondary schools, further education colleges or universities. Therefore, they apply similar approaches to PAL as educators to explain complicated concepts using highly interactive learning strategies (Liou-Mark & Ghosh-Dastidar, 2018).

PAL leaders need to be dedicated and organised to be able to facilitate participant learning via an appropriate delivery method and enhance their experience. Leaders need to deliver weekly sessions as well as dedicating extra time to review the session plans and develop their delivery method. We provide leaders with guidance and tips to help organise their time, allowing them to actively take part in the scheme while maintaining their own studies at a high standard. The practice also helps leaders recap their knowledge of previous years, which assists them in their learning throughout their degree.

3.2 PAL Subject Leader

When promoted to a subject leader, they not only improve their transferable skills by facilitating discussion in small groups but also take part in the development of session plans at an appropriate level to Chemistry undergraduate programmes. The job requires meaningful and productive communication with PAL coordinators and the academic lead, as well as course lecturers to ensure the content is being delivered at an appropriate level. It may also include collaboration with other subject leaders, to ensure all the relevant topics are covered, while avoiding possible overlaps. The role, which enhances communication on a broader basis, serves as an excellent asset when graduates progress into their chosen career. Many jobs require some element of teamwork, with multiple people working on the same project. It is vital that while everyone is carrying out their individual role, they also communicate with the rest of the team

to ensure that no tasks are left incomplete, there is no overlap in assignments and that there is no conflict or confusion upon completion of work.

Subject leaders develop appropriate questions to test student knowledge effectively. They provide leaders with model answers, allowing them to plan their own delivery method and approach the solutions from different angles. The process of creating suitable session plans provides subject leaders with an excellent source of revision for earlier concepts, deepening their understanding of the subject (Young, Hoffman, & Reinhardt, 2019). The experience of designing teaching materials at the correct level to cover the challenging concepts is invaluable for one pursuing a teaching career. Being a Subject leader familiarises students with a teaching career; it allows them to test their interest and skills for a future teacher or lecturer job.

Although all leaders develop organisational skills, subject leaders need to be highly organised due to the extra responsibility of creating, updating and reviewing weekly session plans. They must manage their time to study their own courses alongside facilitating PAL sessions and providing leaders with session plans. This requires working under pressure, to meet several impending deadlines.

3.3 PAL Coordinator

Students in the final year of their degree programmes are eligible to apply to be a PAL coordinator. The successful applicants are chosen based on their excellent work ethic and dedication throughout the PAL programme, as well as leadership, organisation skills, ability to develop new content, approachability and academic performance.

PAL coordinators fulfil the fundamental principle of communicating regularly with the academic lead, other staff and PAL leaders, to supervise and manage the whole scheme. They are also responsible for checking the suitability and correctness of the content developed by subject leaders. PAL coordinators provide constructive feedback on session plans to make sure subject leaders improve their skills in creating material. This practice develops student coordinator skills in assessing the teaching material and providing constructive feedback to enhance one's session plan.

PAL coordinators are skilled leaders, who have the experience of creating session plans. They must have sufficient knowledge and confidence (Usman & Jamil, 2019) to answer both the leaders' and participants' questions during and outside the sessions. They need to be approachable and fair, but also assertive enough to manage the scheme. Given that there are two or three student coordinators in charge of the general running of the scheme, students experience collaborative leadership, which is different from the leadership skill experienced by leaders. Collaborative leaders are equipped with the essential skills of establishing group goals, handling conflicts and sharing control to assure everyone's voice is heard in today's interconnected world (Archer & Cameron, 2013).

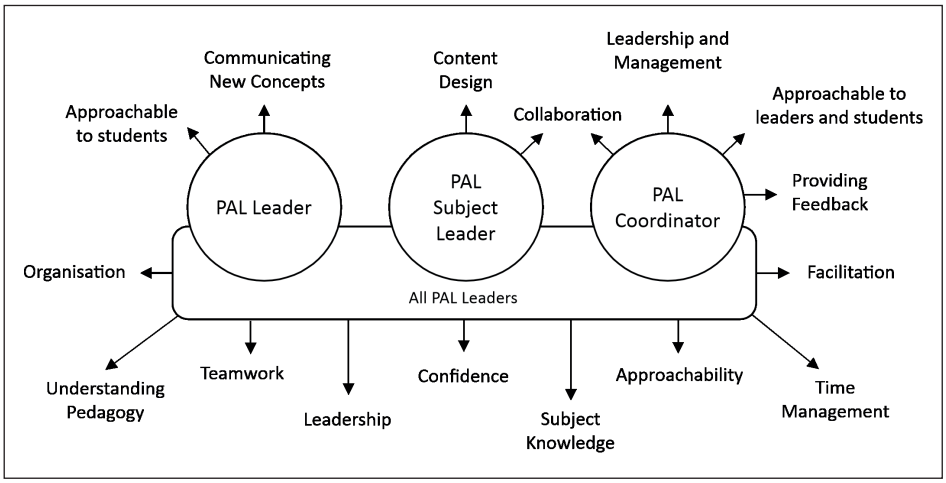

Fig: 2. Skills acquired throughout the PAL leader programme

4. Case Study

Our case study will walk you through the experiences of an undergraduate student, who took on the role of a PAL leader at the beginning of the scheme in 2012 and was promoted to a subject leader. She not only took the leader training pre and during her leadership role, but also participated in focus groups and interviews to improve and develop the scheme. The student took on leadership of the scheme in her final year of undergraduate studies. During her engagement with PAL, she took every opportunity to enhance her employability skills by giving short promotion lectures, helping on Open Days and presenting at pedagogy-focused conferences and seminars.

Having had the PAL experiences, the student articulated her skills in various jobs after she graduated in Chemistry, including graduate teaching assistant, postdoctoral research, college teacher, and university lecturer. Her practice as a graduate teaching assistant, at the beginning of her teaching career, was recognised by Advance HE, a British professional membership scheme promoting excellence in higher education; hence, she was awarded the Associate Fellowship of the Higher Education Academy. Advance HE has developed the UK Professional Standards Framework (UKPSF), a globally-recognised framework for benchmarking success within HE teaching and learning support, to award fellowships as a method of professional recognition for higher education practitioners. Mapping the skills and attributes gained by different categories of PAL leadership to the UKPSF Dimensions of Professional Practice in HE teaching and learning will be discussed in details in this case study.

4.1 The Role of PAL Leader

After signing up as a PAL leader in the second year of my undergraduate degree, I attended training delivered by the academic coordinator of the scheme. The training

was focused on leading discussions in a small group of students, as well as the difference between teaching and facilitating. We were introduced to different learning styles (Fedler, 1988) and appropriate techniques to engage participants.

It is not always easy for students to harness their prior knowledge to deepen their understanding of the subjects studied, so the training introduced PAL as a useful way to support lower year students while building upon my existing skills. An essential part of the training was exploring different questioning techniques to investigate student understanding of a specific topic and guide them towards the correct answer, enhancing their problem-solving skills. Roleplay activities demonstrated how various methods were used to engage the participants with different learning styles in group discussions.

Initially, I was hesitant to join the scheme due to the lack of confidence in my knowledge and ability to become a leader. Having had an introductory lecture by the academic coordinator, I was encouraged to step out of my comfort zone and explore my potential as a leader. At first, I led PAL sessions for organic chemistry, in which I was most confident. During my first year as a leader, I expanded into inorganic chemistry which showed how the scheme improved my confidence in my abilities after a short period.

Throughout the first year, my confidence in speaking and engaging with new people, especially in groups, improved. The scheme was in its early years at this stage, and the ratio of PAL leaders to students was small, so we often interacted with a group of 8–12 students. Learning to communicate and explaining challenging concepts to a large group of students was daunting at first, but after a few sessions, it became easier. Eventually, I even learned to adapt my session delivery based on individual learning styles. Consequently, I became more confident in my abilities, so I started to enjoy delivering sessions and interacting with peers outside my year group.

Preparing and delivering PAL sessions which involved revisiting materials from the previous year, explaining these to students and approaching problems from different angles allowed me to deepen my understanding of the subject. At this point, I became interested in creating new materials, as well as improving existing session plans to enhance learning.

In the second year in my role as a PAL leader, I decided to step further outside my comfort zone, by facilitating study sessions for Year 2 students. Although the delivery of the higher-level subjects was challenging at the time, it significantly increased my understanding of the chemistry subjects, as well as confidence in my abilities.

4.2 The Role of Subject Leader

During the third year of my undergraduate degree (second year of the PAL programme), I was promoted to a subject leader for the organic section. In this role, I used my subject knowledge to develop session plans, to be used by PAL leaders facilitating the study sessions. My engagement with the lecturers of the course to cre-

ate suitable materials at the right level raised my understanding of the teaching and learning system in the Department of Chemistry.

Creating session plans alongside delivering the content gave me a better understanding of various learning styles, as well as the difference between creation and delivery of the content. The experience enhanced my personalised approach to support student learning, including introductory guidance before problem-solving, formative feedback, breaking solutions into steps and drawing diagrams. I had to adapt my delivery of the materials based on individual needs, which gave me a valuable lesson that I have used to succeed in my teaching career.

During this period, I gained a better understanding of teaching and learning in higher education by developing session plans, using various modes to deliver the content to students with different learning styles, and engaging with academics. Being an active leader, I was invited to help with University Open Days, advising prospectus students on the chemistry programmes and our teaching and learning system. My enjoyable and fulfilling PAL leadership experience led me to consider a teaching career after graduation.

4.3 The Role of PAL Coordinator

Having been promoted to a PAL coordinator in my final undergraduate year, I led the scheme and looked after the week-to-week delivery of the sessions. In my role, I assigned leaders to various sessions and supervised the development of session plans. I was responsible for the evaluation of the system by getting feedback from both leaders and participants. I engaged with the staff coordinator, academic staff, subject leaders, and PAL leaders to ensure the scheme was being delivered as effectively as possible. Being a PAL coordinator required me to be highly organised.

Usually, there are not many opportunities to gain leadership skills during an undergraduate degree; PAL leaders learn this invaluable skill by participating in the scheme. Becoming a student coordinator gave me the unique ability to work in a group of leaders which was different from working in a team of peers or colleagues. As part of a team of three PAL coordinators, I experienced collaborative leadership when we all took the coordinating responsibility and shared decision making. The new responsibility was different from other PAL leadership roles, as we had to gain credibility and trust each other. We learned to manage unavoidable conflicts between the three leaders, ensuring the smooth running of the scheme. We realised the importance of separating our professional partnership from friendship, to keep both relationships safe and manageable.

Our team took the responsibility of leading a group of 50 leaders and 150 participants, which required organisation, diplomacy, patience, approachability, flexibility, fairness and firmness. Although the student coordinators did not have to facilitate the group discussions unless it was required, e.g., to cover absences, they had to attend the sessions to supervise leaders and answer possible student enquiries. We made sure

there was an appropriate ratio of leaders to participants and recorded the attendance for future evaluation purposes.

As coordinator of the scheme, I was responsible for utilising a range of teaching and learning environments to satisfy student participant and leader needs. I employed various tools and platforms, to enhance the student experience as required. Examples of activities were to use the university's virtual learning environment (Blackboard) for depositing the session plans, making announcements and resourcing useful online materials, as well as creating a Facebook group to improve the engagement between students. Furthermore, I organised one to one sessions for students with special learning requirements.

Having been responsible for coordinating the scheme in my final year study, I needed to be dedicated and show excellent time management. I had to assign enough time to study my highly demanding degree, as well as being responsible for coordinating the scheme to ensure adequate support is provided for lower year students. I had to multi-task and work under pressure to meet the deadlines, which taught me the importance of prioritising tasks. Managing my final year studies at the same time as coordinating PAL made me highly organised and productive. I realised the significance of being focused and making the most of opportunities, which helped to maintain my academic performance to a high standard. Although I had to work under pressure at the time, I found the leadership role fulfilling, enjoyable and rewarding.

Collaborative leadership taught me about different leadership styles and helped me to find my own. Splitting the work between the three leaders was very much dependent on the individual's leadership style. Overall, being a PAL coordinator was an enjoyable but challenging experience, which gave me a better understanding of academia. The experience solidified my desire to become an educator.

4.4 Articulation of Skills

After graduating in a master's programme in chemistry, I took on a PhD in the Department of Chemistry at the University of Liverpool. During my PhD, I took on the role of a graduate teaching assistant to fulfil my teaching aspiration. The PAL scheme not only guided me into a teaching career but also revealed my ability in teaching specific areas of chemistry. I taught organic and inorganic workshops, as well as labs which were in the areas of chemistry I was interested in and practised as a PAL leader. As a graduate teaching assistant, I applied the same strategies used in PAL to facilitate student learning, by asking open-ended questions and providing guidance towards the correct answer in workshops and practical sessions. Since I was familiar with the preparation and delivery of the teaching material, I could easily organise my time to read and understand the content and chose the delivery method before attending each session. I taught a Year 1 laboratory course which students found difficult due to the lack of more substantial practical experience from school. Being a PAL leader taught me to be patient and flexible while teaching people with different abilities, which helped me support students in succeeding in this challenging course. My abil-

ity to recognise individual needs and different learning styles made me stand out in teaching during my PhD.

During my PhD, I helped to supervise master's students undertaking a research project in my area of expertise, synthetic organic chemistry. I was responsible for the day-to-day supervision of students, in addition to giving feedback on their project reports and dissertation. Having had the experience of PAL, I was able to act as a guide and facilitator as students progressed through their own research project. Given that most of these students were working on a research project for the first time, I trained students to become independent learners. I guided students to the relevant resources, provided them with research strategies, and persuaded them to take charge of their own project. I facilitated discussions between a group of students working in the same research area similar to that in PAL. My experience of reviewing PAL session plans and providing feedback to improve the materials helped me to support master's students by giving constructive suggestions to enhance their research report and dissertation.

Due to my successful engagement with teaching undergraduate students, I was asked to take on the personal tutoring of chemistry students. In this job, I applied my skills as a former subject leader to write session plans and assignment questions for my tutees, at a level appropriate to their background knowledge. During these sessions, I drew on my PAL experience of identifying how students learn, as well as their strengths and weaknesses. I customised the teaching material and modes of delivery for each student based on their knowledge, ability and learning style.

The next step in my teaching career was to take on a tutor job at an international college. My passion for and success in teaching allowed me to work under pressure by undertaking multiple positions, including postgraduate research, graduate teaching assistant and college tutor. As a PAL leader, I stepped out of my comfort zone by teaching various chemistry subjects. Once again, I broadened my horizons by teaching topics in the areas outside my teaching experience to international students from different cultures and backgrounds. Although teaching in the college was different from that at the university, I applied my skills developed as a PAL leader to support students in bridging the gap between the two different educational environments. The job was a big career move as I was in charge of my classrooms with the opportunity to put all my teaching skills and knowledge into practice. Having a formal teaching job in the college, I still found the skills of facilitating student learning by structured discussions in a group of peers invaluable in teaching; hence, using active learning to create lifelong learners became my teaching philosophy. Reflecting on and articulating my skills developed as a PAL leader to my teaching job allowed me to strengthen my abilities over time, which increased my confidence and the fulfilment of my career. My understanding of how students learn and individual needs, as well as my enhanced communication skills, made me a happier and more successful teacher, who enjoyed every step taken to enhance student learning and experience.

My leadership skills, enhanced by becoming a PAL leader, helped me in all aspects of my profession, from applying for my PhD and jobs to career progression.

Throughout my time at the college, I was responsible for the planning and delivery of the course, ensuring students met the learning outcomes of the module and that their learning was assessed by valid and reliable means. I also worked with other staff members as part of a leadership team to advance student learning and experience in line with the institution's strategies. I could easily adapt to sharing ideas and responsibilities, as well as dealing with conflicts. Tackling issues and communicating at a team level in a group of experienced academics improved my teaching practice and work ethic.

Several factors contribute to international student academic performance, including educational background and language proficiency (Neumann, Padden, & McDonough, 2019). Even with good background knowledge, some international students are limited in their learning by their language, as well as having to adapt to a new country and educational environment. Learning new scientific concepts and vocabulary in English is a challenging task for non-native English speakers. I acknowledged international student needs, which were different from that of home students by adopting specific learning activities suitable to their knowledge and skills. Having had the PAL leadership experience, I used my communication skills with people from different backgrounds to interact with international students; I took different approaches in my teaching, which in turn made scientific concepts understandable.

My experience as a subject leader supported me to create teaching materials for lectures, tutorials and assignments in the college. I also created assignments and exam questions at a suitable level to assess the learning outcomes of my modules. Since I was already familiar with different learning styles, having my own modules encouraged me to incorporate relevant scholarship to inform my practice. I was particularly fascinated by increasing student engagement through active learning, so I implemented flipped lectures and technology-based learning, e.g., gamification, in my teaching. I created revision bingo, to cover scientific key words and definitions and also jigsaws to support the recognition of organic functional groups in molecules, which proved particularly useful for international students. The integrated approach in my practice resulted in enhanced student satisfaction and performance.

My involvement in the curriculum change at the college was another valuable experience, in which I contributed to reviewing and developing the curriculum for the Introductory Science course at the foundation level. I articulated my skills as a PAL subject leader to improve the content, as well as utilising active and flipped learning approaches in the module to enhance the international students' English and scientific vocabulary, which was a significant focus of redevelopment. The process of evaluating the chemistry and biology modules, to ensure their alignment with the new curriculum, was built upon my experience as a PAL coordinator where I checked the accuracy and suitability of the session plans.

In the last year of my PhD, I was awarded the Associate Fellowship of Higher Education Academy (AFHEA). The process of applying for AFHEA involved mapping my educational teaching experience and skills against the UK Professional Standard Framework (UKPSF), which consists of three sets of dimensions: areas of activity (A1–

A5), core knowledge (K1–K6) and professional values (V1–V4) (Table 1). Throughout this procedure, I realised that most of the skills I developed as a PAL leader, subject leader and PAL coordinator mapped directly on to this framework. I built upon the skills and attributes obtained through my involvement in the scheme to meet the requirements of the UKPSF at the beginning of my teaching career.

My experience of teaching different subjects at various levels helped me secure a multidisciplinary lectureship job in the School of Environmental Sciences. As the coordinator of a first-year module, I was in charge of improving the course and developing new materials. Having had the knowledge of creating and improving teaching materials at an appropriate level, as a subject leader and college tutor, I introduced combined chemistry and environmental sciences topics, which had broader applications to the "real world."

In this role as module leader, I was not only responsible for the planning and delivery of my lectures, assignments and assessments, but also led a team of graduate teaching assistants, to deliver the workshops. I put my experiences of being a PAL coordinator in practice, to make sure enough demonstrators were assigned to each workshop, and the teaching material was available in advance. I supervised the teaching staff in the workshops and provided everyone with constructive feedback to improve the course.

Collaborative leadership is a common practice in higher education where multiple staff members deliver different components of the course. Due to the nature of shared teaching activities, which necessitates consistency throughout the whole module, the lectures need enhanced communication skills and the ability to tackle conflicts and ensure a fair and transparent marking process. My past experience of collaborative leadership in the PAL scheme and at the college helped me work with other lecturers successfully. It also allowed me to view other teaching styles, thus improving my own practice.

Since active learning became the focus of my practice, I used innovative teaching methods in lectures and workshops to enhance student engagement in classes. I still found myself applying the PAL strategies to facilitate group discussions in workshops and lectures to encourage deep learning and problem-solving. I skipped traditional teaching by introducing active learning, in which students are guided towards the correct answer by targeted questions and formative feedback and flipped learning by providing materials for new concepts, allowing review outside lectures.

Working in an informal setting such as PAL, where students feel confident to ask PAL leaders questions about subject materials, university life and any possible worries and concerns has given me a better understanding of undergraduate student needs and expectations beyond that of a teacher or lecturer. I used the acquired skills over the years as a PAL leader and a graduate teaching assistant to teach students from different backgrounds, academic level and language abilities in both the college and university.

My experience of PAL has enriched my practice with skills (Table 1) that are essential for not only a career in teaching but also any job I may wish to take up in the fu-

ture. I have learnt to balance my workload effectively and remain efficient at all times. I became confident in my academic abilities, interacting with staff and students and presenting to groups. Giving introductory lectures about PAL, as well as presenting the schemes at conferences and seminars, developed my ability to present my research to the broad audience and raised my confidence in public speaking during my PhD. Through the PAL scheme, I developed lifelong friendships and networks that have allowed me to progress into my career of choice. As someone who was not confident about her abilities and hesitant to become a PAL leader, I benefitted from the scheme so much that I owe my current confidence and success to PAL.

Tab. 1: Mapping PAL leader skills to the UKPSF Dimensions; PAL leader (PL), PAL subject leader (PSL) and PAL coordinator (PC)

Descriptor	PAL Roles	Comments
A1: Design and plan learning activities	PSL	• Designing subject material
	PL	• Planning session delivery
A2: Teach or support learning	PL, PSL, PC	• Delivering sessions
A3: Assess and give feedback to learners	PL, PSL, PC	• Assess understanding through open questions and giving feedback for improvement
	PC	• Giving feedback on session plans
A4: Develop effective learning environments and approaches to student support and guidance	PC	• Utilising different tools and platforms to support learning, e.g., Blackboard
A5: Engage in continuing professional development in subjects and their pedagogy	PL, PSL, PC	• Ongoing PAL training, giving introductory lectures, participating in recruitment events and conferences/seminars
K1: The subject material	PL, PSL, PC	• Using the existing subject knowledge and previous experience to facilitate learning.
	PSL	• Creating session plans
K2: Appropriate methods for teaching, learning and assessing in the subject area and at the level of the academic programme	PSL, PC	• Liaising with the lecturers of courses to create session plans at an appropriate level and giving formative feedback on student work
K3: How students learn, both generally and within their subject/discipline area(s)	PL, PSL, PC	• Adapting the session delivery to participants' different learning styles by employing various techniques and tools.

Descriptor	PAL Roles	Comments
K4: The use and value of appropriate learning technologies	PL, PSL, PC	• Utilising different learning technologies, e.g., Blackboard, discussion boards, and interactive 3D chemistry animations
K5: Methods for evaluating the effectiveness of teaching	PL, PSL, PC	• Seeking verbal and written feedback from student participants to evaluate the session plans and delivery methods
K6: The implications of quality assurance and quality enhancement for academic and professional practice with a particular focus on teaching	PSL, PC	• Continuous engagement with relevant academics to ensure session plans are accurate and written at an appropriate level in line with the lecture materials.
V1: Respect individual learners and diverse learning communities	PL, PSL, PC	• Adapting teaching delivery to accommodate learners with different learning styles, special needs and background knowledge.
V2: Promote participation in higher education and equality of opportunity for learners	PL, PSL, PC	• Interacting with higher year students promotes informal discussions around degree programmes, further studies and career options between students from different background, culture and academic ability.
V4: Acknowledge the wider context in which higher education operates recognising the implications for professional practice	PC	• Introducing the employability skills and training to reflect and articulate the skills to future employers.

5. Summary

Peer-assisted learning has proven to be an effective scheme in higher education with numerous benefits to both leaders and participants. Advantages to student participants include increasing student engagement, academic performance, experience and confidence while leaders enhance their transferable, leadership and employability skills.

Training is a crucial part of the scheme to ensure leaders learn how to develop, reflect on and articulate the skills and attributes gained during the programme. Although some studies demonstrate the organisation and delivery of various training undertaken in higher education institutions, there is not much information as to how the leaders articulate their skills and attributes in their future career.

Our formal and informal training, before and during the leadership roles, not only teach students how to gain and improve their skills but also show how to reflect on their abilities and articulate them to future employers. Our expert Career and Employability staff provide leaders with informative and interactive lectures, as well as a skills audit, which is a useful tool to practise and reflect on the skills gained.

In this case study, we took you through an undergraduate student's reflection on and articulation of her leadership skills in her teaching career. Mapping different categories of PAL leadership against the UK Professional Standard Framework showed the importance and effectiveness of PAL to improve one's employability skills.

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