STEM Self-efficacy for Pre-service Social Educators

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Abstract. This paper studies pre-service social educators' motivation in a science, technology, engineering, and mathematics (STEM) directed project, investigating how double stimulation can help them develop and improve STEM self-efficacy. The study provides preliminary insight into the signs of the pre-service social educator's self-efficacy concerning STEM when working on a small-scale course on STEM activities. With the many educational reforms focusing on improving STEM-competencies in society there is also a heightened focus on enhancing the competencies of pre-service social educators. These educators are expected to have a solid understanding of STEM subjects and skills. The paper aims to unfold pre-service social educators' work with STEM activities concerning their STEM self-efficacy. The study focuses on how to support pre-service social educators when engaging in STEM activities with the methods of double stimulation. In the study pre-service social educators build and program an automated greenhouse. The double stimulation method provides the pre-service social educators with the help of a booklet, which they can use if they get stuck on a task. The number of participants was 14 pre-service social educators. The data included pre-service social educators screen recording of how they programmed the greenhouse, pictures, reflections, and surveys. The data were analyzed using a thematic analysis. As a result of working on the STEM project, the pre-service social educators showed signs of improving their confidence in their STEM capabilities and thereby also signs of improved STEM self-efficacy.

Keywords: STEM self-efficacy · Double Stimulation · Pre-service Social Educators · ARCS

1 Introduction

This paper examines how pre-service social educators (PSE) develop their science, technology, engineering, and mathematics (STEM) self-efficacy during a three-week course. PSEs are students in Denmark who, after their exams, can work in kindergartens, schools, and with children and adults with disabilities. Self-efficacy can be defined as the degree of confidence in one's ability to accomplish a task. It encompasses a personal assessment of one's competence in performing a particular task or action and the confidence in possessing the requisite skills to execute that task or activity (Bandura 2006).

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7 Conclusion

Creating a course, in our case, 9C, and making the materials available is not sufficient to ensure its take-up, so there was demand from the facilitator target group for training in implementing 9C which led to the development of the M9C course. The pedagogical approach in 9C was chosen to empower potential refugee entrepreneurs as a contrast to their more usual role of supplicant. As part of the M9C training, as well as a general belief in the empowerment of learners, this pedagogy was carried over to the M9C course.

Feedback from relevant stakeholders led to the development of M9C, differentiation of the 9C materials and the discovery of complementary pedagogical approaches between the Transformative Learning Circles and Mastermind.

The good practices that were used in the development of the two courses included:

- The tightly scripted sessions to help less confident trainers but from which more confident trainers could deviate.
- The visual tool at the center of the 9C course, the BMC, not only helps refugees with low language skills but makes it easier to transfer the course from one language area to another.
- The system of optional certification according to context.
- The mirroring of the 9C approach in the M9C train the trainer course, including working on a business canvas as a learning outcome.
- The inclusion of local experts at least twice in the 9C course and reflected in the M9C course through the making of a local case study video.
- The low-tech digital tools used to present the materials to be accessible on a handheld device and easily transferable to other digital media.

The challenge of promoting effective networking remains. The Stepper approach seems promising but rigorously tested investigations of the "working out loud" method remain to be completed.

The pair of courses is highly relevant to the new wave of refugees now arriving in Europe and elsewhere from Ukraine. We have shown how to adapt them to local area needs through the M9C course, which makes them relevant globally. As an example, there are plans for applying the M9C package to the promotion of Fair-Trade businesses in Africa aiming to sell to Europe.

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the pace of activity changes from tentative exploration to concrete actions to start the business. A handoff to continued support is how the 9C course ends.

We were unable to avoid the need to create an account to follow either course due to our use of Google tools, however, many refugees already have a Google account in connection with their email so we judged that this would adversely affect the fewest potential participants.

One of the challenges of the 9C course for both participants and the facilitators is the nurturing of a relevant network of professionals as this largely happens between sessions rather than during the sessions. For the participants the main issue is one of language and stepping outside the familiar circle of friends and family. For the facilitators, this is a challenge because it happens out of sight, and they may feel less equipped to help participants if they themselves have lower levels of business knowledge.

A major challenge in both projects was the reduced funding from the amount requested. In both cases this affected the piloting of each course. This would not be a problem under the current 2021–27 Erasmus + program which operates under a lump sum model where applications can only be accepted as presented or rejected.

6.3 Implications for Theory and Practice

The M9C project was a combination of accessible pedagogy and technology. The TLC pedagogical approach recognizes and values the skills that participants come with. We note an element of convergent evolution with the existence of TLC, Mastermind and EduSCRUM.

Designing for handheld devices reflects what is happening in wider society where Smartphone ownership outstrips laptop ownership by a large margin. Thus, paying attention to what learning materials look like on a Smartphone and how learners could reasonably be expected to complete, and share assignments will have benefits that extend greatly beyond our initial narrow target group.

Place-based efforts are likely to benefit a much wider target group than the initial refugee group. Whilst we were targeting the needs of refugees and their facilitators, our small pilot shows that these types of initiatives would appeal to a wider range of locally based groups.

One major remaining challenge is how to make the networking between sessions even more effective. We encourage facilitators to suggest that participants with overlapping needs could arrange visits and meetings together. Feedback shows the video case studies and expert visits during the course tend to be very powerful. We could work further in the direction of Stepper's "Working Out Loud" approach (2020) to make networking less awkward and stressful, and more of a mutually beneficial exchange for both parties. This would then reflect the process during the sessions between the participants.

Course materials in Google Slides with implementation guidance in the speaker notes, and all other materials in Google Drive, are portable, low-cost, and transferable.

these was appreciated. Feedback was gained through a post-course survey issued shortly after the end of the course and during a follow-up social event in an interruption of the Covid 19 restrictions three months later. In particular, the local case studies of new refugee businesses carried the most weight. This could seem paradoxical in that they, by definition, knew less than the local bankers, suppliers, and small business advisors, however the peer effect was very strong.

The course materials were accessible from a Google website and participants preferred to complete their BMC in paper format for the duration of the course. As a tool for the future, they produced a digital version at the end. The final presentation to an external expert in the last meeting was the impetus to set the BMC in a more digital format at this stage.

The M9C course has not been piloted in full even though this was planned. The two projects overlapped and M9C was also affected by pandemic restrictions while another significant reason was that financing was once more reduced at approval stage so that strategic amendments had to be made to work within the reduced budget. Two different M9C sessions were trialed at local events in Lithuania and Italy where they were well received (steps 1 and 3 of 9). The Lithuanian Red Cross expressed a strong desire to adopt the whole M9C package after attending the public event.

6 Discussion

6.1 Integration into the Current Literature

The two projects stretched over five years from 2018 to 2023 with a core partnership. This timescale allowed the consortium to test ideas and notice what worked and what needed to be changed or enhanced in the areas of pedagogy, certification, supporting technology and content.

The Transformative Learning Circle approach functioned as intended with participants working on their own personal BMC project while exchanging experiences with their course colleagues and giving useful feedback and practical support where they could. Similar approaches are found in the organizational world such as the Mastermind method (Garmy 2019) which seeks to offer the same benefits of a group of like-minded people each working on personal growth projects that support each other through discussion. This meant that our approach had legitimacy as an accepted professional practice although in both 9C and M9C we prescribed the structure to a greater extent than is usual either in TLC or Mastermind. TLC was appropriate for the 9C participants in giving them agency and especially so for the M9C course both as a model for implementation in 9C and as a way of promoting an egalitarian learning community.

The EduSCRUM method of tracking progress that was implemented in the M9C course helps to overcome the multi-faceted nature of that course's outcomes that includes, completing a BMC, making a video and localizing the 9C course materials.

6.2 Limitations

Whilst the M9C course can be effective as a standalone experience, in the case of the 9C course, follow-up is needed. This could take the form of one-to-one mentoring as

edited versions of the 9C facilitator handbook and 9C materials as well as a completed BMC and a local case study video for use in the local version of the 9C course.

However these learning activities are shared with the facilitator, the issuance of a certificate of attendance and completion needs to be more secure and verifiable by external stakeholders. The project has tested a commercial option, Qryptal, and the use of certificated PDFs using Public Key Infrastructure (PKI) and a QR code that leads the reader to the certificate specification and confirms the identity of the issuer and recipient. The EU has recognized the need for such secure certification and has developed their own European Digital Credentials for Learning (EDCL) which can be used free of charge but require specific prior technical recognition to operate. In the M9C project we leave the final choice of certification up to the RSO as it is possible that they already have a preferred method. In this case our contribution is the certificate specifications. We describe implementation of Qryptal, certificated PDFs using PKI, and the EDCL in the technical guide we provide to RSOs.

5 Results

We piloted the original 9C course in Denmark and asked for feedback on both courses from potential refugee participants and RSO staff at public events in Italy, Greece, and Lithuania. The pilot was disallowed in the original Erasmus+ KA2 application for administrative reasons but the Danish partner was able to secure funding from the local municipality to run one very small scale iteration of the course in her area. The course was advertised locally in supermarkets, language schools and the local libraries and the Danish partner also got permission to recruit from three classes at the local language school for foreigners (including refugees).

In the pilot run of the original 9C course, we experienced that it was of wider interest than we had intended. Not only did we attract two refugees as contributors, but we also attracted two non-EU foreigners who had migrated to Denmark for other reasons, and a native Dane who had recently moved to the course location and felt she needed to grow her local network from almost zero. This indicates that the need to extend one's local business and professional network after moving to a new area is widespread for those intending to start a new business. The 9-week run of the course was disrupted by the Covid 19 pandemic, but the course continued online with the final presentation session taking place also online with the participation of a journalist and a local business advisor who gave feedback to our participants.

One concrete example of the benefits of forming a cohort around starting a business in a new area concerned logistics. One pilot participant was already importing a product into Denmark at great cost using air transport. This prompted another of the participants to mention that one of her relatives had previously worked for Maersk, the global shipping company, and that she could establish a link to explore maritime shipping as a cheaper alternative. It is exactly this sort of exchange that the 9C course was designed to promote. This example also shows the impossibility of expecting facilitators to be able to anticipate every question that 9C participants are likely to have.

While it could be argued that any individual could set up meetings with relevant professional contacts, the post-course feedback showed how greatly help with enabling

Site with links to all the presentations and some additional local information. As we moved into the M9C project we explored the possibilities with a wider range of Google tools.

The solution we adopted was to gather the course materials on to a Google Drive folder (see Fig. 3). Sadik (2017) found that this was a practical way of sharing course materials which students actively liked.

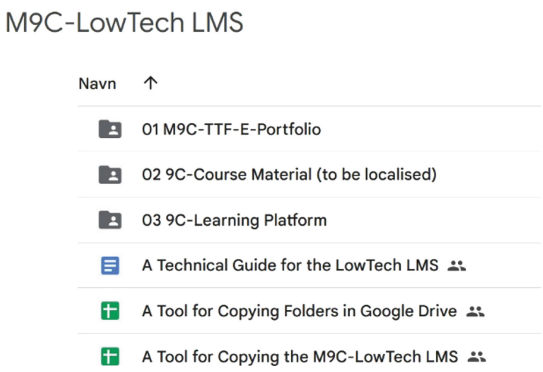

Fig. 3. M9C and 9C course materials template folders

The link to this shared folder is freely available on the M9C project website under the following menu item: Courses - > M9C Learning Platform - Google Drive. A new RSO wishing to implement the courses could copy the M9C Learning Platform (Google folders and files) by following the instructions in the following file: A Tool to make a copy of the M9C-Learning Platform for the RSO. The M9C Learning Platform contains A ReadMe file for Instructions that explains what kind of resources are available and instructions on how these should be used.

We facilitate prior inspection of the materials by mirroring the course materials on a WordPress website (Mastering 9 Conversations) using the Lifter LMS plugin. The materials are presented using the open source H5P book tool (H5P, n.d.) as a way of mirroring the slides and speaker notes of the original presentations. The materials can be viewed without creating an account. This also demonstrates that the materials can be transferred to other presentation modes.

Tracking and Certifying Progress

Tracking participant progress is necessary if certificates are to be issued. As argued earlier, the demand for evidence of attendance and completion is likely to vary according to context. When certification is necessary then tracking progress and certification are two tasks that can be carried out in different ways. Depending on the scale of implementation, progress tracking can occur on a very simple basis starting with pen and paper or a digital document filled in by the facilitator or trainer.

In the 9C course there are tasks that must be completed each week of the program to qualify for the final completion certificate. In the M9C course, there is a requirement to complete an e-portfolio that, in addition to learning diary entries, will contain the final

the presentations can be saved as PDFs that include the notes, and then distributed as workbooks.

Devices

We use the digital format as a convenient way of passing on the courses from one stakeholder to another. We also needed the assignments to be presented digitally in most cases. One important activity in the 9C course is to build up a contact list of professional people that can help with various aspects of the proposed business and this is best done digitally to take advantage of automatic links between emails and telephone numbers. In the M9C course, one of the important activities is to produce a case study video of a local refugee business.

A possible exception to the use of the materials in digital format is the completion of the BMC template where it is often more convenient to work with a paper version that can easily be amended using sticky notes. Editable digital versions of the BMC are available but perhaps not so convenient to interact with on a Smartphone and the paper version works best during face-to-face sessions when sharing ideas with course colleagues.

We also discovered the advantage of having the materials online while running the pilot 9C course as Covid-19 struck and we were able to continue online with minimal disruption.

Learning Management System

Both courses are designed to take place primarily face to face. The learning artefacts that participants produce in the 9C course center on an ongoing learning diary, a growing contact management list and an increasingly detailed BMC. In the M9C course the major learning artefacts include an ongoing e-portfolio, an increasingly detailed BMC, a localized version of the 9C materials and facilitator guide, and a local case study video. Both courses result in authentic outputs which the participants can make use of once the courses are over.

The restrictions on face-to-face meetings during the Covid 19 pandemic demonstrated that the materials were also suited to an online cohort model.

The technical requirements for the two courses are as follows:

- An editable repository for the nine slide presentations that make up each of the two courses.
- A link to the template for the e-portfolios that can be copied for each of the participants.
- Routines describing how you can track and verify progress on the certificate for each 9C participant.
- An editable repository for the support documents, 9C facilitator guide and M9C handbook and technical implementation guide.

Most RSOs do not have access to their own fully featured learning management system (LMS). It is possible to rent space on a commercial LMS, but we were wondering if it was possible to run the courses conveniently using freely available tools. We had already offered the 9C course as a series of presentations that could be used as PDF workbooks and during a pilot of the 9C course we had presented the course on a Google

The most critical outcomes of the M9C course are a thoroughly worked out BMC describing how the 9C course could be implemented in the participant's organization and a better knowledge of the local business landscape which includes the production of at least one case study video of a local refugee business that can be used as study material in their upcoming 9C course.

The materials that were produced for both courses contain little in the way of content and are rather discussion prompts within a timetable. These prompts could seem overly scripted. However, the aim is to give support to the less experienced facilitators, while more experienced facilitators can easily ignore and/or adapt the script if the main aim of each session is achieved.

4.2 Certification and E-portfolios

The assumed primary motivation of 9C participants is to develop their business idea with certification of this process not strongly desired. On the other hand, if refugees are in receipt of state welfare payments, they may need to account for how they spend their time, in which case certification may be necessary. To meet this possible demand, the M9C consortium developed certification for the 9C course and an e-portfolio approach for the M9C course and for the newly differentiated 9C course. If the RSOs do not have access to the mainstream, secure learning management installations that are common in education, this gives rise to some technical challenges which are explored below.

4.3 Technological Ecosystem

The 9C and M9C courses consist of timetabled discussion and activity prompts presented as a series of presentations with speaker notes. The M9C course mirrors the format of the 9C course as an effort to train future facilitators in the pedagogical philosophy of the 9C course. One of the key considerations of the M9C project was to make the materials as accessible as possible both to participants and to the facilitators and their organizations. We took into consideration that the refugee participants would most likely be using their Smartphones to access material and make notes (Betts 2017). In the 9C project we had tried out the phone app route but in M9C we decided that we should choose a more operating system agnostic route. We were also mindful of the low resource environment of most RSOs as well as the fact that running the M9C and 9C courses would likely be an occasional event that does not require the full panoply of secure learning management systems of a dedicated educational organization. The following factors were the most relevant.

Materials

Both the 9C and M9C courses are designed primarily as a place-based, face to face course. We prepared the materials as a series of Google Slide presentations, one for each of the nine weeks. In the presentations we made use of the speaker notes, initially as guidance for the facilitators, but it became apparent that in an egalitarian setting, this guidance was equally useful for all the participants. Although the format is a Google Slide presentation, this does not imply that the sessions must run with a projector, as

4 Methods

4.1 Learning Outcomes

To determine the learning outcomes of M9C we used the DACUM approach (Norton, 2004) to analyze the job of a 9C facilitator, starting with how to make the case to run a 9C course, implementing 9C and dealing with post program activities such as evaluation. This led us to propose three main learning outcomes.

1. To have sourced relevant information to produce a localized business model for offering the 9 Conversations training in their area and/or organization.
2. To be familiar with the materials of the 9C training (either to facilitate it themselves or to be able to support others in facilitating the program).
3. To know how to lead each 9C session using the suggested process (either to facilitate it themselves or to be able to support others in facilitating the program). This includes administration of certificates, suggested tools such as EU Skills Profile Tool for Third Country Nationals (EU, n.d.), and curation of materials.

Each of these main learning outcomes was further sub-divided for the purposes of the M9C course (Mastering 9 Conversations, n.d.).

The learning outcomes of the original 9C course were for participants to be able to:

1. Complete an EU skills profile that will be useful in presenting yourself to your new professional network.
2. Decide on a business idea to explore in the rest of the course that links the personal profile (in the EU skills profile) and the new local business environment of the participant.
3. Explain what a BMC comprises (for example to a fellow refugee).
4. Produce a BMC for a specific business idea rooted in the local community and personal context that includes all nine elements of the BMC.
5. Give constructive feedback on your study colleagues' completed BMCs and reflect on your own.

In theory, the nine weeks of both courses are meant to reflect the nine sectors of the BMC with the focus moving from one sector to another over each of the weeks. In practice, there is much to do in preparation before discussing the first sector. Many of the sectors interact and it makes sense to discuss them together and each course ends with the presentation of the group's ideas to an external expert. Therefore, in the end, four of the weeks are devoted to exploring the nine sectors, while the remainder of the time is dedicated to finding out more about each individual's skills, how to extend your network, the local area, how to tell a business story and the final pitch.

In the 9C course, as important as the nine sessions, is the time between the sessions when participants are expected to extend their local network by contacting relevant people and organizations. These could include potential customers, suppliers, financial institutions, and logistics organizations. Part of each 9C session is a debrief of the contacts made and how they can be followed up.

The most important outcomes of the 9C course are a thoroughly worked out BMC that can be presented confidently and competently by the participant, and an extended network that serves as a basis for plans to develop and implement the business idea.

of an individual" (Slettli 2019). Both courses aim to extend the entrepreneurial mindset, in 9C to start your own business, and in M9C to plan how to offer 9C within their RSO. The EU's EntreComp framework (Bacigalupo 2016), a set of 15 entrepreneurial competences (see Fig. 2) in an 8-level progression model, was used as the basis for the course as a way of building the entrepreneurial mindset, with its three main areas of Ideas and Opportunities (reflexive e-portfolios), Resources (through self-assessment), and Into Action (covering experiential elements such as the building up of a professional contact network or the making of a case study video). The facilitator role is that of an enabler, directing the discussion, organizing the venue, any materials and tools needed as well as organizing any guests or visits that the group wishes to undertake as part of their business canvas development.

When a person is defined primarily as a refugee, they are often in a supplicant role having to be careful to keep to the rules to avoid losing that status and being repatriated. The pedagogical approach in 9C was therefore carefully formulated to ensure that course participants were empowered by the process to further their business plans.

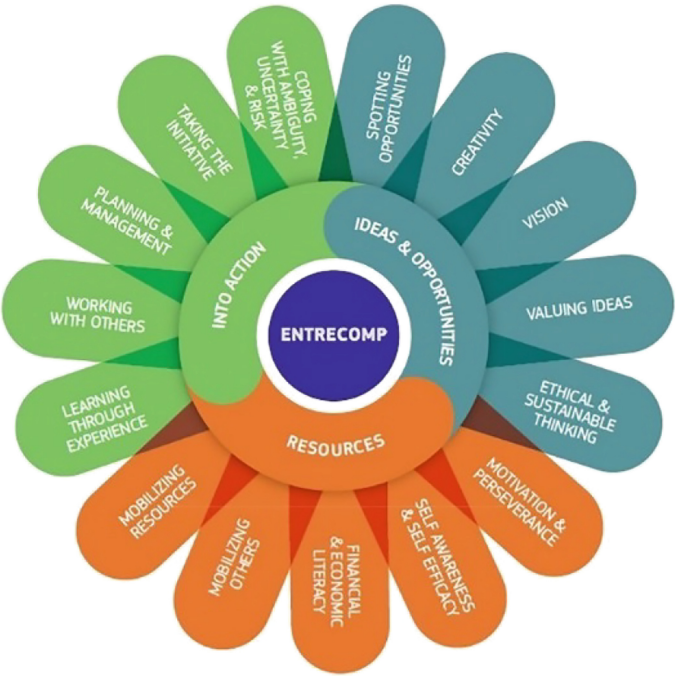

Fig. 2. The EU's EntreComp framework of entrepreneurial competences

When developing the M9C train the facilitator course, the additional feature of documenting progress on the personal project through the EduSCRUM approach (Delhij 2015), derived from the Agile method (Hazan & Dubinsky 2014), was added. This enabled trainee facilitators to document their progress on their personal project which, in this case, was making the business plan for how to offer a 9C course.

3.3 Pedagogy

The original 9C course was based on a process of filling the one page nine-sector business description as developed by Osterwalder as the focus of a nine-week course (Osterwalder 2010). The BMC template (see Fig. 1) was used as the major vehicle for the development of a business idea for two main reasons. Firstly, that it is a visual representation of a complex idea, the interplay of different aspects of a business, and this would be easier to follow for participants with a low language level. The other main reason for using the BMC is that it is an established approach that is well-documented with many organizations creating entrepreneurship materials around its use. When it came to developing the train the facilitator course, we realized that preparing a business canvas about how to offer the 9C course was a value-added strategy. This would not only train the facilitators in the use of the BMC but also give them a useful product at the end of the process that they could implement immediately or expand into a full-blown business plan (for which we also developed a template).

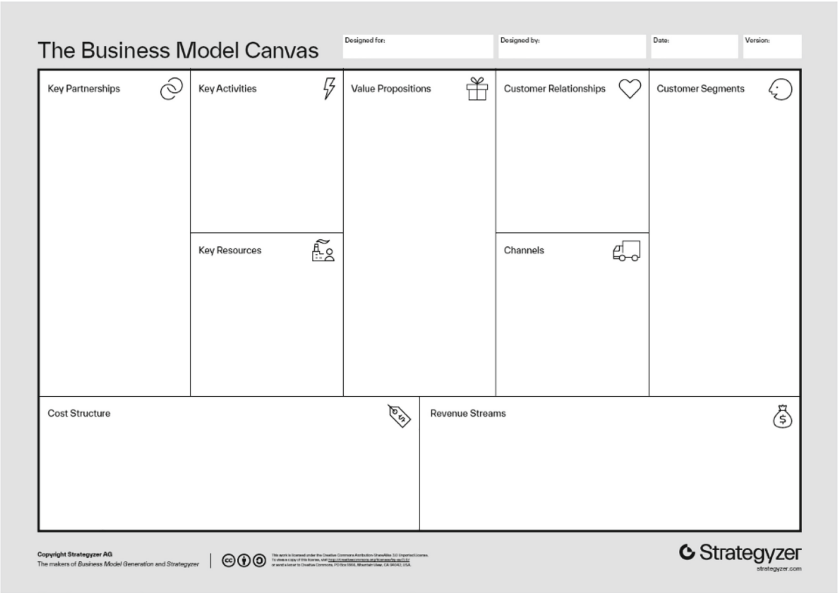

Fig. 1. The Osterwalder Business Model Canvas

The intent was to implement the Transformative Learning Circles (TLC) approach (Slettli 2019) in 9C whereby all participants are equal and develop their personal projects, in this case their business idea, through discussion. In TLCs "learning which promotes transformational entrepreneurial mindsets occurs in a dynamic iterative loop where individual level learning is combined with knowledge-sharing and interaction at the group level." (Slettli 2019). The word entrepreneurial in this case is used to refer to its broadest definition as "a purposeful action and a capability of bringing about changes in the life

3.1 Target Groups

The two courses have different target groups. The target group of the 9C course was refugees interested in setting up a business as a way of supporting themselves and their families in their new country of residence. According to Betts (2017) 32% of his sample of Syrian refugees had previously owned their own business but only 1.5% of these had gone ahead and started one in their new country of residence, while 12% aspired to do so in their new circumstances. This represents a 10.5% proportion of the Syrian refugees as potential 9C course participants. These are most likely to be refugees with a certain level of security that they can stay in the new country for some years rather than asylum seekers for whom different laws and time horizons may apply. Another feature of the target group is that they have been resident for two or three years and are therefore able to take a course in the national language.

The target group of the later project, M9C, is the facilitators of the 9C course who may be uncertain about their ability to promote entrepreneurship but bring facilitator skills and a deep knowledge of their clients and the local area to the process. These are most likely to be volunteers or staff of refugee support organizations (RSOs).

3.2 Target Group Needs

Betts (2018) found that in another geographical context "when asked to whom they would turn for social protection in an emergency, nearly 90% of refugees in the city said they would turn to their own communities." p.2. The refugees taking the 9C course therefore often have a supportive network with their compatriots but could benefit from closer contact with local people, especially those who could help them find out more about how business works in their area. According to Betts (2017) 97% own a Smartphone, whereas computer ownership is low and cannot be assumed. Therefore, we designed the 9C course to be completed on a handheld device.

There also tend to be language barriers between the refugees and the local population as well as a lack of understanding of key cultural differences which may affect the chosen business area. We attempted to design the 9C course to strengthen language capacity with a visual tool at its heart, supportive exchange of views as its main activity and facilitated meetings with local experts as a way of expanding perspectives.

The prospective facilitators could be volunteers or staff from RSOs. Both 9C and M9C were developed by a consortium including RSOs and university staff with expertise in entrepreneurship, pedagogy, and technical implementation of learning. Personnel from other RSOs may lack this deep knowledge and need to be scaffolded into being prepared to run these courses independently. The project consortium attempts to meet these needs by providing:

- Scripted materials for each course session
- Low tech and low-cost suggestions for implementation
- A participative pedagogy that values all participants' contributions as well as recommending the inclusion of local experts at strategic points in each course

cultural differences that were relevant and any legal consequences could ultimately seriously jeopardize their permission to stay in their new host society. The project partners were aware, for example, of a local refugee who had imported a truck from Germany into Denmark without knowing that duty should be paid and began selling cooked chicken without any registration of the business as a food enterprise that needed to be inspected for health hygiene. We specifically developed the 9 Conversations (9C) course to address such legal issues, as well as the cultural adaptations necessary to ensure that their new business could generate sufficient income to sustain them. The 9C course was developed to enable the facilitation of the course purely by volunteers and Refugee Support Organizations (RSOs) staff, neither of which were necessarily business experts. It was therefore essential that an important part of the course should promote the process of expanding each participant's network so that they could get the specific help and support they would need in the medium term to thrive in their new country (de Lange 2021). Following on from the 9C course, it became clear that the prospective facilitators needed additional support and therefore the Mastering 9 Conversations (M9C) course was developed, in which mirroring the pedagogical approach taken by the original 9C course, was a deliberate training strategy.

Note that we use M9C to refer both to the project and to the train the facilitators course and that information about both projects can be found on the M9C website.

2 Context

While the European continent is no stranger to refugee influxes, the Syrian civil war posed challenges in terms of the size of the refugee flows aiming for Europe, which became significant from 2015 onwards.

The Erasmus + Mastering 9 Conversations (M9C) project targets refugees in European countries that wish to start or resume entrepreneurial activities in their new country of residence. The earlier 9 Conversations project developed a course to extend the refugees' professional network so that they could more easily start their business. The 9C course was based on Osterwalder's Business Model Canvas (BMC) and its nine sectors (Osterwalder 2010), hence the course title, 9 Conversations. The M9C project extended the scope of the initial 9C course by developing training for 9C facilitators in an additional course called Mastering 9 Conversations. The M9C project also enhanced the existing 9C course with videos to provide differentiation as we had found that potential 9C participants varied a great deal in terms of their prior experience and educational level.

3 Theoretical Foundation

There are many aspects of the M9C course which refer to the original 9C course and therefore it will be relevant to describe both. We refer to a train the facilitator course rather than the more usual train the trainer to emphasize the pedagogical philosophy. The aim of the M9C course is to enable prospective 9C facilitators to adapt the 9C materials to meet their own needs, to create a video case study of a local refugee business for use in their 9C course, to be able to carry out the facilitation process and to become more familiar with their own local business landscape.

Low-Cost Learning: Enabling Refugee NGOs to Lead Entrepreneurship Programs Independently

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Abstract. The challenge at the end of any project is how to embed its newly developed approaches over the long term as widely as possible. The Mastering 9 Conversations (M9C) project developed a train the trainer course to enable volunteers and refugee support organizations (RSO) to implement an earlier course that helps refugees to start their own business in their new country of residence. RSOs and their staff typically have no entrepreneurship training, therefore any training approach aimed at them must be easily implemented at low cost, while fostering a process that empowers all participants, including the facilitator. We describe how the combination of a pedagogical and low-cost tech approach of both our courses, run using Google Drive with secure certification, leads to increased inclusion.

Keywords: Refugee · entrepreneurship · transformative learning circle · Business Model Canvas · facilitation · place-based learning · Mastermind · EduSCRUM

1 Introduction

As Syrian refugees began to leave their homeland in large numbers from 2015 (UNHCR, n.d.), the European countries receiving them began to process and integrate those given leave to remain. Although Syrian refugees were not the first wave of significant refugee flows, they arrived in larger than average numbers and with a higher-than-average degree of entrepreneurial experience than was common at the time in the European Union (EU) (Betts 2017). Individual EU countries applied different conditions to the refugees: some required refugees to join the labor force as quickly as possible (Arendt 2022), while a small but significant minority of the refugees began to explore ways of starting or restarting their own businesses. Promoting entrepreneurship for refugees is useful (Embiricos 2020) but we should be wary of ascribing specific characteristics such as entrepreneurship, to individual groups such as Syrian refugees (Turner 2020). Many, however, sometimes started a business lacking an awareness of the legal requirements or

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the development of the extended teacher/mentor role(s). This appears to be critical as the teacher and/or mentor role, is potentially influenced by the introduction of AI and data-generated insights.

6 Conclusion

In conclusion, previous research shows that student well-being is a major concern in education, and that there is a concerning gap in data-driven research on K–12 students' well-being in particular. The present study also contributed with insights into how the use of a data-driven tool can provide benefits to students, through: 1) focusing on students' well-being, thereby providing an otherwise elusive metric, 2) offering insights at multiple levels – individual, class, and school – enabling targeted interventions, 3) encouraging data-informed actions such as the implementation of group-based activities, and 4) facilitating the development of caring pedagogies, thereby fostering a nurturing educational atmosphere. However, to fully exploit these transformative potentials, several challenges must be confronted. While this study contributes with teachers' experiences of using a data-driven tool for student well-being, the teachers highlight that the well-being tool influences a range of aspects in current practices for example, the need to agree on guidelines for operational use, data literacy, teachers' role, and responsibilities in relation to caring pedagogies, and educational improvement. All these dimensions are important for understanding the relationship between students' overall well-being and academic performance. In addition, we found that using any tool must be appropriately incentivised for both students and teachers, where competence, resources and leadership guidance is critical for effective outcomes.

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address issues related to student well-being, are not the same. Extending the findings of [40] we found that there are large variations in quality and time between schools. Almost all teachers expressed a lack of guidance in addressing aspects like emotional, social, and physical well-being. None of the teachers reported being professionally trained to guide and meet students in need to help them excel. These shortcomings may impact the experienced lack of resources (insufficient time, instruction, and guidance) and feelings of insecurity. However, with informed and guided leadership, exploration could be more systematic in the received values and visions.

As has been pointed out elsewhere, this includes highlighting what competencies teachers need to develop their pedagogical approaches and using these insights to support students' learning and well-being in meaningful ways [8, 29]. We did see example, in mentoring sessions and parent-teacher meetings, when a detailed focus or self-monitoring can support meta-cognition, which has been shown to improve cognitive outcomes [4]. With insights being used to inform teacher(s) (and parents) of a potential need for more social support. While the data-driven insights on well-being can inform planning and preparation in the pre-active phase, these insights were currently not intentionally directed toward learning activities, to support meta-cognitive abilities, evaluate intervention, or providing feedback when a student improves their well-being. This indicates that more guidance is needed on how to use the tool, but also, that schools can share their innovative adaptations of the tool, thereby fostering a supportive community for learning and growth.

The data-driven approach creates a number of unique values for various actors in school, enabling new effective methods that strengthen the school's ability to work preventively and improve their students' well-being in a continuous manner. A key value which emerged under the theme Teacher leadership (theme III) reflects opportunities of using the well-being tool to inform strategic and operational decision-making. Indeed, one challenge related to when teachers have the time to use the well-being tool and how the tool-use is used with students. We note a lack of theory to support integrating learning analytics tools. Theoretic grounding can provide teachers with a strategy for using data-driven insights to guide classroom instruction e.g., [38]. This can improve the school's ability to employ a scientific and evidence-based approach for building school improvement capacity and continuous data-driven school improvement. Building on [37, 40], the micro level encompasses the iterative process of data-generated insights and how these support each pedagogical phase. We see that teachers have access to data but need awareness of how to use it, reflect on the relevance of the data, and request new insights to support sensemaking to impact student behaviour or induce new meaning. On the macro level, on the other hand, addressing the workflow across multiple lessons or at the organisational level, the well-being tool was reported to provide support for abstracted insights. However, such opportunities also embed tension in what a teacher or a mentor is, in which teachers report on restrictions of resources and a need to empower teachers as leaders in decision-making and management. Indeed, the tensions also make visible that there are ongoing negotiations on what teacher and mentor roles may be, as identified by Faculty transformation (theme IV). This concerns if and to what extent schools are responsible for student well-being and how this would impact relational aspects and responsibilities, which in turn highlights the need to approach tensions in

students mark certain answers, then I must follow up! How will I get that time? How do I take those calls in a good, proper way? I became a teacher to teach. I didn't become a teacher to talk about well-being with teenagers. I don't feel super comfortable in it. I don't feel trained in it. I am very worried about it and handling that task well. (Teacher 6)

[We] have developed from a school where the teacher's role was defined as somewhat more authoritarian [...] to a school where the relational aspects like trust and respect matter more... (Teacher 1)

Modern faculty roles change as relational features are added to traditional instructional approaches. Some educators recognise the benefits of establishing trust and respect in the classroom, but others worry about their capacity to adapt and handle their new responsibilities. While teachers' approaches differ, none of the teachers interviewed reported being formally trained to handle psycho-social well-being. To ensure the best outcomes for students and educators in this quickly changing educational landscape, educational institutions must give proper training and support to teachers.

5 Discussion

In this paper, we explored upper secondary school teachers' experiences using a data-driven tool to support student well-being. Our research questions revolved around what benefits and challenges upper secondary school teachers experience when using data-driven tools to support student well-being, and how these factors impact successful implementation and integrating the tool into educational settings. We identified four themes: Insight diversity, Caring pedagogies, Teacher leadership and Faculty transformation, which we discuss using the theoretical lens suggested by [37], which includes orchestration aspects, phases of pedagogical practice, target actors, and levels of the iterative process. Our findings show that the well-being tool does present possible solutions that may support teacher by providing insights into student well-being, motivation, and other areas where support may be needed, which are imperative to identify the diverse needs of learners [1–3]. Drawing on the insights from the well-being data, we discovered a variety of perspectives, categorised as Insight Diversity under our first theme. This multi-faceted understanding broadens the utility of our tool, facilitating its application at various levels - from individuals, groups, or classrooms, up to broader program levels. This, in turn, could indicate areas of potential organisational improvement.

Exploring opportunities and challenges in Caring pedagogies (theme II), we noted that a key value is an incentive for the teacher collective to focus on the interpersonal values of high-quality relations and social support structure, where this well-being tool can capture data (which is otherwise illusive) to illustrate states, improvements, effects of interventions and identification of other critical factors, e.g., [29, 31]. Schools are generally advised to think about creating welcoming social learning environments that enable and support the well-being of their students [16, 17]. However, the challenges mentioned imply that many teachers might not feel prepared to address problems with students' well-being or to organise value-based and group-strengthening activities in response to the well-being tool. Knowing what interventions could work and having the capacity to

for that, it seems silly to ask lots of questions about how the students are doing, and then the students notice that there will be no difference. I say week in and week out, something like, "You're lying bleeding like that", and you say, "I'm bleeding, I'm bleeding". Yes, we have received information, but there will be no plasters or bandages, either. So, what capacity does one have to receive it? (Teacher 1)

The teachers describe the importance of being responsive to the findings, for example in initiating *group-strengthening activities.* On the other hand, the teachers were not talking about value-based work or psycho-social support as something being generally agreed in between colleagues. Rather, it seemed to be up to each teacher to determine how to respond or not. An implication of such approach may be that if students notice that their data did not come to use, e.g., that the school was not using the data to making improvements, that the students may question the necessity of sharing how they feel.

4.3 Teacher Leadership

Recognising that teachers' roles extend beyond classroom responsibilities and instruction is important. Teacher's report being part of a decentralised leadership system in which they use the tool to save time, gain insight and ensure they provide effective student support.

As I teach English, I don't take the students aside for mentor-related reasons. Then this tool gives me a good overview; that I can still see if there is someone marked on red, so I can reach that student. So, there is definitely a possibility that I will get insight into aspects that I would not have time to discover during an 80-minute, quite packed lesson". (Teacher 4).

Above all, I think there is value in the fact that changes we want to make (possibly costing the school money) can be supported [by data]. Then it is good to have a tool showing them [the school leaders] that there is something to improve here. It's not just that we [the teachers] have some insignificant opinion [...] then you are met by the school management: "Yes, and we are looking into it", and then nothing happens. Now we can show the data. (Teacher 6)

Apart from using the tool operatively to ensure all of their mentor students are on track, teachers also point to using the data to underpin strategic decision-making, being able to present something to school leaders that may support an experience or a feeling of a situation with generated data that may reflect duration, intensity and spread of a problem.

4.4 Faculty Transformation

Faculty roles are changing as educational systems change. In the classroom, trust, respect, and well-being are now prioritised. However, teachers may object to having to take on responsibilities in relation to student well-being.

That was one of the reasons I wanted to use this tool - because it would be a way to save time. But by using it - I also accept taking on this role. If I identify that the

day," feel stress, test anxiety or mood swings without these being investigated. Thus, the insights provided may be diverse in nature, reflecting both program level and individual perceptions and experiences. Underlying influencing factors may differ, which is why contextual awareness is key. Based on a contextual understanding, teachers may decide if it's appropriate or not to address the issue with the student or student group. Teachers suggest this decision be made with colleagues, followed by a tactful, sensitive, and respectful approach. Whilst gaining new insights two of the teachers also shared their reflections on students' attitudes towards using the tool.

> *Because now it's more just like something they need to do, a necessity they have to go in and click on, and they do that quickly just to finish earlier, that is.* (Teacher 5)
>
> *The students have, for example, mentioned that they don't see it as that important because we haven't spent much time on it.* (Teacher 2)

Acquiring insights inevitably means that teachers and schools have the possibility to intervene if a group or an individual signals a decrease in the parameters measured or adjust and continue an ongoing intervention. However, how teachers frame using the tool, the time they dedicate, and how they then use it would influence student perception. If there is no framing or further use of the tool, students could approach it as rather pointless. However, teachers also reported that some students seemed to view it as a valuable opportunity to make their thinking about their well-being more concrete, which could help them to self-regulate and express their feelings.

4.2 Caring Pedagogies

The third theme, Caring pedagogies, reflects teachers' views of supportive learning environments encouraging student well-being, educational participation, and success. The teachers, for instance, point out that the tool strengthens their capacity to identify students that need attention on an individual and group level, to improve aspects of social relations, and their capacity to address students' performance dissatisfaction and sense of self-worth.

> *For my part, it's like there are two perspectives: partly, it's individual, finding individual students who are having a tough and difficult time, but it's also very interesting on a group level, as well. Because the mentors have an extra responsibility for their own students, but in our work team, you are also part of the responsibility for the entire grade year, so to speak. According to the value-based work, we can work further on questions: "Is there a problem with the social relations between the students?" Well, maybe we need to add group-strengthening activities here for a while now, for example. And when students are dissatisfied with their performance, yes, but then maybe we should have a conversation about it. So, talk a little about education, grades, and value: "It's not just your grades that make up your worth. You are more. - Like that."* (Teacher 3)
>
> *If you start asking questions about students' well-being, you may also have to be prepared to act for students' well-being. If you as an organisation are not ready*

3.3.4 Levels of the Iterative Process

Fourth, the combined analytics framework employs perspectives at the micro- and macro levels. Building on [37, 40], propose that the micro level encompasses the iterative process of data-generated insights and how these support each pedagogical phase. Teachers *have access to data* but need *awareness* of how to use it, *reflect* on the relevance of the data, and request new insights to support *sensemaking* to impact student behaviour or induce new meaning. The macro level, on the other hand, addresses the workflow across multiple lessons, allowing tools to provide support for abstracted insights.

4 Results

We identified four themes related to teachers' use of the well-being tool: *I. Insight diversity* relates to context-dependent data and emphasises the need to understand contextual influences in order to interpret data relevantly, *II. Caring pedagogies,* which reflect experiences in relation to improving the learning environment, educational participation, and school success, *III. Teacher leadership* reflects teachers' use of the tool for operational and strategic purposes; and *IV. Faculty transformation* deals with reports on tensions in relation to the teacher role.

4.1 Insight Diversity

The teachers reported using the tool to acquire different kinds of insights that were otherwise unavailable to them. These insights allowed teachers (and students) to gain insight into individual students' motivation and well-being in a continuous way compared to traditional practices, and thus in a timely manner, identify who may need support, in addition to program-level insights.

> *To the individual parent-teacher meeting [we want the students to use the tool to] that they [the students] explore specific data and check historically: "How has it looked historically" and "What is the reason for that?", "How do you want it to be in the future?", "How will we achieve it?", "What should we do differently?" and so on. [...] So if there is something that we need to do to support the student, you have to pay attention to that. It's clear that if they have an exam the next day, then the workload might be perceived as high [due to that. So, you might have to think about checking [data] over time so that you do not point to something that applies to one day only.*
>
> [...]
>
> *(sitting with the application open)… now when I look at…(scrolling)…for example…I see here that it is quite clear that the girls here have much lower ratings on motivation, for example, which is perhaps a picture you have not seen elsewhere before. Of course, anyone can have a problem with motivation, but we often have the personal chats with the boys.* (Teacher 3)

However, timeliness and being sensitive are key, teachers say; otherwise, students may stop revealing how they feel. Teachers underline that it must be ok to "have a bad

3.3 Theoretical Lens

Recognising the need to balance well-being and academic performance, we have chosen a multi-theoretical approach to analyse data, including consider stakeholders' varying purposes, roles and conditions for use and interaction, orchestration aspects [37], collaborative learning [38], exploring both the micro- and macro level perspectives. The framework combines four dimensions: *I. Orchestration aspects* relating to design and planning, regulation and management, adaptation, flexibility and intervention and awareness and assessment, *II. Phases of pre-active, interactive, and post-active pedagogical practices* that are supported, *III. Target actors, i.e.,* students, teachers, and researchers; and *IV. Levels of the iterative process*, considering both micro- and macro levels. A description of the dimensions I-IV is provided below.

3.3.1 Orchestration Aspects

[37] included orchestration aspects proposed by [38]. They developed a framework for constructing learning analytics (LA) solutions that include four functional orchestration aspects: 1. Design and planning: preparing learning materials and methods. Applications that generate data-driven insights support the design of learning activities, 2. Regulation and administration: coordinating educational processes. LA tools provide essential operational data. 3. Adaptability and intervention: adjusting to unanticipated events or novel duties. Tools for learning analytics facilitate task adaptation, and 4. Awareness and evaluation: gaining insight into the learning processes of students. The range of tools includes visualisations and predictive approaches, and the fifth factor examines the roles of teachers, students, and other stakeholders in relation to the tools.

3.3.2 Phases of the Pedagogical Practice

Second, [37] included specific aspects from the Implementing Collaborative Learning in the Classroom (ICLC) framework by [38], which specifies five teacher competencies: planning, monitoring, supporting, consolidating, and reflecting. These competencies are mapped to the teaching practice's pre-, interactive, and post-active phases. Pre-active entails designing and preparing learning activities; planning is the primary skill. Typically, this occurs before the activity but can also be modified during the activity or redesigned afterwards. In interactive learning, the teacher facilitates the learning process and guides the students while monitoring, scaffolding, and consolidating. In the post-active phase, the teachers evaluate the outcomes and make modifications for future sessions.

3.3.3 Target Actors

Third it is also critical to consider stakeholders' varying purposes, roles and conditions for use and interaction. Here, we follow [37], and include students, teachers, mentors, and individuals in the community of research (where applicable).

3.2 Data Collection and Analysis

Data were collected at three upper secondary schools in Sweden during March and April 2023, following informed consent by the participants. Interviews (n = 6) with teachers (two female, four male) were conducted and recorded online using a videoconferencing application. A total of 204 min were subsequently transcribed verbatim. We adopt a reflexive approach to thematic analysis [33] and followed a six-step methodology suggested by [34] The reflexive approach to thematic analysis, is rooted in qualitative inquiry [33, 35] and emphasises the importance of researcher subjectivity and the situated, interpretative nature of the analysis [33] rather than seeing interrater reliability as a marker of quality. This method was selected as it is suitable for well-being analysis [35] and interview data [36]. Each phase of data analysis was conducted by all authors in order to ensure transparency and rigour.

1. Initial familiarisation with the data: All four authors became acquainted with the general interview findings using a fully inductive approach (within the context of using the well-being tool). This entailed rereading the transcripts, making initial notes, and discussing the results as a group. During our meeting we both discussed initial themes and codes, thus our thematic analysis process was iterative, allowing us to revisit earlier stages as new insights emerged [35].
2. Developing initial codes: Following the generation of initial codes, the authors divided the interview transcripts and coded the data separately. This was accomplished by identifying meaningful data segments and labelling them. The codes were then distributed to the group, and the authors convened to discuss their individual coding and any emerging tentative themes. For example, with regards to "Insight diversity" the authors agreed that the data revealed gaining access to insights that the teachers had not previously had, not limited to well-being. Thus, instead of limiting the tentative theme to motivation and well-being insights, we agreed that there was diversity in the insights gained.

3-5 Themes: searching for themes, reviewing themes, and defining and designating themes: In meetings, while a high level of agreement among authors was observed for tentative themes, the focus was to adopt a reflexive approach to thematic analysis, rooted in qualitative inquiry [35]. This reflexive approach provided the freedom for each author to expand on their individual interpretations without being constrained by predefined codebooks or similar methodologies. As part of this process, the themes were reworked, and the data were categorised to capture the essence of the participants' experiences. The tentative themes were discussed thoroughly to attain the same comprehension, and representative interview excerpts were selected. To maintain transparency throughout the analysis the authors continuously discussed their interpretations. This iterative strategy allowed for refining and elucidation of the themes, ensuring they were precisely defined and labelled.

6. Creation of the report: The final step involved incorporating the findings of the thematic analysis into a cohesive and consistent narrative. This included providing evidence from the data to support the identified themes and clearly explaining their significance within the context of the research question [34, 35].

that used AI and traditional statistical measures to distil data-generated insights on upper secondary students in Portugal found this approach to be more accurate than traditional methods [30]. However, the experiences of well-being applications and the data generated on student well-being may be considered an internal matter by schools, which may cause them to be reluctant to share their insights. In this regard, it would be difficult to determine the experiences and effects of interventions on teachers and students [11]. Nevertheless, it has been argued that continuous, systematic data analysis can lead to sustained school improvement [31]. [31] encourages school leaders and educators to create a culture of inquiry where data-based insights are utilised to identify areas of improvement, develop strategic plans, and evaluate the effectiveness of their actions. While research on wellbeing application in education overall is scarce, novel research, e.g., [9, 25, 30], on data-driven insights and well-being in higher education highlight how this is still developing, and the first K-12 initiatives are only just starting to be published.

3 Methods and Materials

3.1 Context and Participants

The software, EdAider Wellbeing, was developed in 2020 to assist schools with supporting insights to promote student well-being. The software tool was developed with school personnel, students, and researchers within a national research and development program (R&D) focused on data-driven school improvement organised by an independent research association: Ifous (Innovation, research and development in school and preschool). Now being used in around 20 schools in Sweden, it offers three features: facilitating high-frequency scientifically based screenings of a student's performance, providing students, teachers, health teams and school leaders with data insights that facilitate student reflection and learning about well-being as well as timely evidence-based interventions and data-driven feedback. During the R&D program, the authors established connections with schools. As three schools had used the tool the longest, we approached the principals and asked if they could suggest teachers, that used the tool from the start and who would have time for an in-depth interview. Adopting purposive sampling [32], we only approached teachers who were active users of the tool. Six teachers from this subset of schools were chosen for in-depth interviews, for this pilot-study, with a more comprehensive study under way. The teachers had varying years of experience: the one with the most experience had taught for 25 years, four teachers had 20, 16, 15 and 10 years of experience, and the one with least experience had taught for 4 years. All participants provided informed consent before data collection. In Swedish schools, a mentor is a teacher who supports, guides, and monitors a group of students' academic and social development. Swedish schools have mentee groups that are assigned to a mentor. Mentee groups are usually students from one class who share academic and developmental experiences. The mentor thus plays a dual role in the student's educational journey: They actively engage in strategies aimed at fostering emotional and psychological well-being, as well as assist the student's academic progression by providing feedback, engaging in dialog, and offering academic guidance.

e.g., [13–15]. The European Commission [16] emphasises the necessity of well-being at schools, highlighting the rise of mental health issues amongst school children and the additional challenges brought about by the Covid-19 pandemic. Internationally, countries like Australia, New Zealand, and Scotland have integrated well-being into their educational policies [12]. The OECD's recent PISA results also indicate a decline of well-being as it is related to students' sense of belonging, highlighting the timeliness of this research [17]. While there is no definite agreement on the boundaries of well-being in schools [18], researchers currently relate the concept to the school environment [19] and how positive influences on well-being may be account for calm, peaceful, and fun atmosphere [20], meaningful engagement [21], supportive relationships [20, 21], and negative influences by for example teacher stress [22], lack of social status, withdrawal and disengagement [23]. Thus, there may be some variations of what teachers mean when they talk about supporting student well-being in school. Still, an everyday understanding of well-being that aligns with the mentoring descriptions seems to relate to having an affective mode that does not hinder learning, engaging in learning in a meaningful way, and having functional relationships and a supportive environment. Whilst "well-being" is a commonly understood term in ordinary language, it is a broad and multifaceted concept, with cultural connotations and subjective properties, which does not easily lend itself to any general definition or measurement independent of context. Any attempt to generally define "well-being", even in an educational context, uncovers a wide range of yet multifaceted sub concepts which would require further clarification for scientific scrutiny. For example, the European Commission defines well-being in terms of eleven aspects, ranging from feeling safe, valued, and respected, to social engagement, self-esteem, self-efficacy, autonomy, personal relationships, a sense of belonging, happiness, and life satisfaction [16].

2.2 Data-Driven Approaches to Support Student Well-Being

Existing research on data-driven insights (focusing on university-level students) have shown that internal factors (experiencing pain) and external factors (like duration of electronic device use) have been associated with student stress which in turn was associated with problems like burnout and depression [9] and poor sleep quality [10] and the effects of non-ergonomic study positions on student physical well-being (when students study from home) [24]. Other approaches analysed student emotion, as academic emotions provide insight into the student well-being for both on-site and online learners [25] and used wearable sensors to detect student academic emotion [26], Fitbit and smartphones to detect loneliness [27]. In addition, we have seen initial contributions to theory and concept development to better understand student well-being as aspects related to worrying, health, and social factors when artificial intelligence (AI) is used to categorise and rate students' state and behaviour, e.g., [28].

2.3 The Balance Between Well-Being and Academic Performance

There exists a delicate balance between fostering well-being and achieving academic excellence [12]. While insights into student well-being can inform interventions that support stress-management and academic re-engagement, as also noted by [29], a study

into the effectiveness of educational interventions and enable personalised support for learners [3]. However, to make sense of the data and apply it effectively, a strong theoretical background is required that can explain how different variables and factors affect learning outcomes [4]. One promising area of research that integrates data analytics and student well-being is using digital tools to support student well-being. Research has shown that student well-being is critical to academic achievement and inclusive societies [5]. By collecting data on students' emotions, behaviours, and attitudes, teachers and school leaders can gain insights into the factors contributing to student well-being and make informed decisions about supporting students' social and emotional needs [6]. Previous research has pointed out that it is particularly critical to consider how schools can ensure that the data is used in ethical and responsible ways that respect students' privacy [7] and develop their pedagogical approaches, using these insights, to support students' learning and well-being in meaningful ways c.f. [8]. Despite its significance, there is a noticeable scarcity of research on how data-driven methods can promote student well-being, particularly for K–12 students. Most of the existing research focuses on university-level students [9, 10]. Where, for example, [11] explored university student's adoption of technology in relation to their well-being, from the Technology Acceptance Model, and concluded that even though university students seem to display a growing acceptance of mobile applications, more research is needed, both that include other populations and build on empirical data. As theoretical insights are critical, but without empirical finding there is a risk that future theories will not reflect what is happening in situ [11]. To contribute to this gap, we explore the K-12 contexts. Researchers, e.g., [12] emphasize the crucial role teachers play for student well-being. This study extends that discussion by approaching the experiences of implementing and using a well-being application from the teacher's perspective, an aspect that, to our knowledge have not yet been explored in existing literature. Research questions posed in the study are:

1. What benefits do upper secondary school teachers report when utilising a data-driven tool aimed to support student well-being in schools?
2. What challenges do upper secondary school teachers report when utilising a data-driven tool aimed to support student well-being in schools, and how do these challenges impact the integration and successful implementation of such a tool in educational settings?

The primary objective of the study is to explore teacher perception of how a tool, used to provide data-driven insights is impacting them in their roles as teachers and mentors. Exploring these implications from a multi-theoretical approach we consider stakeholders' varying purposes, roles and conditions for use and interaction to offer insights that may inform an improved integration of similar tools, and improved educational strategies and interventions.

2 Background

2.1 The Importance of Well-Being in Education

As a way to address student well-being and assist students with developing and maintaining healthy habits, educational institutions have made student well-being a priority, developing formal strategies and frameworks for addressing student mental health

Tech for Student Well-Being: Exploring Data-Generated Insights in K-12 Education

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Abstract. Student well-being is important for inclusive societies and academic achievement. As studies have shown, well-being is associated with school success. Today, it's common for schools to use different technologies to collect and analyse digital data with the purpose of improving educational outcomes. Generally, this collected data focus on student engagement, attendance, and results, with novel advancements being aimed at supporting student well-being. In this pilot study, we analyse teachers' experiences to identify benefits and challenges during a spearhead integration of a data-driven tool for examining student well-being in upper secondary school. Using thematic analysis of teacher interview transcripts, we identified four themes: insight diversity, caring pedagogies, teacher leadership tools, and faculty transformation. The themes are discussed using the theoretical perspectives of orchestration, practice, process, and actors. Key results show that some high-value benefits teachers report on are gaining insights, saving time, and informing decision-making. The challenges include a lack of systematisation, guidance, and resources, and tensions related to defining the role and responsibilities of a teacher or mentor. We conclude that schools that work to support student well-being can benefit from the diversity of insights and practices related to the presented tool. However, an informed and systematic approach would be needed to leverage the benefit of spearhead integration. The contribution of the study is to provide insights on how a well-being tool can be used in an educational context to bring understanding of student well-being to teachers. Our results may inform decisions and guide integration and implementation practices in schools.

Keywords: Digital competence · Digital literacy · Student well-being · Innovation · Implementation · Integration

1 Introduction

1.1 Supporting Well-Being and Understanding Tool Implementation

In recent years, there has been increasing interest in developing adaptive learning environments that can accommodate the diverse needs of learners [1, 2]. The rationale is that collecting and analysing data on learning processes in real-time can provide insights

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Innovative Approaches to Enhancing Education and Student Well-Being