Jantje Halberstadt
Antonieta Alcorta de Bronstein
Jean Greyling
Shaun Bissett *Editors*

Transforming Entrepreneurship Education

Interdisciplinary Insights on Innovative Methods and Formats

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Foreword

The University of Vechta is honored to be the lead partner in the outstanding YEEES project with its international and interdisciplinary network of university teachers and researchers from Southern Africa and Germany. Developing and implementing innovative teaching based on state-of-the-art research becomes more and more important in this quickly changing learning and work environments. Therefore, the book provides teaching approaches, methods, and a diversity of fine elaborated examples that readers can greatly benefit from and develop even further for their specific needs. Most importantly, we are very optimistic that the YEEES project will spark new ideas and innovation in its research and teaching perspectives for not only current lecturers but also students who may become new entrepreneurs or junior researchers and pursue the project's aims.

University of Vechta, Vechta, Germany Kim-Patrick Sabla-Dimitrov

Foreword

The University of Oldenburg is privileged to have supported the YEEES project and to be part of its interdisciplinary international network of partner universities in Germany and Africa. The project promotes higher education at the next academic level and the exchange of researchers to develop a solid base for sustainable, innovative entrepreneurial approaches. Specifically, the Department of Computing Science at the University of Oldenburg with Prof. Dr.-Ing. habil. Jorge Marx Gómez and his scientific staff working for this project are proud to have supported the implementation of the YEEES Training Center in which many of the contents of this publication were developed.

Specially in these turbulent times for the education sector, in which university lectures and students alike are challenged to adapt to new educational formats and be more resilient, it is when this book on innovative insights on teaching methods and formats becomes more relevant to a wider readership such as university teachers, researchers, students, and entrepreneurs alike, as well as practitioners and policy makers in the higher education sector. Through this publication, the University of Oldenburg corroborates once again its commitment to the promotion of international cooperation in teaching and research.

University of Oldenburg, Oldenburg, Germany

Verena Pietzner

Foreword

Nelson Mandela University is privileged to be part of and has benefitted greatly from the collaborative, interdisciplinary network of German and Southern African universities participating in the YEEES project. Evidence of the impressive work being done can be found in this book, which has both an applied and a scholarly focus. The COVID-19 pandemic is an unprecedented moment in the history of the world and in higher education. We are being called on to generate innovative solutions to ensure that students continue to learn and develop the attributes needed for the rapidly changing world of work. The case studies covered in this book and the lessons learned in the YEEES collaborative provide excellent examples of innovative teaching activities, approaches, and methods which foster interdisciplinary transformational learning. Lecturers will be able to engage with these examples, which could spark further innovations. In addition, developing graduates with entrepreneurial mindsets and interdisciplinary competencies that can be applied to develop innovative solutions to the grand challenges faced in our societies is key to attaining the global sustainable development goals aimed at securing a better future for everyone across the globe.

Nelson Mandela University, Gqeberha,
South Africa

Cheryl Foxcroft

Foreword

Save University of Mozambique is privileged and honored to have played an integral role in the prestigious YEEES project. Our collaboration with YEEES over the past few years has brought beneficial academic and cultural experiences to both our student body and our teaching staff. Through the participation of scholarly international networks, our researchers have formed long-lasting partnerships that promise to bear fruit long after the YEEES project is over.

The COVID-19 pandemic was an extremely trying moment for higher education in Mozambique. As COVID struck we were caught completely unprepared having only just started the process of integrating technology into our approaches of teaching and learning. If there was any bright side to COVID, it is the progress that was made in the Mozambican education sector toward embracing technology and innovation.

Innovation and sustainability are now an indispensable element in any conversation about how universities in Mozambique will operate moving forward. The hybrid approach of teaching (presential and online) has shown positive results not only in regard to overall learning but also in guaranteeing gender equality as well as the participation of students with disabilities, and those that live far away from urban centers where universities are found. The case studies in this book speak to the importance of innovation and how it can be harnessed in the teaching and learning process. With its focus on interdisciplinary transformational learning and innovative approaches and methods to teaching, it is our hope that universities both in Mozambique and across the world can benefit from its teachings.

Faculty of Education and Psychology,
Save University, Maxixe, Mozambique

Gregório Vilanculo

Introduction: Making a Difference by Supporting Transformative Entrepreneurship Education

If you think you are too small to make a difference, try sleeping in a room with a mosquito.— African proverb

Making a difference, however, is directly connected to transformation, which is urgently needed to build a sustainable future. In light of society's urgent problems such as inequality, poverty, climate, and war, we need innovative solutions created and implemented by (future) agents of change. Teaching current students to be change agents is experiencing growing interest for research as it connects various disciplines such as sustainability and entrepreneurship education (Hsu & Pivec, 2021; Kickul et al., 2018; Rashid, 2019).

Just like inventions need to be transferred to markets to become innovations, entrepreneurship also plays a central role in transformation. Theoretical solutions may be perfect on paper, but remain only ideas until they are successfully implemented. This is why we consider entrepreneurial competencies as crucial for change agents. Regardless of whether entrepreneurship is defined with a focus on founding businesses, or captured in a broader way as the action-oriented ability to find solutions (Gibb, 2002; Ucbasaran et al., 2001; Watson, 2012), we see identifying and taking transformative opportunities as the underlying concept of long-term positive change. Entrepreneurship education can contribute to building the competencies needed for transformation as it also changes mindsets (Dimov & Pistrui, 2022; García-González & Ramírez-Montoya, 2021). In doing so, it has the potential to spur the motivation and ability of today's students as they tackle future challenges. At the same time, entrepreneurship education can thereby be transformative and transformational as it contributes to the transformation of the students directly and to the transformation of societies by providing them with relevant skill sets.

While entrepreneurship education with its potential in various fields is increasingly recognized in research (Carpenter & Wilson, 2021; Nabi et al., 2017), authors stress that there is still a need for additional work (Aparicio et al., 2019; Nicotra et al., 2021), especially regarding its effects on the long-term positive change of systems and societies (Mets et al., 2021; Ratten & Usmanij, 2021). When it comes to

entrepreneurship education, we still lack research work, practical advice, methods, and tools, as well as concrete teaching approaches and modules. This is why our book focuses on *Transforming Entrepreneurship Education: Interdisciplinary Insights on Innovative Methods and Formats*. In other words, we are calling for educators to act more entrepreneurially themselves, and start adjusting their (traditional) education toward new directions to transformational entrepreneurship. We provide theoretical and methodological insights, and share experiences in creating, using, and evaluating innovative teaching approaches with a particular focus on building entrepreneurial mindsets and competencies in trans- and interdisciplinary contexts. By integrating innovations in technology into learning situations and/or focusing on the creation of entrepreneurial solutions based on technology innovations, we broaden the perspective as it integrates the opportunities achieved through digitalization and information and communications technology (ICT). The collection of chapters focuses both on the learners' first-person perspectives and on the role of teachers and the learning environment.

This book consists of three parts.: While the first part introduces teaching methods and tools, the second part focuses on selected innovative formats that have been developed and used to promote entrepreneurship education. The authors here argue why they consider these formats particularly suitable in transformational entrepreneurship contexts, sharing their experiences in designing and implementing them. The final part discusses the importance of research in entrepreneurship education—especially that connected to the field of sustainability and transformation.

Starting with a broader perspective, the first part introduces selected approaches and tools to use in transformational entrepreneurship education. Schank and Halberstadt underscore service learning as a promising approach for entrepreneurship education, combining academic learning with real-world problem-solving. The chapter also introduces a tool that aims to support lecturers and help streamline programs based on a service-learning approach. In the next chapter, Hölzner and Halberstadt focus on the development of entrepreneurial mindsets and how they can be supported by challenge-based learning as a further permutation of experiential learning. The chapter discusses the relevance, antecedents, and elements of an entrepreneurial mindset while exploring which didactic methods can be used to promote them in higher education. An introduction of the teaching approach is followed by experiences designing and applying challenge-based entrepreneurship education. Meyer et al. introduce the "sandbox approach" that they developed and tested. It combines a structured open innovation process for sustainable idea generation while fostering an innovation community enabled to solve regional challenges. Switching to a more technical perspective, Mwatilifange and Mufeti describe how Moodle can be used in higher education for students with highly varying backgrounds as a learning management system (LMS). They provide insights from a case study at the University of Namibia investigating the suitability of an online environment for teaching computer literacy courses to first-year students.

In the second part, Alcorta de Bronstein and Timm introduce a seminar format that is designed to encourage students to become change agents, named

"Transformational Sustainability Entrepreneurship." They introduce the concept they have been using for four years at two different universities, and elaborate on five fundamental aspects according to which the seminar is designed for students' transformational learning experiences. Bohlayer delivers insights into an action-oriented training program that was successfully implemented in international contexts in Uganda and South Africa, presenting ways to include sustainability aspects as cross-cutting aspects in an existing seminar to empower individuals to identify sustainable business opportunities and manage the increasing complexity of sustainable ventures. Alcorta de Bronstein et al. then share their experiences developing, implementing, and testing their YEEES Camp series format. This is a four-week international stay consisting of various training, input sessions, workshops, and excursions that focus on gaining experiences in thinking and acting entrepreneurially. While these camps are designed as an international offering, the format presented afterward by Unger et al. focuses on trans- and interdisciplinarity. We learn about two seminars conducted at German universities that build upon the work within a joint project focusing on sustainable energy consumption. Greyling, in the last chapter of this part, shows how an entrepreneurial approach can lead to a learning format that teaches coding and robotics without the technical equipment required to do so. Based on a gaming approach, he presents the coding app TANKS, a powerful unplugged tool for introducing coding and computational thinking without the need for computers.

The final chapter addresses research in the field of entrepreneurship education. In their chapter, Mapaling et al. provide a new interdisciplinary understanding of how entrepreneurship education can contribute to students' academic resilience based on a study on engineering students in South Africa. They present their findings, discussing through a youth development lens several implications these might have regarding how entrepreneurship education can be utilized to enhance resilience among students. Euler et al. stress the importance of research on (sustainable) entrepreneurship education by elaborating on the question of what entrepreneurship education's aims are or should be. They show how entrepreneurship education's success can be measured, deliver arguments for creating an entrepreneurship education ecosystem, and carve out future research directions.

This book is one of the many results achieved by the joint work of international researchers and lecturers, mainly from sub-Saharan Africa and Germany, within the YEEES Training Center. YEEES stands for **Y**ields of **E**vocative **E**ntrepreneurial **A**pproaches on **E**nvironment and **S**ociety, and its team aims to foster the development of innovative entrepreneurial approaches, supporting among many things the founding of sustainability start-ups and organizations in a variety of fields. Two centers have been developed that are closely connected: the YEEES Research Center and the YEEES Training Center. The latter is an international network focusing on trans- and interdisciplinary academic learning. Since future change agents should be capable of identifying and exploiting opportunities for creative and innovative solutions, the work here mainly supports the development of skills and mindsets that lead to this kind of entrepreneurial behavior – with a particular focus on the partner countries.

The YEEES Training Center consists of four units: the lecturing hub, postgraduate training, continuing training, and scholarships. Via these units, the center has created an international, trans- and interdisciplinary network of relevant lecturers, researchers, practitioners, and students developing and implementing innovative teaching based on state-of-the-art research in the fields of entrepreneurship, sustainability, and ICT. The YEEES Training Center structures supported the development of the ideas in this book, the call for papers, and the selection and review process. On behalf of the editors, I want to thank the YEEES team for their continual support and motivation. The work of everyone involved was simply fantastic, and is very much appreciated. We are happy to have received so many submissions for the book, and thank the reviewers for contributing their expertise to carefully evaluate the work and make valuable suggestions to further increase the chapters' quality. We thank the authors, our universities, the publisher, and everyone else who contributed and assisted.

Our gratitude especially goes out to the German DAAD and the BMBF for funding the YEEES activities, with this book being one of the visible results. We, however, are convinced that the impact being created by the funding of this kind of work goes so much further. We are grateful for the opportunity to contribute to such broad, strong German-African networks and partnerships in various ways, allowing mind-changing experiences which from the short- and long-term perspectives enable people to achieve sustainable change.

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Contents

Part I
Teaching Approaches and Support

Teaching Transformative Service Learning

Christoph Schank and Jantje Halberstadt

1 Introduction

Service learning describes a phenomenon established in higher educational institutions that bring together academic learning with real-world action. In the absence of a broad consensus definition, service learning is used to describe and "characterize a wide array of experiential education endeavors, from volunteer and community service projects to field studies and internship programs" (Furco, 1996, p. 1). Its distinctive features are rooted in experiential learning (Dewey, 1938) and a strict orientation toward reflecting on the experiences lived through in a learning environment outside the classroom. At the same time, it builds a bridge between universities and society (Benson et al., 2007).

Service learning today takes place in a variety of contexts, with different student audiences and a wide range of objectives. While some approaches focus on clearly defined tasks with a small scope, others try to achieve far-reaching, even systemic changes. The following will particularly focus on programs that are transformative in character.

Programs taking place in an international context and bringing together people from different cultures and walks of life have certain challenges, but considerable opportunities as well. Structured international service learning programs operate in sub-Saharan Africa (Tyran, 2017) and the Caribbean (Curtin et al., 2015), for example. It has been repeatedly demonstrated that, especially in international and intercultural contexts, learning experiences are diverse, and include intercultural competence and sensitivity, gender awareness, diversity learning, cultural techniques, and an awareness of global issues and concerns (Kohlbry & Daugherty, 2015; Chen et al., 2012; Camacho, 2004; Fitch, 2004; Monard-Weissman, 2003).

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Culturally aware international service learning programs not only contribute to this cross-cultural understanding and awareness of global challenges, but can make a tangible contribution to the development of countries in the Global South as well (Crabtree, 2008). This requires that these projects do not provide a "frontier experience" for privileged Western students, but that a respectful process focused on mutual learning is initiated and achieved. To paraphrase Guo (1989, p. 108), service learning must be prevented from allowing people from the Global North to "experience other people's misery for a life-enriching experience."

Complex service learning programs embedded in international contexts that address real-world problems are as demanding as they are rewarding. The exchange of perspectives between the Global North and the Global South is not infrequently associated with deep challenges to existing world views, beliefs, and routines (Naudé, 2015).

The following outlines a competency-based approach to transformative service learning programs (not necessarily) taking place in an international context, with a focus on the lecturer perspective. Particular attention is paid to the competencies necessary for shaping sustainable development.

2 Traditional, Critical, and Transformative Service Learning

According to Chesler (1995), traditional service learning responds to mostly social problems that are selectively dealt with in a delimited setting. However, the structures that cause these problems are usually not critically questioned. This kind of depoliticized service learning is said to have little impact beyond the development of the students, and may even contribute to further deepening of established paternalistic hierarchies (Mitchell, 2008). Enos and Morton (2003) conclude that a large number of service learning programs are wedded to this traditional understanding, and follow a transactional logic: While there are certainly mutually rewarding exchanges between the parties involved, their effects are achieved solely within existing structures, and the tasks to be worked on within them are narrowly defined. A critique or transformation of existing structures and arrangements does not take place. Ironically, this may further diminish the power of the social groups that service learning was intended to empower (Pompa, 2002).

This is why authors suggest critical service learning that, according to Mitchell (2008), encourages students to use their experiences as agents of social change to identify and address injustice. Accordingly, the focus here is on an understanding that extends beyond "service" itself and is intended to lead to a fundamental shift in students' consciousness, norms, and values (see Fig. 1). Similar to Forbes et al. (1999), Mitchell (2008) focuses on social change that students are expected to strive for in social coalitions. Students then become system changers through their political agency and justice-oriented commitments (Mitchell & Coll, 2017). Critical service

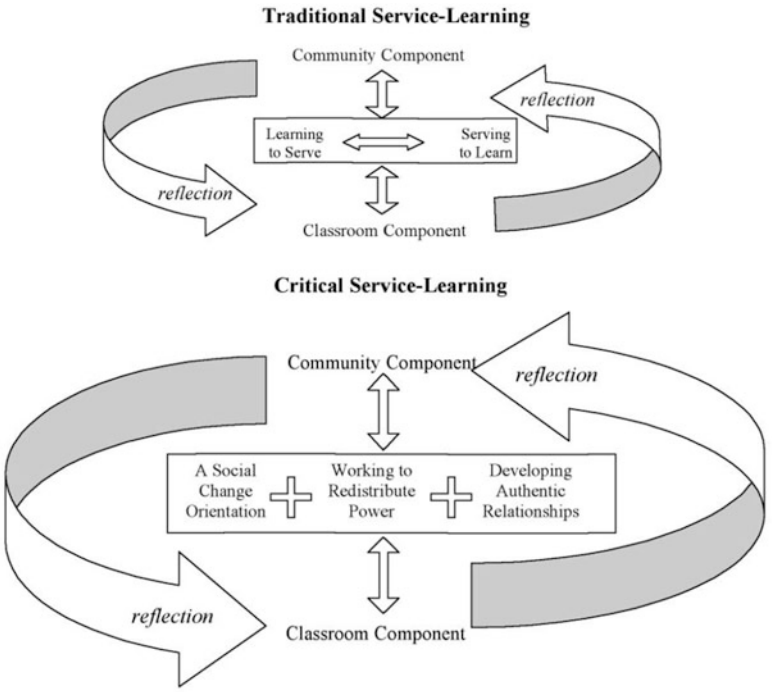

Fig. 1 Differences between traditional and critical service learning (Mitchell, 2008, p. 53)

learning underlines the issues of unequally distributed power and privilege as it aims to contribute to the creation of a socially just society (An & Decker, 2019). As Butin (2003, p. 1684) states, service learning can be viewed as "a site of identity construction, deconstruction, and reconstruction."

According to current work on the topic, an understanding of a critical and transformative service learning are closely related (Cranton, 2006; Kiely, 2005; Mezirow, 2000; Jacoby, 1996). However, there are certain difficulties in distinguishing between critical and transformative service learning, because both understandings draw on a common vocabulary and a similar set of objectives. When talking about transformative learning in education literature, it is often based on the foundational learning theory introduced by Mezirow (1978) stressing that transformative learning happens when students critically question their perspectives and values. Mezirow (2009) defines transformative learning as "learning that transforms problematic frames of reference to make them more inclusive, discriminating, reflective, open, and emotionally able to change" (p. 22). Reflecting upon their own actions and beliefs, students may take other, more suitable perspectives that can lead to a fundamental change in how they see themselves and the world (Dal Magro et al., 2020; Sterling, 2011). Thus, transformative learning is described as acting at the deepest level by influencing ways of thinking, knowing, and acting. By having a focus on challenging dominant beliefs, social habits, and normative

practices, authors often point at transformative learning as addressing a person's competence to be critical and reflective (Bosangit & Demangeot, 2016; Lange, 2004). In this way, transformative learning and service learning could be equally used because critical service learning as well as transformative learning address students' reflectiveness and attitude and therefore contribute to the transformation of learners.

This understanding extends beyond gradual changes in existing environments, ultimately challenging the fundamental principles of existing systems. If service learning wants to be seen as not simply working within existing systems and reproducing them, it requires the ability of all partners to think critically and without reservation—not just the students. This is a key prerequisite for service learning that does not seek to work within and reproduce existing systems, but instead leads to competence development being achieved for transformative change (Kahne & Westheimer, 1996).

However, since service learning addresses students' competence development while at the same time generating societal impacts, service learning also has the potential of transformation in both directions. While some authors state that transformative learning—at least in the long run due to peoples' changing views—also creates possibilities for both individual and societal transformation (e.g., Zembylas & McGlynn, 2012), the additional potential of directly having a positive impact on society and contributing to sustainable systems change can be seen as a specific element of transformative service learning. In addition to offering transformative experiences to students, service learning can also directly contribute to societal transformation processes and the development of competences that students need as they serve as (future) agents of transformation.

We argue that a distinction between critical and transformational service learning remains necessary. As shown, being critical—and teaching critical thinking—is seen as important, with critical service learning being an improved avenue toward service-oriented teaching. It should be stressed that, without questioning existing structures and systems, problems cannot be identified to help create a picture of a better future, develop solutions to reach this, and translate them into transformative action. The latter is not possible by merely being critical; it also needs sustainable systems to change. Therefore, we see being critical as an important prerequisite for transformation, with transformation additionally needing action-oriented components. While some authors do in fact include a social change orientation in their concept of critical service learning (Mitchell, 2008; Mitchell & Coll, 2017), underlining this important connection, we call for transformative service learning to be understood as an even more integrative approach that includes critical aspects.

When training strives to teach future system changers or, in other words, sustainable transformers, it should include both critical and action-oriented competences. By adopting a competence-oriented view in the following section, we will shed light on how transformative service learning addresses a set of skills and the knowledge needed for educating future change agents.

3 Competence-Oriented Education Through Service Learning

There is broad consensus on the salient suitability of service learning in competency-based teaching (Molderez & Fonseca, 2018; Cantor, 1997; Chen et al., 2012; Giles Jr. & Eyler, 1994; Biberhofer & Rammel, 2017). In the following, we understand along with Rieckmann (2011, p. 129) competencies to be "characterized as individual dispositions to self-organization which include cognitive, affective, volitional (with deliberate intention) and motivational elements; they are an interplay of knowledge, capacities and skills, motives and affective dispositions."

Extensive efforts have recently been made to identify competencies for sustainable development, and merge them with entrepreneurial competencies (Biberhofer et al., 2018; Lans et al., 2014; Hesselbarth & Schaltegger, 2014; Osagie et al., 2016; Wesselink et al., 2015). The starting point for these considerations is often Wiek et al.'s (2011) five key competencies of sustainability, shown in Fig. 2.

We draw on the further development of this thinking by Lans et al. (2014) and Ploum et al. (2018), who were able to validate six relevant core competencies in the context of sustainable entrepreneurship:

- *Strategic management and action competencies*. These are understood as merged competencies to actively and responsibly participate in the sustainable development of socio-ecological systems (De Haan, 2006; Mogensen & Schnack, 2010), as well as the necessary ability to design strategies and actions for corresponding development steps (De Haan, 2006). In this context, strategic management and action competencies are the most relevant. Tschopp (2004) points out that certain elements typically applied in service learning, such as drawing up a business plan, can contribute significantly to building strategic competencies.
- *Embracing diversity and interdisciplinary competence* refers to the ability to build relationships with stakeholders, design joint projects, and assess the legitimacy of concerns in social, environmental, and economic contexts (Ellis &

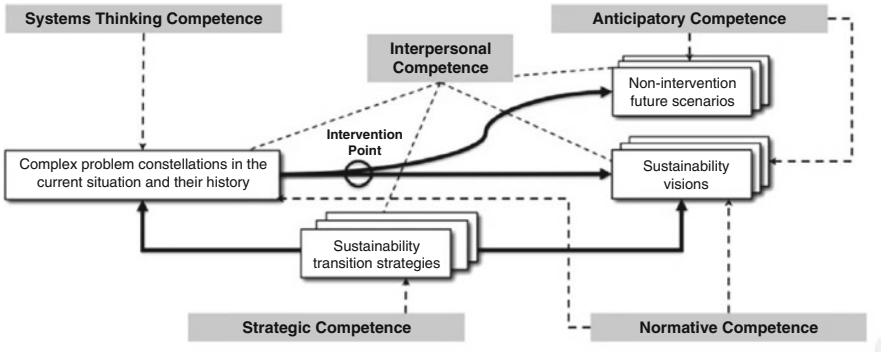

Fig. 2 Key competencies of sustainability according to Wiek et al. (2011)

Weekes, 2008). This ability to collaborate through service learning has been emphasized several times (Toncar et al., 2006).

- *Systems thinking competence* corresponds to the ability to holistically understand problem situations, opportunities, and conditioning factors across the boundaries of social subsystems and disciplines. Remington-Doucette et al. (2013) and Clevenger and Ozbek (2013) note a strong connection between real-world learning experiences and the development of this competence.
- *Normative competence* refers to the ability to analyze and discursively engage with stakeholder value judgments, principles, and objectives (Blok et al., 2015). Although Wiek et al. (2011) also state that normative competence is at the core of any sustainable development and thus plays a central role within it, this competence, in particular, is often rarely examined in the context of service learning.
- *Foresighted thinking competence* allows the analysis, evaluation, and genesis of future ideas about the long-term and possibly supra-local effects of decisions made about ecological, social, and economic areas and contexts. Wesselink et al. (2015) come to the (at first glance surprising) conclusion that this particular competence is rarely found in concrete practice, even in the context of sustainability. One possible explanation for this can be found in the fact that this competence is required particularly in the early stages of projects. This raises the profile of the lecturer in service learning events, who must not only promote this competence with the students but also demonstrate it him/herself in early phases such as event conception.
- *Interpersonal competence* stands for the ability and motivation to work cooperatively and in participation with different social groups (Schlange, 2009). Here, a number of analyses highlight the particular contribution of experiential learning methods that address real-world problems (Clevenger & Ozbek, 2013; Remington-Doucette et al., 2013; Barth et al., 2007).

As noted by Meza Rios et al. (2018), these competencies are not stand-alone constructs that can be clearly delineated, but instead are highly intertwined. Settings that call for and develop multiple competencies in a holistic and problem-oriented manner are gaining importance as a result. This too underscores the importance of real-world learning settings such as those provided by service learning programs. Although the competencies raised here were developed in the context of sustainability-oriented entrepreneurship, they are generic and open enough to provide orientation and action competence within a wide range of socio-economic fields of action.

When applying this competence-oriented view to the different forms of service learning, we notice that, according to the definitions and descriptions of service learning, different sets of competencies are addressed. As shown in Fig. 3, the concept of service learning as such can be especially suitable for developing personal competences of students. Due to regular and intensive contact with peers, as well as with external partners, students encounter interaction opportunities and challenges with various personalities in new contexts. The more teachers design a specific course that includes diverse stakeholders from, e.g., politics, society, and/or

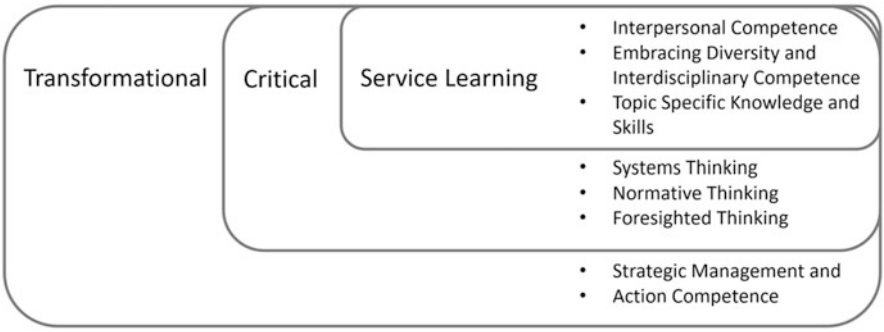

Fig. 3 Key competencies assigned to forms of service learning

business, the better service learning can train competences embracing diversity and interdisciplinarity. This competence will also be fostered by courses being offered to students from different disciplines. In addition, all service learning approaches are assigned to a specific bundle of skills and knowledge depending on the topic-related setting and the course of study (e.g., service learning in computing science may be designed differently than in medical studies).

Integrating a critical perspective shows the potential to broaden the competence development. When adding a critical orientation, service learning can additionally foster the acquisition of systems and normative thinking; after all, a critical and reflective mind should have a holistic understanding of how systems actually function and what they should do. Forward thinking may also be mainly addressed in critically oriented service learning contexts because generating, analyzing, and evaluating future ideas is hardly possible without being able to critically reflect on how these ideas may influence future settings—and thus will lead (or not lead) to the desired outcomes.

Finally, being able to contribute to transformation also needs action orientation. When designing transformational service learning courses, lecturers should create situations that motivate and accompany students as they develop their own innovative solutions and bring them into action. This opens up the chance of additionally addressing action and strategic management competences. Doing this would help ensure that transformational service learning always remains entrepreneurial.

Based on these ideas, transformative service learning shows the greatest potential for addressing all sorts of competences that are important for future change agents. Or put differently: Only if service learning formats are designed to address a combination of key competences can they reach their full potential of being transformative. We, therefore, suggest adding transformative service learning to the differentiation provided by Mitchell (2008), as shown in Fig. 4.

Research on this topic is still at an early level. The question remains if and how various forms of service learning actually lead to which competences are necessary for sustainable transformation. There is also little work on learning processes and the diverse personalities (of students, teachers, and partners) required to have an impact

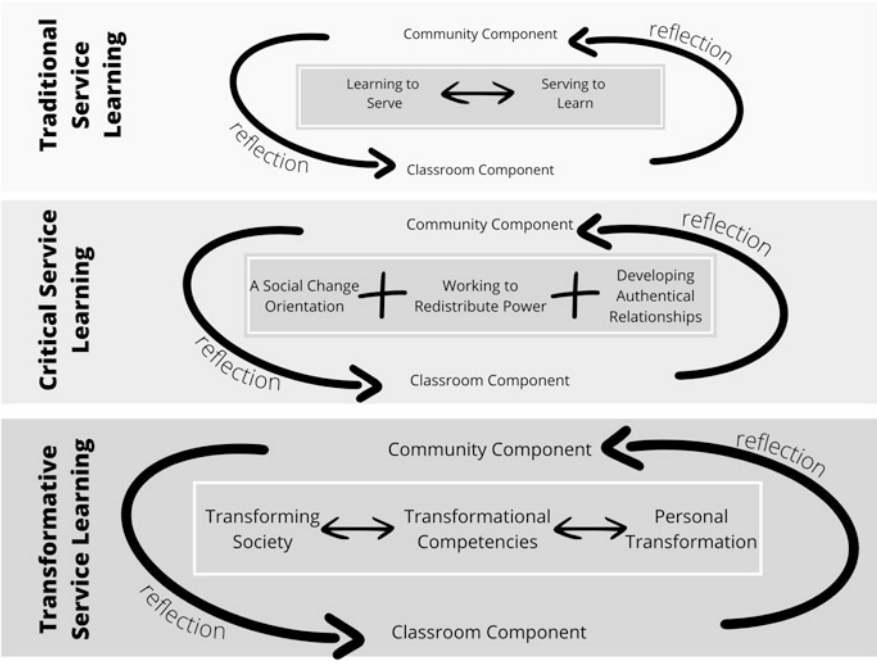

Fig. 4 From traditional to transformative service learning

on service learning approaches. While embracing diversity and interdisciplinarity is shown to be an important competence for future transformers, it often remains under-recognized when designing and researching service learning. Work is also needed on the factors pushing or impeding the successful implementation of transformational service learning. Empirical studies in particular are missing here. This is why we strive to motivate researchers to address service learning as a tool for educating future system changers.

This also requires openness by teachers and universities toward innovative teaching and learning methods. We encourage teachers to adopt service learning approaches to their fields as they hopefully contribute to designing innovative ways of transformational teaching. In the following, we introduce a method for supporting lecturers in structuring, systematizing, and professionalizing their service learning courses. We begin the following section by stressing the importance of adopting a lecturer's perspective.

4 The Lecturer's Perspective on Service Learning

As a result of the establishment of service learning in schools and universities over several decades, service learning, in general, has advanced to become a format that has been intensively researched empirically and conceptually. A number of international meta-studies identify service learning as fundamentally and extensively studied (Eyler et al., 2001; Salam et al., 2019; Yorio & Ye, 2012; Celio et al., 2011; Conway et al., 2009; CUREE, 2005; Muscott, 2000). Nevertheless, transformational service learning only now is receiving its due attention in research. In addition, the abundant supply of case studies and empirical evidence offers comparatively little added value to the question regarding concrete didactic tools for university teaching and the role of the lecturer in the complex teaching process. The focus so far has predominantly been on the learning effects of the students as well as on general success factors. Furthermore, only a comparatively small fraction of the studies address higher education and the special framework conditions of universities at all, while the main focus is still on students at general education schools.

Rarely discussed are the benefits to lecturers, although Salam et al. (2019) do in fact point to a number of findings here. Carrington et al. (2015) note that teachers in service learning programs can themselves build important skills such as critical thinking, critique and develop their learning methods, and come to a better understanding of how scientific theories interact with real-life problems. The real-world reconnection of theories and a resulting deeper understanding of social contexts have also been emphasized in a number of other studies (Lasen et al., 2015; Kohlbry & Daugherty, 2013).

As Fig. 5 illustrates, the predominant focus on the learner shifts the focus to the process of experiential learning, represented here by Kolb (1984), and the extensively researched effects on students. In this regard, while much of the work is insightful and eminent for the study of competency development, research often leaves out, marginalizes, or mostly reduces the practical design of courses by instructors to single case studies or purely anecdotal evidence (Hébert & Hauf, 2015). This is due to a wider academic and abstract discussion that describes competencies as significant and learnable, albeit not teachable (Dlouhá & Burandt, 2015; Weinert, 2001). As a result, lecturers gain a profound understanding of what competencies are needed to develop solutions to real-world problems, but learn too little about how to address them in an experiential setting.

By adopting a lecturer perspective, we focus on the challenges of planning, implementing, reflecting on, and evaluating events, and in doing so, identify an initial set of tools that can be used to establish learner- and lecturer-centered service learning at universities.

The lecturer's perspective is depicted in Fig. 5 with the five stages or phases of service learning, which illustrate the role of the lecturer in the interplay with the learners and the partners over various points in time (Berger Kaye, 2010). The *Inventory and Investigation* phase serves as an introductory stocktaking of the social needs and existing motives, interests, and resources of all participants, ideally in

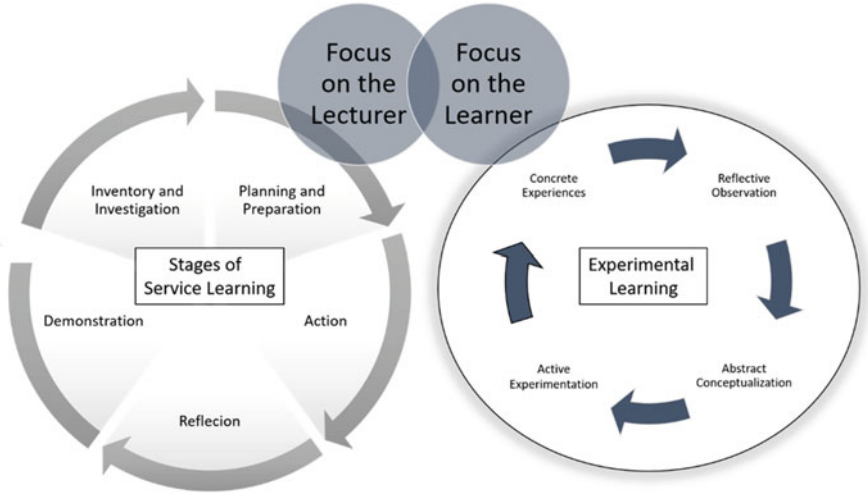

Fig. 5 Perspectives on service learning. Source: Own research: Halberstadt et al. (2019) with reference to Kolb (1984) and Berger Kaye (2010)

close coordination with the cooperation partners. Careful preparation can ensure that relevant issues and concerns are addressed, and that the right partner organizations can be acquired. Continuing from this, in the *Planning and Preparation* phase, the project idea is further concretized and transferred to the institutional framework of academic course work. In this process, internal and interorganizational areas of responsibility are defined, and project roles are assigned. It is necessary to create an atmosphere of trust between all participants right from the start during the first two phases to ensure the local anchoring of the project orientation, and to enable the exchange of academic and non-academic knowledge at eye level. Only on this basis can the actual implementation take place in the *Action* phase, which is then characterized by a meaningful linking of the "university" and "non-academic living environment" learning locations. Based on a self-determined learning approach, concrete actions by the students and their consequences can be discussed and reflected upon in a protected space. Accordingly, the *Reflection* phase cannot be reduced to a single fixed point in time, but is carried out in parallel. The lecturer systematically supports the students with feedback channels. Just as dynamic is the *Demonstration* phase, in which the learners make their progress internally and externally explicit and discussable. This includes keeping a learning diary as well as internal presentations or joint exhibitions with partners. The *Reflection* and *Demonstration* phases are thus more dynamic than the first three, and are best understood as a cross-sectional task for the lecturer.

Based on this dynamic-processual understanding, which particularly emphasizes the role of the lecturer while neglecting the interaction with the learners, the first instrument for its design can be recommended in the following.

5 How to Start and How to Measure—Introducing a Service Learning IOOI

By developing the service learning IOOI (**I**mpact—**O**utcome—**O**utput—**I**nput), we aim to provide a tool for lecturers that unfolds its greatest effect in the inventory and investigation phase, while also providing valuable services for planning and preparation. It can be used both autonomously by lecturers and in conscious collaboration with students.

This instrument is composed of two models which methodically build upon each other: The starting point is the logic model developed by the W. K. Kellog Foundation (1998) and intends to help organizations manage and evaluate their charitable projects: "The program logic model is defined as a picture of how your organization does its work - the theory and the assumptions underlying the program. A program logic model links outcome (both short- and long-term) with program activities/ processes and the theoretical assumptions / principles of the program" (p. 3). This model was taken up and further developed into the IOOI model by the German Bertelsmann Foundation, which aims to professionalize the management of corporate citizenship (Bertelsmann Stiftung, 2010). On the one hand, both developments have in common how nonprofit activities, which are easily aligned with the community service of service learning, should be subjected to systematic planning and performance monitoring. This makes our model especially suitable for service learning. On the other hand, neither model takes the approach of the person-centered, competency-based learning essential for our purposes. This is why we adapted our model to a service learning context.

As a result, we provide a service learning IOOI that aims at structuring, systematizing, and professionalizing courses by elaborating target and expectation horizons and operationalizing them into (envisioned) work processes. It simultaneously serves as a compass and map within a dynamic process. In order to ensure the systematic integration of both the students' competence development and effects on society, we included the two perspectives of academic learning and social impact as the core characteristic of service learning (Fig. 6).

A careful consideration of the intended impact, i.e., the medium- and long-term effects of someone's own efforts, counteracts the lack of orientation of many formats. With regard to academic learning, the intended competence gains should be clearly named and communicated in a motivating manner. The key competencies discussed above are a possible starting point that lends themselves to a variety of (not exclusively) social or economic issues. The goals of societal activities should be treated no less sensitively, since blind charity or even activity solely for its own sake is not genuinely capable of motivation and, of course, does not bring about systematic change. Through the core topics of organizational governance, human rights, labor practices, the environment, fair operating and business practices, consumer concerns, and community involvement and development, complex organizational problems can be systematized and structured in a manner allowing them to be addressed in groups.

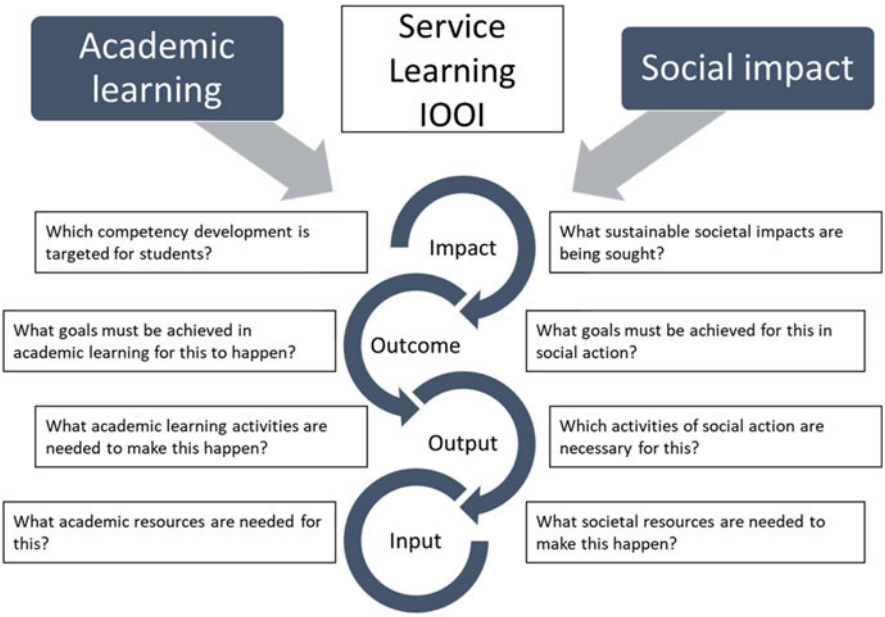

Fig. 6 Service learning IOOI

The three steps of outcome, output, and input follow the impact outline using milestones of decreasing complexity. From the academic perspective, the outcome focuses on the formally successful completion of the course or a certain event, which can be measured using indicators such as completion rate, quality of final theses, and course evaluations. The output comprises the seminar activities leading to this result, and measures both qualitative and quantitative recordings or planning of coaching and mentoring units, as well as theoretical lessons or practical contacts. Academic requirements and framework conditions are defined via the inputs. These include, e.g., the planned workload, possible excursions, personnel support via co-teaching, and the forms of examination. Applied to the societal impact, the outcome is understood to be material in nature such as catalogs of measures, or concepts with concrete recommendations for action, indicators and evaluation tools, films, donations raised, information brochures, or survey results in the target group. Output on the other hand comprises the work steps that were necessary for this (research, presentations, workshops, etc.). The input encompasses the competencies and skills already available among students, lecturers, and practice partners, while also identifying resources that still need to be developed, such as contacts, financial resources, or expertise.

The service learning IOOI does not necessarily have to follow the schematic described above. It can alternatively start at the various points, e.g., an input-oriented start with the circumstances, enabling further thinking from a resource perspective. This would provide the lecturer with an understanding of whether the learning

outcomes and benefits for society envisioned are realistic, and what steps are presumably required to achieve them. The lecturer here would be free to autonomously use this tool for preparation or involve the students and practice partners in the strategic considerations in a planned way.

6 Conclusion

Due to increasing societal challenges, we need system-changing solutions, and people who are willing and able to develop and implement corresponding ideas. This is why educating these (future) agents of transformation is one of the key aims of higher education. With service learning representing a particularly promising approach toward this, it is receiving growing attention in both educational practice and research.

While traditional forms of service learning are often criticized for not addressing their complete transformative potential, authors underline the necessity of critical service learning because it systematically includes critical reflection that raises awareness about societal imbalances, questioning learners' personal views and values as well as existing structures. We also emphasize service learning's potential to be transformative in three ways: contributing to the transformation of learners' norms and values; contributing to societal transformation directly; and contributing to the development of a specific set of competences that are crucial for generating and implementing transformational solutions.

Designing and implementing successful service learning formats places the focus of our work on the teachers. We have stressed that this is a field requiring more attention, with the lecturer perspective being less researched than the student perspective, even though lecturers are key for the successful use of service learning methods. In response, we have introduced a service learning IOOI tool, helping teachers plan, structure, and monitor the different phases of developing and implementing service learning formats.

With our chapter, we want to emphasize the vast potential of transformational service learning, and deliver a tool inspiring and assisting (potential) service learning "providers." We furthermore want to encourage teachers to use service learning as the promising approach it is, adopt existing service learning formats, and create innovative ways of transformative service learning. Lecturers as well as researchers are welcome to follow up on our work, try out and evaluate our service learning IOOI tool, and further contribute to research on transformative service learning in higher education.

In doing so, we consider various fields of research as explicitly important and promising. First, we call for combining research on service learning with a stronger transformational competence orientation. As we have shown, different ways of (service) learning approaches may address different competences that are crucial for enabling transformation (Halberstadt et al., 2019; Molderez & Fonseca, 2018; Rieckmann, 2018). More empirical work is definitely needed in this area. Second,

we currently observe an educational paradigm shift toward distance and technology-supported learning (environments) (Marcus et al., 2019). Only a few studies have to date addressed the potential of digitalization and innovations in information and communication technology (ICT) for service learning, and only recently have authors completed studies on e-service learning approaches (Figuccio, 2020; Harris, 2017; Marcus et al., 2021). With the COVID-19 crisis requiring innovative solutions, including e-service learning (Adkins-Jablonsky et al., 2021; Schmidt, 2021), we expect digital and hybrid formats to gain increasing attention in future research.

We want to highlight transformational learning opportunities in international contexts, e.g., by critically experiencing cultural differences and imbalances (Dorsett et al., 2017; Johnson & Howell, 2017). Service learning in international settings (and research on it) can contribute to a better understanding of global interconnections in combination with the positive effects on students' personal intercultural competences, while at the same time having the potential to build international relationships (Daniel & Mishra, 2017; Liou, 2022). Improving technologies and increasing expertise in using e- and hybrid formats allows for increased opportunities in service learning design, and should in turn lead to innovative forms of international service learning. We additionally call for a longer-term implementation of service learning formats instead of "one and done" models (Musial, 2020). By embedding service learning into various modules throughout a curriculum (as single units or full seminars), students may be influenced by a practical orientation while simultaneously considering the consequences of societal change. Teachers developing curricula in higher education may also want to consider generating long-term seminars taking place over several semesters, and which can also be offered within extracurricular formats accompanying regular studies.

Universities themselves should also act more entrepreneurially, transforming themselves into modern organizations reacting to the urgent needs of our time. Higher education should motivate teachers that are training future agents of transformation to apply the immense potential of service learning to help develop important transformational competences, creating space and opportunity for innovative teaching and learning arrangements.

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Challenge-based Learning: How to Support the Development of an Entrepreneurial Mindset

Heike Marita Hölzner and Jantje Halberstadt

1 Introduction

Let us wage a positive glance into the future: the 2020s could go down in human history as a decade of social, cultural, and economic progress. True, the corona pandemic plunged society and the economy into a deep crises. But it also helped new technologies to break through, such as mRNA molecular biology. From this perspective, the start of the 2020s has been an impressive demonstration of what is possible through science and technology.

Yet we are only at the beginning. Artificial intelligence, robotics, distributed ledgers, quantum computing, and green hydrogen are all examples of new key technologies that will experience their breakthroughs in the coming years. This provides the necessary tools to overcome the vast challenges of our time, including the climate and biodiversity crises, or the resource strains caused by geopolitical conflicts and a growing world population. The ability to seize the opportunities that present themselves will be essential.

This is where entrepreneurs come into play. As central figures of economic development and social change, entrepreneurs innovate by combining the resources at their disposal in a novel way (Schumpeter, 1934). They are said to be able to recognize opportunities in change processes, implementing them with the necessary perseverance. In fact, start-ups have not only weathered the current crisis better than the average company, but have also been able to turn it to their advantage. The European and international start-up scene has been flourishing since mid-2020,

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providing important impulses as well as solutions to overcome or cushion the pandemic. This can be attributed in part to the special attitudes, thought patterns, inner attitudes or, in short, the mindset that distinguishes entrepreneurs.

Our chapter introduces an innovative method for teaching entrepreneurship. While underlining the importance of building an entrepreneurial mindset, we show how challenge-based learning as a special form of experiential learning can contribute to generating entrepreneurial competences and attitudes. The chapter combines education theory and psychology with our own experiences to show how challenge-based learning can be used to improve entrepreneurship education formats.

2 Entrepreneurial Mindset

Entrepreneurship research has long focused on studying the personality of entrepreneurs. Particularly with reference to the model of the "big five," (Zhao & Seibert 2006) a possible connection between a person's relatively stable personality traits and their entrepreneurial inclination or success has been the focus of investigation. But empirical results here have been contradictory and generally unconvincing (Busenitz et. al, 2003; Mitchell, 2007). In their meta-analysis, Zhao et al. (2010) found that the big five personality traits could explain only 13% of the differences in entrepreneurial intention and only 10% of the differences in entrepreneurial performance. These deficiencies resulted in the research problem being addressed from another angle, focusing more on how entrepreneurs think and process information. A large body of knowledge has emerged that deals with the so-called entrepreneurial mindset, its influencing factors, and effects (Naumann, 2017).

Mindsets are conceived as "cognitive operations with distinct features that facilitate a given task" (Torelli & Kaikati, 2009, p. 233). The term expresses the fact that our mind or consciousness is "set" to perceive the world according to pre-defined criteria. It acts as a kind of perceptual filter that determines what information people recognize, how they interpret it, and how they react to it (Humphrey, 1951). In terms of entrepreneurship, McGrath and MacMillan (2000, p. 15) define the entrepreneurial mindset as the "ability to rapidly sense, act, and mobilize, even under highly uncertain conditions." McMullen and Kier (2016) align their definition more closely with the task. They describe the entrepreneurial mindset as an "ability to identify and exploit opportunities without regard to the resources currently under their control" (McMullen & Kier, 2016, p. 664). A mindset is something different than just a set of skills. Rather, it precedes and affects our skills and competencies. Take creativity, for instance. This key competence only leads to innovations if the people who possess it have a positive attitude toward change.

Instead of focusing on the cognitive skills an individual uses to identify entrepreneurial opportunities, we need to shift our focus to metacognition, the process by which entrepreneurs promote and learn about higher-order cognitive strategies (Haynie et al., 2010, Kouakou et al., 2019). Adokiye et al. (2017) state that the entrepreneurial mindset "refers to the behaviors, disposition, attributes and attitudes

that are connected with creativity, [and] innovation with a view to capture opportunities in the business environment for organizational success" (Adokiye et al., 2017, p 30). Similarly, Kouakou et al. (2019) define the entrepreneurial mindset as "the state of mind of an entrepreneur which allows him to analyze the world and the opportunities and possibilities that it offers" (Kouakou et al., 2019, p. 116) and "an innovative practice which leads to discover and evolve opportunities and then set up the right behavior to effectively exploit those opportunities" (Kouakou et al., 2019, p. 117).

To reintegrate the sometimes very different perspectives with which research has approached the study of the entrepreneurial mindset, Kuratko et al. (2020, p. 2) propose three distinct aspects of it:

1. The way entrepreneurs use mental models to think: the *cognitive aspect*.
2. How entrepreneurs engage or act for opportunities: the *behavioral aspect*.
3. What entrepreneurs feel: the *emotional aspect*.

"Central to understanding the entrepreneurial mindset is the recognition that the three aspects described above [...] do not operate independently of one another; rather they interact and reinforce each another" Kuratko et al. (2021, p. 1687). A person's thoughts serve as an enabler and facilitator of individual actions and emotions. Emotions influence how people react, while actions themselves influence how people feel and think.

Although the model by Kuratko et al. (2020) helps to better differentiate the various dimensions of an entrepreneurial mindset, it does not yet clarify how to determine an entrepreneurial mindset. Metastudies such as those by Shaver & Commarmond (2019), Naumann (2017), Kouakou et al. (2019) have established the following list of characteristics displayed by someone with an entrepreneurial mindset:

- Lifelong learning and openness to change.
- Engagement in a complex and uncertain world.
- Creative and innovative approaches to problem solving.
- Fast decision-making based on heuristics and biases, which is very effective and efficient under high complexity and uncertainty.
- Attentiveness and inclination to see sudden insights of value.
- Belief and confidence in one's own capacity and competency.
- A belief in one's ability to influence.
- Ability to reflect on one's own thinking process.
- Desire, motivation, and intention to practice entrepreneurship.
- Taking the initiative and personal responsibility for actions.
- A pursuit of goal attainment through personal mastery and value-creation.
- Recognizing opportunities.
- Access to disparate information across the own social network.
- Grit and perseverance in the face of challenges.
- Taking risks that lead to learning, growth, and value.

Mindsets are never pre-programmed, but instead evolve over time, and are influenced by an individual's interaction with the environment. Social interaction plays a significant role along with individual experience. Our mindsets are therefore constantly changing and can be influenced. Empirical research in the context of education has shown that implementing an entrepreneurial mindset is strongly correlated to entrepreneurial activities (Mathisen & Arnulf, 2014). In fact, the development of mindsets goes from elaborating to implementing and becomes compulsive, i.e., a function of repeated action (Gollwitzer 1990). This is why an entrepreneurial mindset can only be promoted using particularly suitable learning methods.

3 Entrepreneurship Education

Since the end of the 1980s in the USA, and since the 1990s in Europe, researchers have been intensively dealing with various questions concerning the goals and pedagogical and didactic models of entrepreneurship in higher education. The fact that entrepreneurship research initially concentrated primarily on traits, as described above, had a significant impact on early efforts (Kuratko, 2005; Nabi et al., 2017; Hägg & Gabrielsson, 2019).

4 The Development of Entrepreneurship Education

Halbfas and Liszt-Rohlf (2019) identify a total of four phases in the development of entrepreneurship education. The first phase that lasted until roughly 1999 had the primary idea of teaching students the methods qualifying them to run a start-up. The goal or task of entrepreneurship education in this context was to increase the number of start-ups. Later, at the beginning of the millennium, the discussion and practice of entrepreneurship education focused more on the development of competencies of entrepreneurial personalities. The aim was to develop independent thinking and proactively acting personalities who in turn would be able and willing to found innovative companies and lead them to success (Braukmann, 2002). In the subsequent phase three (from around 2004), a new expansion of the understanding of entrepreneurship education was observed. Now the impact of entrepreneurial thinking and its impact on society was also addressed. From the differentiation in phase three, an intensified discussion about the correct educational design and corresponding didactics emerged in the fourth development phase of entrepreneurship education, which continues to this day (Halbfas & Liszt-Rohlf, 2019).

The distinction made by Gibb and Nelson (1996) that describes three intentions of entrepreneurship education is generally accepted: education for, through, and about entrepreneurship. At the "about" level, the main aim is to impart theories and knowledge from entrepreneurship research and create an understanding among

learners of the process of entrepreneurship and its significance for society. Education "for" entrepreneurship provides methods and tools that enable learners to implement ideas and launch a business at a later stage. Finally, education "through" entrepreneurship aims at making learners entrepreneurial by providing them with entrepreneurial experiences.

All three objectives of entrepreneurship education are relevant and important. Selecting the appropriate approach means distinguishing where and how the learners should be educationally connected with. One example here would involve whether the learners already have an idea of their implementation status (Lindner, 2018). Depending on the target group, the learning objective is also different, and ranges from awareness and development (Phase 1) to the concretization of ideas and implementation (Phase 2).

Until recently, teaching methods in higher education mainly focused on education about entrepreneurship by concentrating on imparting knowledge using teaching methods such as lectures and seminars (Neck & Corbett, 2018). Examination regulations and curricula usually never permitted teachers to take their students out of class for longer periods of time to give them a "holistic" start-up experience. However, research has advocated that learning entrepreneurship means students must engage in entrepreneurial activities and processes to gain experiential knowledge (Read et al., 2011). In the following, we discuss concrete experiences from the use of challenge-based learning (CBL) in higher education. CBL can be understood as a specific implementation of experiential learning theory. Other forms include problem-based learning, project-based learning, co-operative learning, service learning, and reflective learning (Furman and Sibthorp, 2013). We single out CBL because we are convinced that this technique has an especially positive effect on the formation of an entrepreneurial mindset; we will present our concrete experiences with this method after discussing the underlying educational theory.

5 Underlying Educational Theory

In experiential learning theory, learning is understood as "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p. 38).

Learners go through four steps, as shown in Fig. 1.

1. *Concrete experience*: A concrete experience with real character, i.e., it has an observable consequence for the learner.
2. *Reflective observation*: The experience is brought back to mind and, for example, the possible cause of the experience is mentally played through.
3. *Abstract conceptualization*: The reflection process leads to abstract conceptualization, i.e., concrete experience influences the learner's knowledge structure. In this step, a generalization occurs in which the concrete experience is abstracted, and underlying principles are recognized.

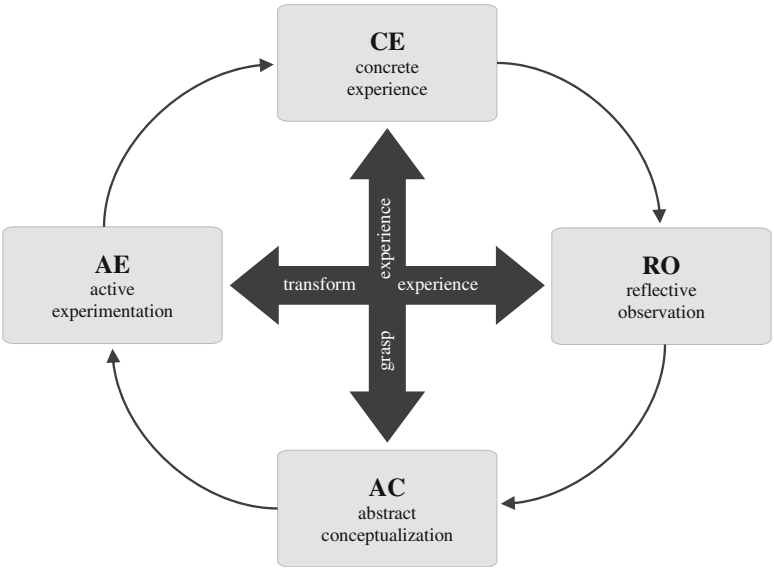

Fig. 1 The experiential learning cycle (Kolb, 2015, p. 51)

4. *Active experimentation*: In the fourth and last step, the learner becomes an actor again: By actively experimenting with newly acquired knowledge, he or she tries out new real-life situations. As a result of this last step in the learning cycle, concrete experiences become possible again for the learner, and a second cycle begins.

In principle, it is possible to start the learning cycle at any of the four points, i.e., also when teaching abstract concepts (e.g., theories), which are tested in practice through active experimentation, and thus become concretely experienced by the learner (Kolb 1984). It is in fact important that all four steps are completed, and that reflects upon what has been experienced occurs. Only through this step do the insights gained from the experience become knowledge that can be transferred to other situations. The optimal entry point can be made dependent on the learning environment, but also on the different learning styles that learners can adopt (Corbett, 2005; Kolb, 2015).

Experiential learning thus breaks with the doctrine of behaviorism, which is based on a more mechanical learning process in which outcomes, routines, and having the "right" response to each stimulus are the dominant learning goals. From the perspective of educational psychology, experimental learning can be assigned to the theories of social learning (Bandura, 1997) or situated learning (Lave & Wenger, 1991). Here, the most important aspect is that individuals experience some kind of mastery of specific practices, and that this mastery matters to others as well (Bandura, 1997).

6 Experiences from Implementing Challenge-Based Learning in Higher Education

The basis of our implementation of CBL is the "challenge-feedback learning circle" (Sternad, 2015). Learning begins as shown in Fig. 2 with a challenge posed to the students by the teachers. In the next step, the students themselves actively act to solve the challenge. The action usually takes place in group work. During and after the active completion of the challenge, the students receive feedback on their performance and behavior. Afterward, they are given the opportunity to reflect on their own actions and particularly the feedback in a structured way. In doing this, the learning experience can be made conscious, which facilitates the memorization of what has been learned and its recall in future challenging situations. The learning circle can be repeated thereafter, ideally with progressively more complex or more difficult challenges (Sternad & Buchner, 2016) (Fig. 2).

Challenge-based learning does not stand in contrast to traditional lectures. It can in fact be used as a learning supplement. Corresponding elements of direct knowledge transfer, for example, can be integrated if a certain basic knowledge or certain contexts are necessary for mastering a challenge.

The authors have been using CBL in courses categorized as "Education about Entrepreneurship" and "Education through Entrepreneurship" for over two years now. The lessons learned to date are described below.

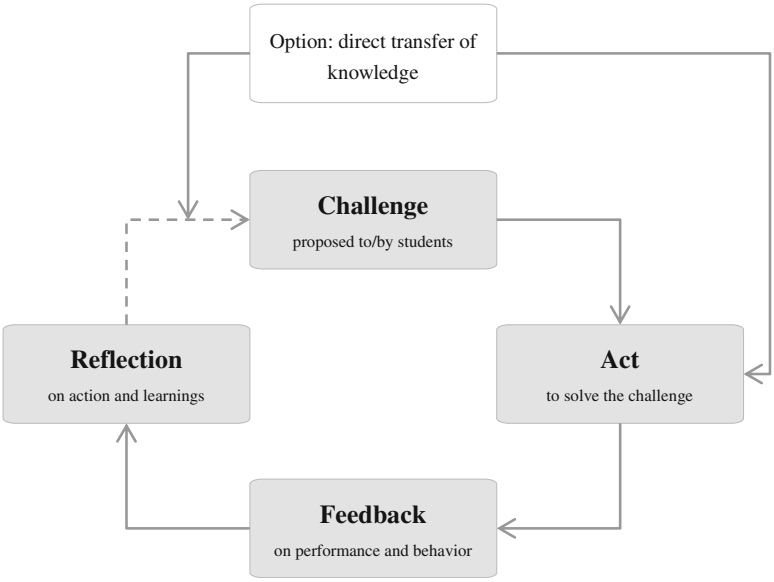

Fig. 2 The challenge-based learning cycle (Sternad & Buchner, 2016, p. 8)

6.1 Formulating Challenges

A challenge should provide a demanding, complex task that students can master in cooperation with others, without a model solution, and with a high degree of freedom while proceeding down the solution path. An important prerequisite is that the challenge is relevant to the students and can be connected to their realities of life. Otherwise, it may be perceived as difficult in terms of the solution, but not as challenging in terms of personal development. Designing this kind of challenge means teachers must place themselves "in the shoes" of their students even more than usual. At the same time, it must also be ensured that the challenge is embedded in the overall context of the curriculum, and adapted to the prior knowledge of the students. Without this, the challenge may not be taken seriously by students and dismissed as a gimmick. A conflict of goals can arise here. The reference to basic knowledge and the formulation of clear learning objectives, which are also recommended for making learning and the learning process visible and comprehensible for students, and thus have a positive effect on learning motivation (Sternad & Buchner, 2016), are partly at odds with demanding maximum freedom for students in their approach.

In our experience, it is important to distinguish between long- and short-term challenges. An example of a long-term challenge is a business venturing course in higher semesters, whose participants have already taken "for" entrepreneurship classes such as in the fields of entrepreneurial marketing and entrepreneurial finance. The aim of the business venturing course would be for the students to develop and implement a start-up idea in a team. In this context, we believe it makes sense to structure the approach by formulating intermediate goals, but not structure the solution path. For example, learning objectives during the course could be: "Identify an attractive market." Here it remains fundamentally open what attractiveness refers to: The size of the market? The severity of problems faced by users in the market? Their willingness to pay? The competitive situation? For the solution, the students can fall back on already-known basics, while they choose the approach themselves. Another learning objective includes: "Develop a minimum viable product and offer it to real customers." Both the technical implementation of the product or service and the simulation of the sales situation are again left completely open. The goal is achieved when the product has been sold to customers and customer feedback has been collected and processed.

In contrast, short-term challenges pursue less extensive learning objectives that can be experienced in a very short period of time, and may have less direct relevance to the start-up. Short-term challenges without a direct connection to an entrepreneurial setting can be related to overcoming certain fears or leaving comfort zones, e.g., assisting in elderly care or hospice work; talking in front of (large) audiences; being involved in a debate session; or visiting intensive livestock farms. Short-term challenges also can include physically and mentally connected challenges such as skydiving or bungee jumping. In these cases, students need to have options, because some of them might not see a challenge as such in them, while others might be

pushed too far and associate facing the challenge (or having to neglect the challenge) as being a negative experience void of the desired learning outcomes.

An example of a short-term challenge in relation to entrepreneurship is an investor interview. Here, the students learn to convince others of their idea by putting themselves in another person's shoes, and arguing from his or her point of view rather than their own. This challenge can be completed in its entirety in a 180-minute session. First, the students are told they are vying for a maximum amount of money that the investor is willing to give to only one of several teams. In order to create real competition for the investment, two prerequisites are necessary: 1) a sufficient sum (i.e. 250 euros for a course in Germany) and 2) a direct benefit of the investment for the students. The students can suggest investments such as plants to beautify the classroom, the purchase of software, free lunch for the team, or the purchase of a game console to be shared by the team members. They merely have to succeed in convincingly presenting the added value to the investor in a real negotiation with the teacher and/or guests (being or playing the role of investors).

6.2 Act

In this phase, the teacher's restraint is the most important factor for success: Here it's necessary for learning success that the students are left alone with their thoughts and doubts for a certain period of time. Only in this way will the students take responsibility for choosing the solution, and have the chance to be proud of something they have achieved on their own. In the beginning, this is difficult for the teachers to do, as they are typically used to intervening immediately in case of mistakes or unfamiliar approaches in order to prevent "wrong" learning. Students are also used to being able to rely on the teacher's advice and will approach him or her at the first sign of a problem. Actively refusing help is here an unfamiliar feeling for the teacher, and can cause resentment among students. Teachers should be prepared to encounter students' reactions (including expressing the need for help and/or frustration) and remain adamant about not intervening in the learning process at this stage.

We, however, do not recommend ignoring students' needs; they should instead be motivated to find their own pathways and solutions. Depending on the challenge, students may discuss with their peers, ask external experts, and use all information available, for assistance on the Internet or in literature. In this way, a real-life scenario is created without providing a pre-defined solution to handling the challenge. Finally, the students have to make decisions and experience consequences. In most scenarios, especially in entrepreneurial challenges, they learn that there is no one right or wrong way, but many different solutions that fit. It also has to be taken into account that the students themselves have varying personalities and strengths, while also being the respective "stakeholders" included in the challenges, e.g., potential investors or customers, whose expectations, demands, and personal favors can vary significantly. So instead of teaching by-the-book "recipes," we make them leave their comfort zones and find out what they need to know on their own. We

create challenging tasks and situations that, although they include some guidelines, still allow for a maximum amount of realistic freedom. Students then learn how to take this diversity of situations and people into account, which typically results in them displaying less fear of failure and a higher degree of (entrepreneurial) self-efficacy.

6.3 Feedback

Without adequate feedback, efficient learning is not possible, and improvement can only be rudimentary, even with highly motivated participants. So in the next step, the teachers return to a more active role, providing and moderating feedback. After phases of independent, creative work by the students, feedback from the teachers becomes necessary. The basic idea of feedback in this context is to allow the teacher to work through, classify, and evaluate the large amount of freedom that the students had in working on the set challenge, which they met through independent reflection and corresponding explanations. It is also a matter of absorbing the uncertainty that can arise at various points in the learning cycle, and transforming it into greater certainty by appreciating what has been achieved (Sternad & Buchner, 2016).

Feedback comes in many different forms, including one-on-one coaching between the teacher and student, a group setting where the teacher gives feedback to the entire team, or peer feedback from student to student. Following the model of Hattie and Timperley (2007), a differentiation should be made between (1) the subject level, where the focus is on content-related feedback on student performance; (2) the process level, where the focus is on how the solution was developed; (3) the self-regulation level, i.e., how students evaluate their own development and performance; and (4) the personal development level of each student. Levels (2) and (4) are particularly important for effective CBL.

But exactly when should this feedback be provided? With challenges such as business venturing, building on a higher level of knowledge and experience, which are often associated with longer phases without the intervention of the teachers, and in which both competences and content-related knowledge play an important role, it is advisable for the feedback to be concentrated on individually decisive points in the project. At the same time, the teams should give each other regular feedback throughout the project work. In our experience, it is essential to learn how to give and receive feedback from the students in advance. In the case of short-term challenges, feedback should be given directly afterward, after the entire challenge has been completed, by both the entire classroom and the teachers. Practicing peer feedback at this point trains providing feedback to those taking on long-term challenges.

The challenging thing about feedback for teachers in CBL is that there is no model solution to the challenge. This is also a problem when it comes to awarding grades. In order to show students as much development potential as possible on the basis of their performance, it is advisable to separate feedback discussions and the

awarding of grades from each other, discussing grades only after feedback has been fully completed, ideally with a time delay.

6.4 Reflection

Reflection gives the students an opportunity to process their personal experience and development. This step positively influences the students' belief in their ability to succeed in specific situations or accomplish a task and is a fundamental element of an entrepreneurial mindset. Since students often tend to focus on their shortcomings, effective reflection should take place shortly after the completion of the challenge, and the teacher should provide the students with key questions that help them reflect on their positive outcomes. Another very important aspect is that it be clear for the students that the reflection is not part of their evaluation, and its purpose is not to provide feedback to the teacher, but instead to allow a focus on themselves.

It is very important that reflection is done, and that it is separate from feedback. In the long-term challenge described above, the students are required to write a written reflection based on guiding questions following the actual project work. Previously, reflection was practiced several times in basic courses as part of short-term challenges. In the beginning, students often would only describe what they had done without reflecting on why they did it, or they omitted something else. Identifying mistakes, which is a prerequisite for learning, is also difficult for many at the beginning due to fear of their own failure. Guiding questions here can be on a more general level, e.g., What went well and what was difficult? What was most challenging? How did you get through this? How did you feel? Additional questions can help reflect on specific situations and/or with regard to certain tools and methods used, for example, What did you do/How did you feel when [certain key aspects/situations]? Did you find any tools/methods/structures for dealing with [certain key aspects/situations]? What did you pick and why? What happened? How was it useful? These guiding questions have to be carefully designed and applied to the specific context.

7 Conclusion

The use of CBL in higher education has numerous advantages, and we believe that more CBL should be used—not only in entrepreneurship education but for education in general. We conclude with the most important reasons for this, following the work of Sternad & Buchner (2016, p. 9):

1. Students learn through CBL to accept, deal with, and solve complex challenges and are thus best prepared for similar situations in practice.

2. Since the focus is on the process of overcoming a challenging and complex task, rather than the challenge itself, CBL can be applied to almost any teaching context. The method can be used in the humanities as well as in design studies or engineering courses.
3. Challenges can be designed as short-term, self-contained learning units. This feature makes it possible to integrate CBL into any existing semester plan without much additional effort.
4. Because students should choose their challenges themselves, or at least the teachers should establish a connection to the learners' immediate reality, the students are more activated and often intrinsically motivated.
5. Social and cooperation skills are always implicitly promoted, since challenges have to be overcome together.
6. Since familiar approaches and thought patterns have to be questioned, and new solutions developed to solve the challenges, it promotes the development of self-reflection and self-development skills, contributing to the formation of a long-term entrepreneurial mindset.

CBL is a approach to teaching which requires time and effort from both teachers and students. The good news is that it is easy to get started with its short-term challenges, and further develop it over time. What is essential from the beginning, however, is a changed understanding of the teacher's role. The teacher has to shift from transmitting knowledge to facilitating the learning process by creating a framework in which students can discover knowledge and acquire problem-solving skills themselves (Robinson et al., 2016). Students on the other hand have to be active. They are no longer on the receiving end of education, but are now responsible for their learning process. In the end, CBL is ultimately a dialogue between the teacher and student. It also helps if the teachers themselves serve as role models by embracing entrepreneurial qualities such as doing things they have not done before, and starting things even when they are not sure how they will turn out. Although this may strike some as being the exact opposite of a teacher, our experience shows that it works. Teachers offering CBL need to stand back and not intervene too quickly, even if something goes wrong. The team needs to be provided space for failure and conflicts, while focusing on the process of the team, not primarily on the task that is given.

Our experiences underline the benefits stated above. The work is worth it: We observed a promising combination of imparting relevant knowledge and entrepreneurial skills with increased entrepreneurial attention, solution orientation, and openness toward innovation as well as an increasing entrepreneurial self-efficacy. We thus strongly recommend using and analyzing challenge-based learning approaches in entrepreneurship education. By conducting research on how challenge-based formats affect students' competence development and their entrepreneurial mindsets, and on factors influencing the implementation of these kinds of formats, future research can have a positive impact on educating future change agents.

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Developing Responsible and Sustainable Innovations in Entrepreneurship Education—Introducing the Sandbox Approach

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1 Introduction

As entrepreneurship scholars and educators ourselves, we use project seminars to teach students about entrepreneurship. Students typically choose what they want to work on during the seminar. They work on apps to save time when grocery shopping or be able to follow a healthy vegan diet, and they work on concepts such as cafés to share skills or strengthen their local community. Many of these concepts already incorporate elements of sustainability, but lack an overall reflection of the possible negative and positive sustainable outcomes. They suffer from a lack of diverse perspectives. With this workshop we have developed a short but creative and interactive format that can inspire other educators and their approaches toward teaching. Within this format, participants develop ideas to foster sustainable innovation in our classrooms through a multitude of perspectives.

One key concept to achieve a multitude of perspectives is open innovation. When Henry Chesbrough introduced the concept of open innovation, it was aimed at

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breaking the barriers of closed innovation processes (Chesbrough, 2003). In recent years, the concept of open innovation received increasing attention from a multitude of theoretical perspectives (Chesbrough & Bogers, 2014; Gassmann et al., 2010; Podmetina et al., 2018; West et al., 2014)—but such perspectives are often missing in actual open innovation processes as open innovation is mostly understood as a firm-centric concept. The engagement of various stakeholders is a key factor to develop responsible and sustainable innovations. To account for the multitude of perspectives in open innovation processes, the concept of innovation communities (Bogers et al., 2017; Fichter, 2009; West & Lakhani, 2008) is a promising direction.

In our "Sandbox Innovation Process" at the Leuphana University of Lüneburg, we developed a concept that brings together the structured approach of innovation processes while building an innovation community. Thus, we bring together a variety of stakeholders who jointly work on regional challenges and aim to develop comprehensive solutions. The term "Sandbox" describes the idea that constraints can be purposefully used to develop high-quality and low-cost solutions (Prahalad, 2006). This approach is particularly suited for regions with a lack of infrastructure or resources. Therefore, the participants of each "Sandbox" form a transdisciplinary innovation community. This community develops ideas which tackle the challenges within a particular region while taking the constraints of this region into account. During a structured process of several weeks, the "Sandbox" becomes a space for experimentation, while equipping the participants with innovation tools and creative methods, such as design thinking, rapid prototyping, and business model development.

2 Learning Objectives

The "Sandbox Innovation Process" is of scholarly and practical relevance. For scholars, it presents an opportunity to extend the open innovation concept and examine the chances and challenges of innovation communities. Additionally, it presents a new approach in which we as scholars can take an active role to engage a multitude of stakeholders in a joint process to best support the development of responsible and sustainable innovation. For this teaching handbook, we introduce a particular short format of the "Sandbox Innovation Process." It incorporates the main ideas of the sandbox innovation process while giving educators a chance to reflect upon how their teaching approaches can foster sustainable innovation. Thus, this workshop concept is not directly addressed to students, but rather to fellow educators aiming to contribute to a sustainability perspective in entrepreneurship education. Therefore, the key message of this workshop is that researchers and educators can play an active role in addressing global challenges while still being locally responsive. With the "Sandbox" we provide a free space in which participants can tackle the global challenges which influence their everyday lives and solve them on a local scale. Through this process, participants will learn the key elements of the "Sandbox Innovation Process" as well as:

- Experience the efficiency of structured open innovation processes and learn how innovation communities function by accounting for a multitude of perspectives.
- Reflect challenges that hinder innovativeness in everyday work and develop first ideas and more comprehensive solutions for these challenges.
- Discuss ideas to combine open innovation processes with innovation communities and reflect on one's own role within these processes/communities.
- Reflect on their own roles as researchers and educators to foster responsible and sustainable innovation.
- Discuss the transfer of this learning experience to other contexts in which sustainable innovations within certain constraints are crucial.

3 Target Groups and Workshop Style

The short workshop format, which we outline in the following figure, was originally developed as a starting format for potential participants of the multi-week/3-month "Sandbox Innovation Process." Due to the increased interest from the scholarly community, we further developed this into a workshop concept for entrepreneurship educators. The concept is highly flexible and can thus be easily adopted to fit a variety of contexts. This short sandbox format typically brings together people to work on common challenges and enables them to develop the first solution as a prototype. Thus, the participants constitute a short-term innovation community that provides a starting point for further active networking. For now, the addressed participants are educators and scholars, but this concept also works well in a classroom of students to get them started with idea development.

The workshop can be held virtually and non-virtually. The interaction between the participants and the joint experience within smaller teams are the building blocks for this creative workshop style. For the virtual version, a video conferencing tool and an online tool for collaboration are essential. In the virtual workshop, interaction will be enabled using breakout sessions and providing the teams with a virtual environment for collaboration, preferably a shared whiteboard (such as Mural, Miro, or Concept board). The main difference in these versions is the prototyping: in a non-virtual setting, rapid prototyping is fostered through a variety of materials such as building blocks, modelling clay, craft materials, and other materials that participants can use to create prototypes. In the virtual version, the prototyping can be done using preselected icons, photos, or pictures (for instance, by providing them on a whiteboard with a selection of visual material, preferably creative commons). In this case, participants are asked to develop a short story using visual aids to explain their concept and therefore develop a visual prototype.

Overall, this workshop concept presents a short format of the "Sandbox" process in which the different stages of the process can be experienced and reflected in two hours. Therefore, the participants will form an innovation community for this time frame, as well as hopefully beyond, and develop comprehensive ideas for their challenges. This is followed by a reflection phase and a concluding plenary, in

which a critical discussion of the learning experience and the possibilities of transfer are actively encouraged. This last part is particularly relevant to ensure the possibility of transfer of the key learnings to each of the participants' own contexts of work and teaching. This format is designed for a range from 10 to 25 participants, working in groups of preferably 4–5 persons. In our experience, this format works best with two moderators (or a moderator and an assistant), especially if more than 15 persons are participating. This ensures that the schedule is kept and the various teams are getting the necessary support. In the following, we present an outline of a typical sandbox short-format workshop including suggested time frames for a two-hour version.

Time	Agenda	Objective
10'	**Welcome and Introduction**—Introduction to the "Sandbox Innovation Process" and insight into our experiences so far, presentation of agenda and learning objectives for this workshop	Getting started
10'	**Matching—**Participants who, preferably, do not know each other form a heterogenous team of 3–6 people; assignment is explained and team members introduce themselves	Fostering a social mix
5'	**Individual Challenges**—Each team member writes down their challenges individually regarding the relevant question, e.g., "What are the challenges in getting my students to tackle global challenges and develop sustainable ideas?"	Individual reflection
7'	**Divide in Breakout Sessions—Exchange**—Each team member presents their challenges with an online whiteboard for collaboration and others can ask questions for a better understanding	Revealing challenges
5'	**Idea Production**—Each team member rapidly collects ideas on post-its for the challenges *of the others* and "pins" these on the virtual whiteboard	Developing first ideas
12'	**Idea Combination and Development**—The teams discuss, which challenges can be combined by using the collected ideas as a basis for the further concept and afterward develop a solution that addresses at least three challenges that were collected within the group	Developing comprehensive solutions
12'	**Rapid Prototyping**—The teams jointly develop prototypes that represent their developed solution, based on a customized template on the whiteboard and using pre-selected photos/material via a shared folder	Joint team experience
14'	**Exchange and Feedback**—Each team pitches their prototype and other teams can (briefly) ask questions and give feedback	Exchange in plenum
9'	**Open Discussion in Plenary**—Answering questions w.r.t. to the process and reflecting on the learning experience	Transfer of learning experience
5'	**Individual Reflection**—Each person reflects on their role as entrepreneurship educators and researchers in fostering responsible and sustainable innovation and writes down their key learnings	Individual transfer

(continued)

Time	Agenda	Objective
15'	**Sharing Reflections**—In new groups of 2–3 people, people get together, share their key learnings and discuss possibilities for transfer of the learnings into their specific contexts	Collegial sharing
15'	**Concluding Plenary**—Discussing together: *What can be our roles as entrepreneurship researchers and educators to foster sustainable innovation? How can we be drivers or initiators for open innovation communities? Should we?*	Critical reflection

4 Learnings and Experiences

This short-format workshop has so far worked in a variety of contexts, either with fellow researchers and educators, but also with students, citizens, or entrepreneurs. In the "Sandbox Innovation Process," this typically presents a starting point for a longer innovation process. From this, we would like to share some learning experiences. Our first pilot was a 14-week process, which meant that participants who came from a similar regional setting, but otherwise differed greatly in age, experiences, and professional backgrounds, worked together over this time. They went through a process of understanding challenges, developing first ideas, and creating solutions toward prototypes, used for getting feedback early on, to business models. We provided them with one workshop each week and therefore an intense format for collaboration. After the 14-week process, the mindset of the participants was more open toward innovation and better able to address global challenges while still being locally responsive. Mainly, this process contributed to developing the participants' own competencies and the understanding of heterogeneous perspectives, which in itself contributes to more responsible innovation.

As the demands regarding time were a challenge for many participants, our second "Sandbox Innovation Process" was restructured into several modules. The key elements in this phase were five workshops, with additional one-on-one sessions, and a series of shorter online sessions on specific topics that were particularly relevant for entrepreneurial endeavors (such as finances, taxes, and funding programs). Additionally, this process was held completely virtually due to COVID19 crisis, which posed several new challenges such as the differences in the familiarity with virtual tools and the struggle to develop a strong team spirit in this setting. Still, the idea development worked well in this virtual setting and the overall modular structure proved to be similarly effective as the 14-week process. As physical and virtual formats were similarly effective, it is also worth considering how each setting influences how sustainable the format itself is, for instance, regarding emissions.

5 Development Toward Responsible Innovation

Originally, the "Sandbox Innovation Process" was created to tackle regional challenges. Thus, local responsibility has always played a key role in this context. However, the idea to combine this more explicitly with the topic of sustainability and responsibility was born at a conference in 2019 about responsible innovation and leadership in rising economies: the "Academy of Management Specialized Conference" in Bled, Slovenia. Therefore, this presents a further evolution of the "Sandbox Approach" and enriched the innovation process. When looking at entrepreneurial projects from a lens of responsible innovation, we can teach participants and, in particular, students not only about entrepreneurship but also about sustainability. Consequently, we aimed to work explicitly with a concept of sustainability. For this, the Sustainable Development Goals (SDGs) presented a good framework to get started (Horne et al., 2020). As educators, we appreciate the great material that is freely available and the easy access for our participants to this concept. While the SDGs are one way to engage with sustainability, we felt that by asking participants how their ideas related to the SDGs (in negative and positive ways) was indeed a good starting point for reflection. In the short format, we typically provided a brief introduction to sustainability and the SDGs and adjusted the challenge question to this context. In the longer sandbox format, we also included specific workshops in which we offered participants the space to reflect on the SDGs and how these relate to their projects.

This reflexivity is again a key driver for responsible innovation (Stilgoe et al., 2013), which strives toward making a positive impact on society. Reflexivity also meant that we actively engaged with the feedback of our participants and constantly tried to improve our own concepts. In general, we learned a lot from our participants as well. One question that came up several times and was intensely discussed: how can we be part of the solution if we are also part of the problem? The participant, in this case an educator, who brought this up felt that she was part of the generation which is responsible for the current mess that is our planet. While many of us could well relate to this feeling, other participants emphasized that this should not stop us. Especially if we are part of the problem, it is our responsibility to become part of the solution. As educators, we can have a great influence by supporting our students in making a difference. Strengthening responsible innovation in entrepreneurship education means increasing our positive impact on society. A short-format "Sandbox" workshop, hopefully, provides a starting point in this direction.

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This workshop concept was tested at the AOM Specialized Conference on Responsible Leadership in Rising Economies in Bled, Slovenia, in 2019 and adjusted for the virtual RENT Conference 2020 hosted by the ECSB. We thank the organizers of both conferences for the opportunity to try out this concept and the participants for engaging with us in further discussion.

Additionally, the pilot version of the Sandbox Innovation Process was scientifically evaluated in a bachelor's thesis by Anja Knaut. The insights from this thesis greatly inspired the further development of our concepts.

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Using Moodle to Teach Computer Literacy to First-Time Computer Users: A UNAM Case Study

Saavi R. Mwatilifange and Tulimevava K. Mufeti

1 Introduction

Technological innovation has transformed higher education teaching in recent decades. Technologies such as television, radio, compact disks, video conferencing, and even e-learning platforms have been in use since as long ago as the early 2000s to improve teaching and learning, even in developing countries (Sife et al., 2007). Although most of these technologies have come and gone, a growing body of literature suggesting that e-learning is here to stay has gained traction in recent years. This is especially true for 2020, with the unprecedented bans on gatherings and stay-at-home orders necessitated by the COVID-19 pandemic. Many educational institutions thus had to transition to online teaching overnight, as management ordered suspension of classes but ongoing teaching and learning. Even before COVID-19, however, e-learning was already becoming more and more prevalent (Bates, 2018) and many educational institutions had already adopted e-learning in one way or another. Despite this, however, many educational institutions in Africa are yet to fully utilize or realize the benefits of e-Learning (Eze et al., 2018).

In a study aimed at identifying the challenges encountered by technology-enhanced projects, Muhammad (2017) stresses compatibility problems as the major impediment to successful implementation in developing countries. He argues that in most cases, developing countries adopt the "latest gadgets" and "leading-edge technologies" as is from developed countries, but the lack of know-how eventually transforms these into "bleeding-edge technologies" that "give more problems than services" (Muhammad, 2017, p. 17). This notion of system transfer misfit between contexts is widely acknowledged in the literature. Heeks (2002, p. 106) also observes that the transfer of information systems from industrialized countries to

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developing countries is problematic, in particular, because the context of the designer is "often distant in physical, cultural, economic and many other ways." Similarly, Avgerou (2001) argues that technological innovation is inseparable from social processes and context, and recommends that contextual analysis be done to judge the potential for fitting the technology to local circumstances.

At the University of Namibia (UNAM), the introduction of e-learning officially began in 2004. According to Mufeti (2005), UNAM initially used the KEWL Learning Management System (LMS), and the initial acceptance of e-learning by both the students and the lecturers was overwhelming. However, the actual understanding and expectations of e-learning, especially on the part of lecturers, seem not to have been clear. Mufeti (2005) also highlights the following challenges experienced by students and lecturers in the early stages: lack of access to computers and the internet outside of the university offices and computer labs, low bandwidth, and few training opportunities for lecturers. More recent research reports that access to devices, connectivity, and resources remain impediments to e-learning at UNAM (Mässing, 2017). There is therefore a need to acknowledge that a lack of resources remains prevalent at UNAM, necessitating measures to ensure that student participation in e-learning is not impeded.

Apart from the lack of essential resources, low digital literacy levels among both lecturers and students are also reported as one of the factors that can hinder e-learning (Muhammad, 2017; Herckis, 2018). To combat this, UNAM has been offering a compulsory Computer Literacy course to all its first year students since the mid-1990s. Over 25,000 students have so far completed this course since its introduction, with an average of 3500 students registering for it per year from all disciplines of study across the University. Quality assessment and delivery methods, coupled with an increased demand for physical, infrastructure, and human resources associated with this course, have increasingly become an area of concern to the institution management. More recently, there has been a push to teach all compulsory courses at UNAM, including Computer Literacy, using e-learning. Prior to this, the Computer Literacy course served as a technical skills equalizer, enabling a diverse population of students, some of whom come from marginalized backgrounds and have never used a computer before, to develop the skills required to participate in e-learning. Moving this course online, therefore, needs careful consideration, to ensure that it does not negatively affect students' participation in other online courses. This research therefore aimed to determine how Moodle could be utilized to teach the Computer Literacy course to first year students at UNAM.

Although UNAM adopted Moodle in 2015, no evaluation has ever been conducted of its suitability in the UNAM context, despite the numerous studies showing that it has issues that prevent users from utilizing it effectively (Senol et al., 2014 ; Hasan, 2018). It is important to systematically identify usability problems at an early stage in the implementation process, so that they can be rectified before the intervention is more widely implemented (Stiller & LeBlanc, 2006; Ternauciuc & Vasiu, 2015). With the planned introduction of online learning for all core courses at

UNAM in 2020, it was important to determine whether Moodle was an appropriate LMS for this context.

1.1 Overview of ICT Access and Literacy in Africa

Many first year students in Africa come to the University without having used a computer before (Tewari et al., 2018; Schlebusch, 2018; Oyedemi & Mogano, 2018). Although many African citizens now have access to mobile phones, the digital divide, whereby some citizens may have "perceived" access but do not own any ICT device to enable "actual" access is still not uncommon in Africa (Oyedemi & Mogano, 2018). In addition, some villages and towns in Africa have poor ICT infrastructure and do not have access to the Internet (Tewari et al., 2018; Schlebusch, 2018; Oyedemi & Mogano, 2018). This is despite the pockets of ICT facilities found in some towns or regions of African countries that are comparable to the infrastructures of developed countries (Oyedemi & Mogano, 2018). The continuum of access to ICT infrastructure is skewed, and some citizens are therefore likely to be more ICT literate than others.

Recent studies have shown that some African secondary school leavers complete their schooling without exposure to ICT facilities and never having used an ICT device (Oyedemi & Mogano, 2018). Namibia is no exception here, as highlighted in its 2011 official Census results, which revealed that only 10.5 percent of people over 3 years of age had access to a computer (NPC, 2011). Additionally, only 5.4% of the population had daily access to the Internet, with figures worsening in the rural regions of the country. A more recent study indicated that the proportion of the population covered by the cellular network increased to 95% in 2019, and that the number of cellular phone contracts with mobile network operators increased to 112.95 per 100 people as of March 2018 (CRAN, 2019). However, this figure is not distributed evenly throughout the country, as it includes individuals that are in school as well as individuals that do not attend school (See Table 1). This spectrum of actual levels of access across the country, especially at school level, makes it difficult to predict the computer literacy levels of first-year students in Namibia. It also does not shed light on the ability of students who may wish to opt for online learning to cope with it (Fig. 1).

Several other countries recognize the importance of ICT literacy at secondary school level and have developed strategies to ensure its inclusion in the curriculum

Table 1 Respondents' ownership of/access to an ICT device

	Gender			
ICT device	Female	Male	Total	%
Personal computer	4	2	6	6.1
Laptop	35	20	55	56.1
Mobile phone/cellular phone	66	25	91	92.9

Type of ICT service	Namibia	Urban	Rural
Radio	68.6	74.0	64.5
TV	36.7	67.1	13.8
Computer	10.5	21.2	2.5
Cell phone	52.6	68.6	40.6
Telephone (fixed)	6.4	12.2	2.0
Newspaper (daily)	8.9	18.2	1.9
Newspaper (weekly)	16.2	26.5	8.5
Internet (daily)	5.4	10.7	1.4
Internet (weekly)	3.4	6.3	1.1

Fig. 1 Percentages of population with access to ICT by type of service in 2011

(Kennedy et al., 2008; Stiller & LeBlanc, 2006). Ezziane (2007), however, found that even with the compulsory provision of IT at secondary level, students leave school with a wide range of computer skills. This therefore necessitates a careful assessment of students' capabilities and the learning environment before online courses are implemented (Stiller & LeBlanc, 2006).

Due to widening gaps in computer and digital literacy skills, many tertiary institutions, including the University of Namibia, include an ICT literacy course in their first year curriculum (Liao & Pope, 2008; Dixon, 2013; Tewari et al., 2018; Schlebusch, 2018; Oyedemi & Mogano, 2018). This course is usually mandatory in an effort to ensure that students acquire basic ICT literacy skills that will help them in their academic life at the University, and in their subsequent life, learning and careers.

The inclusion of mandatory IT courses in most programs of study at most higher education institutions is a recognition of the importance of basic computer literacy skills as a support to students' learning (European Commission, 2005; Bhavnani, 2000; Dednam, 2009; Ezziane, 2007; Foster et al., 2006; Liao & Pope, 2008). In the developing world, especially institutions are advised against assuming that first years already possess some level of computer competency (Šorgo et al., 2017). While it is reasonable to assume that most first year students have some knowledge and experience of using the Internet and web-based social networking, the same cannot be said of their knowledge of fundamental applications such as word processing, spreadsheets, and presentation applications (Kennedy et al., 2008; Stiller & LeBlanc, 2006). It is essential that first year students gain sufficient skills to enable them to work on and submit assignments using word processing applications, enhance presentations using presentation software and produce statistical analysis using spreadsheets (Tewari et al., 2018; Oyedemi & Mogano, 2018). Development of these essential skills would assist their transition into working life (Schlebusch, 2018).

2 Research Methods

The present study used a survey to evaluate the delivery of an online Computer Literacy course on Moodle at UNAM. The population of the study comprised the 1500 first year students registered for the Computer Literacy course at UNAM in the second semester of 2019, and the eight (8) lecturers responsible for teaching the course. All 1500 students were registered both for the face-to-face and for the online version of the course. However, only ninety-eight (98) respondents (39 males and 59 females) completed the questionnaire that formed part of this study. The course consisted of the following 6 units: ICT Concepts, Using Computers and File Management, Word Processing, Spreadsheets, Presentations, and Internet and Emails.

To collect data, we developed a questionnaire in accordance with the Unified Theory of Acceptance and Use of Technology (UTAUT). The UTAUT theory is widely used in the literature to assess individuals' intentions in relation to technology use and their subsequent behavior and acceptance of technology. It has the following four constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. In this study, a Student Perception Questionnaire (SPQ) to assess user intentions, actual usage, and the usability of the Moodle system. In addition, we conducted semi-structured interviews to get an in-depth understanding of actual usage and satisfaction levels in relation to the delivery of online learning. The logs available on the Moodle server were further analyzed to determine the frequency of participation and use of features by respondents.

3 Findings

3.1 Demographic Information

39.8% of respondents were male and 60.2% female. This does not necessarily indicate that more females than males registered for the Computer Literacy course. It simply reveals that out of those who responded to the questionnaire, the response rate included more females than males.

The results also indicated that the majority (66.3%) of the respondents were under the age of 20, and the rest were aged between 21 and 30 years. No respondents were over the age of 30 years.

The questionnaire also required respondents to indicate any previous experience with LMSs, prior to their registration for the Computer Literacy course at UNAM. Most respondents (69.4%) indicated that they did not have any prior experience of using an LMS. Of the 30.6% that had used an LMS before, most were female. This highlighted that overall, most students start using an LMS for the first time at university level.

3.2 Ownership of/Access to an ICT Device

We also wanted to know if respondents had access to, or owned, a personal computer, laptop, mobile/cellular phone. This was important because the online Computer Literacy course required the students to have access to a device, preferably a personal computer or laptop. Table 1 shows the ownership/access results.

Table 1 reveals that 92.9% of the respondents had access to or owned a computing device or some form of a mobile/cellular phone. However, only 56.1% indicated that they owned or had access to a laptop device, while only 6.1% indicated that they had access to or owned a PC. This result is significant, as students enrolled in the Computer Literacy course needed access to a computer to complete their exercises and assignments. The results also show that a Personal Computer was less popular among the respondents. It should be noted, however, that there was some overlap in the numbers, since respondents could choose more than one device in the questionnaire.

Respondents were also required to indicate their key reason for owning an ICT device. Options included browsing the Internet, entertainment, academic purposes, and social media. The results are summarized in Table 2.

As Table 2 shows, the majority of respondents (77.6%) indicated that their primary reason for owning an ICT device or accessing one at home was for academic purposes. Of the remainder of respondents, 32.7% indicated access to social media as the primary reason, 26.5% indicated browsing the Internet, and the remaining 23.5% indicated that they owned or accessed their ICT devices for the purposes of entertainment. The results overall, therefore, reveal that most respondents own devices to enable them to participate in academic activities.

3.3 Computer Literacy Experience

Respondents were asked to indicate whether they had used or worked with Microsoft Office applications, prior to enrolment at the University. The applications in question were: Microsoft Word for word processing, Microsoft Excel for Spreadsheet, Microsoft PowerPoint for presentations, and Internet Explorer and Microsoft Outlook for the Internet and e-mail, respectively. These applications are the primary software packages used for teaching the different topics in the Computer Literacy course at UNAM. Table 3 shows the results from the questionnaire:

Table 2 Primary reason for owning an ICT device or accessing one at home

	Gender			
Purpose	Female	Male	Total	%
Browsing	15	11	26	26.5
Entertainment	15	8	23	23.5
Academic	47	29	76	77.6
Social media	25	7	32	32.7

Table 3 Knowledge of software applications used in the Computer Literacy Course

	Gender			
Application	Female	Male	Total	%
Microsoft Word	58	29	87	88.8
Microsoft Excel	28	10	38	38.8
Microsoft PowerPoint	37	16	53	54.1
Internet Explorer and Microsoft Outlook	13	6	19	19.4

As shown in Table 3, most (88.8%) of the respondents indicated that they had used or worked with word processing before their enrolment at the University level. Many of these (58%) were females. In addition, 54.1% of the respondents had used PowerPoint before. However, only 38.8% of the respondents had used MS Excel and 19.4% had used Internet Explorer and Microsoft Outlook before they enrolled at UNAM.

3.4 Perceptions of the Usefulness of Moodle

The questionnaire included an open-ended question requiring respondents to give their views on the usefulness of the Moodle LMS, specifically for teaching and learning in the first year university-level computer literacy course. Most respondents (69%) rated Moodle as a useful platform for university-level teaching and learning in relation to computer literacy. However, 31% felt that Moodle was not a useful platform for this purpose. The justifications provided in this context are not directly attributable to the Moodle LMS itself. As an example, one of the justifications given was saving time and money, as the respondent did not need to travel to campus on a daily basis to attend lectures. This was attributable to online learning in general, and not specifically to Moodle. Another reason given was the opportunity to access extra learning materials from the Internet, which was perceived as useful, especially when doing assignments. Once again, this cannot be directly attributed to Moodle, but to online learning in general.

Lecturers also indicated that Moodle was useful as it facilitated management of large classes. One lecturer particularly cited the ability to have one-to-one interactions with all the students, unlike in traditional face-to-face classes. This is captured in the extract below:

> *Yes, Moodle is useful because of the huge number of students who will not manage or be able to have one-to-one interactions with lecturers in [a] traditional classroom set-up*

3.4.1 Appropriateness of the User Interface

Respondents were asked to indicate whether Moodle was a user friendly, intuitive, and easy-to-use interface. Figure 2 shows the results.

As shown in Fig. 2, most respondents (61%) agreed that the Moodle interface was intuitive and easy to use. Only 10% of the respondents strongly disagreed.

3.4.2 Collaboration Tools

Respondents were asked to indicate whether they are able to work and learn together using a variety of collaboration tools including forums, wikis, glossaries, and other collaborative activities on Moodle.

Figure 3 shows that 45% of the respondents strongly disagreed that Moodle enabled them to work and learn together in collaborative activities and 20% disagreed. Only 33% agreed that it was easy to participate in collaborative activities on Moodle.

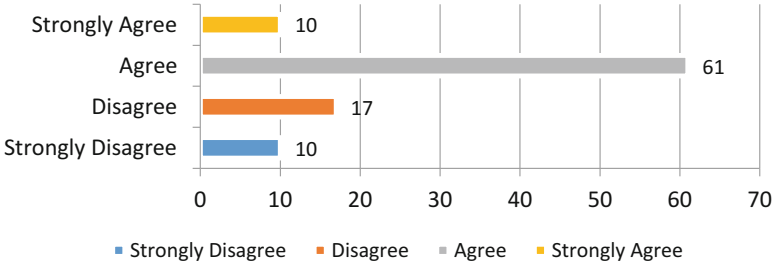

Fig. 2 Modern and easy-to-use interface

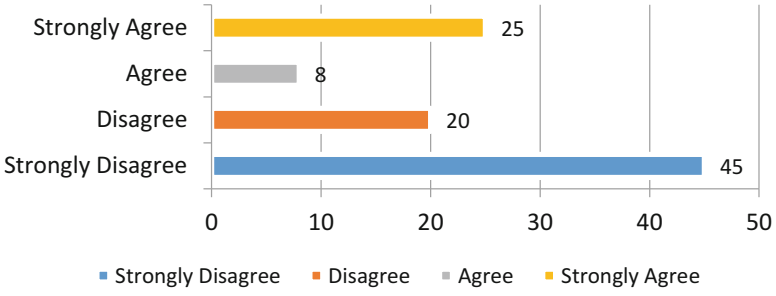

Fig. 3 Ease of participating in collaborative activities

3.4.3 Keeping Track of Course Progression

We also asked respondents to indicate whether Moodle tools helped them to keep track of their academic calendar, including course deadlines, group meetings, and other personal events. Figure 4 summarizes the perceptions of the ability to keep track of progress.

As Fig. 4 shows, 53% of the respondents strongly agreed that the Moodle LMS enabled them to track their progress with academic activities. Only 5% of the respondents strongly disagreed.

3.4.4 Storing and Accessing Files from Cloud Storage Services

The ability to use, store, and access cloud storage services is important for the Computer Literacy course, as students may access the course and work on their assignments from a variety of devices during the course. Storing their work on the cloud enables them to save and resume their work with minimum disruption. We thus requested respondents to indicate their perception of Moodle's capability to drag and drop files from cloud storage services including Microsoft OneDrive, Dropbox, and Google Drive. Figure 5 shows the results.

As Fig. 5 depicts, 58% of the respondents strongly disagreed that Moodle enabled them to drag and drop files from cloud storage services. Only 28% were of the view that Moodle enables them to easily access and store their work on cloud services.

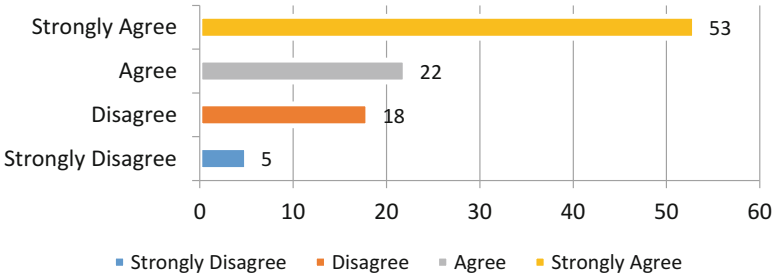

Fig. 4 Perception of tracking academic progress

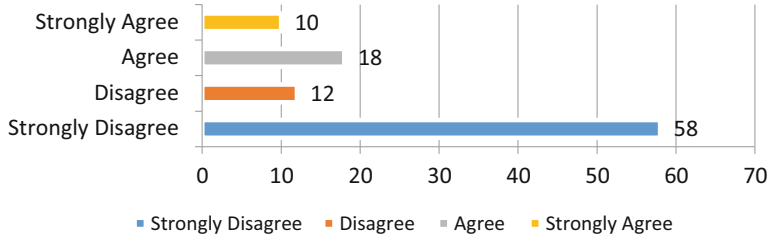

Fig. 5 Utilizing cloud storage services from Moodle

3.4.5 Using Moodle Across Devices

As indicated in Table 1, respondents had a variety of devices that they could potentially use to access Moodle. It was, therefore, important to get respondents' perceptions of their ability to use Moodle across devices. This question also required respondents to indicate whether they were able to format text and add media and images to documents, across all web browsers and devices. The results are shown in Fig. 6.

As Fig. 6 reveals, 70% of respondents strongly disagreed that Moodle enabled them to format text and add media and images across all web browsers and devices. Only 15% agreed with this statement.

3.4.6 Reminders, Alerts, and Ease of Communication

Respondents were also asked to indicate whether Moodle enabled them to receive automatic alerts on new assignments and deadlines, forum posts, and also send private messages to one another. The results are as shown in Fig. 7.

Figure 7 illustrates that 65% (17 + 48) of the respondents agreed that Moodle allowed users to receive automatic alerts on announcements and also to send private messages to one another. However, 13% strongly disagreed.

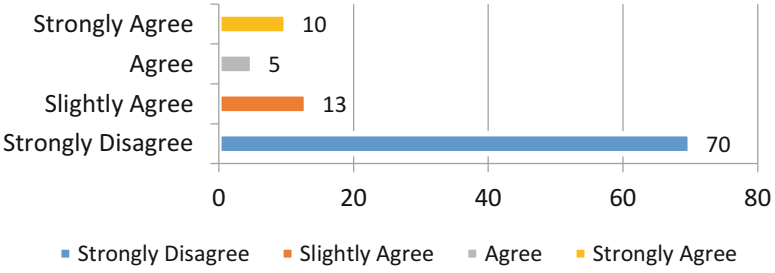

Fig. 6 Using Moodle across devices

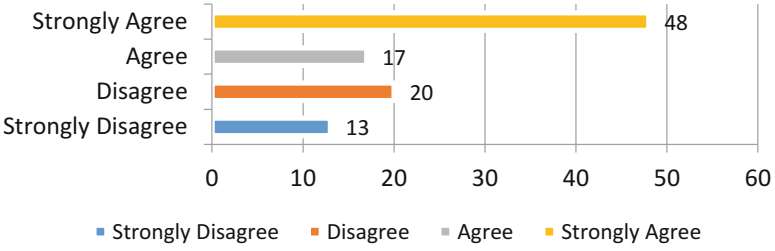

Fig. 7 Perceptions of ease of communication

3.4.7 Progress Tracking

Respondents were asked to indicate if Moodle enabled them to track their progress with the course and their completion of individual activities. The results are depicted in Fig. 8.

Figure 8 shows that 41% of the respondents strongly disagreed that Moodle allowed lecturers and students to track progress and the completion of individual activities.

3.4.8 Satisfaction with Moodle

To determine their satisfaction with Moodle, participants were provided with 12 statements aimed at determining the LMS' contribution to their participation in the course. Table 4 shows the statements and participants' level of agreement/disagreement with the statements.

As the results in Table 4 show, only 12% of the respondents strongly disagreed with the statement that Moodle enabled them to improve their academic performance in the Computer Literacy course. Sixty-eight percent of the respondents agreed with the statement.

With regard to effectiveness, 71% did not believe that Moodle made their learning more effective. Only 28% agreed with this statement. This also seems to be consistent with the statement that Moodle made it easy for participants to learn Computer Literacy. For this statement, 70% did not believe that the LMS made it easy for them to learn on the course, with only 30% taking the opposite view.

Respondents were also asked to indicate whether Moodle was advantageous to their learning or not. In relation to this statement, 67% of respondents agreed that Moodle was advantageous to their learning and 12% strongly disagreed. This is to be expected, however, as some of the perceived advantages of online learning were not necessarily attributable to Moodle, as discussed in Sect. 3.4.

Respondents were also requested to indicate their satisfaction with the ability to navigate course content on Moodle. Results revealed that 97% were of the opinion

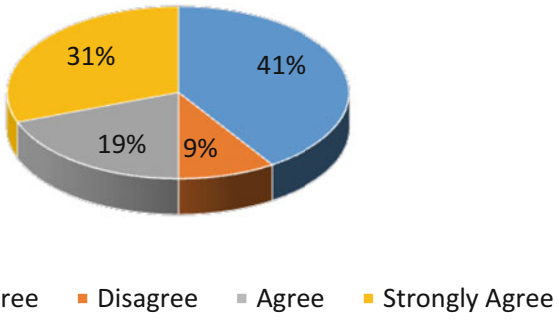

Fig. 8 Lecturers and students can track progress and completion

Table 4 Level of satisfaction with Moodle

Satisfaction item	Strongly disagree	Disagree	Agree	Strongly agree
MOODLE improves my academic performance in the module	12	19	50	18
MOODLE makes my learning more effective	24	47	20	8
MOODLE makes it easier to learn at the University	29	41	15	15
Overall, MOODLE is advantageous for my learning	12	20	21	46
I can access the content on MOODLE any time	53	20	10	16
I can freely navigate the contents of MOODLE	61	36	1	2
I can use MOODLE without needing to be told how it functions	41	20	15	23
I can solve problems that arise on MOODLE	71	5	5	18
Overall I am able to use MOODLE	8	15	51	26
It is easy to download materials on MOODLE	71	10	13	5
Lecturers give constant feedback on MOODLE	61	10	12	16
MOODLE is user friendly	57	30	5	8

that the LMS did not enable them to navigate the course content. Only 1% agreed that they could easily navigate content on Moodle.

One of the statements required respondents to indicate their ability to use Moodle without being told how it functions. Sixty-one percent of respondents strongly disagreed that they were able to use the LMS without any assistance. Only 38% indicated that they could use it without assistance. This implies that an intervention will be necessary to ensure students are able to use Moodle prior to their commencement of online courses, rather than expecting students to figure it out on their own.

Regarding the ability to download materials on Moodle, 81% of respondents strongly disagreed that they find it easy to download materials on Moodle and only 5% strongly agreed. In addition to interactive online content, the Computer Literacy course also has downloadable course manuals that can be saved for access on other devices, or printed out for ease of reference. The low perception of the ability to download study materials from Moodle is therefore an area of concern, as it may hinder students from engaging with the course content when they are offline.

Respondents were also asked to indicate if lecturers gave them constant feedback on Moodle. Seventy-one percent of the respondents strongly disagreed that lecturers provided constant feedback on Moodle, with only 16% of respondents strongly agreeing with this statement. While this may only be a perception, previous studies have shown that perceived lack of constant and timely feedback negatively affects student participation in online courses (Freeze et al., 2010). It is therefore important to ensure that students have access to relevant, up-to-date information in online courses.

The last statement required respondents to give their overall perception of Moodle's user-friendliness. Eighty-seven percent of the respondents disagreed with the statement that Moodle was user friendly, with only 8% strongly agreeing.

3.5 Recommendations on Using Moodle to Teach Computer Literacy

The final question invited respondents to provide recommendations for improving the online offering of the Computer Literacy course at UNAM. Unlike users in Jordan, respondents did not recommend specific features that could be added to Moodle to improve its usability. Rather, they recommended actions to be taken, mostly by lecturers, to ensure better administration of the course. Themes that emerged from the recommendations were as follows:

Extended time for testing or assessment: Respondents believed that the time provided for students to complete online assessments, especially tests, was not sufficient. An extract from one response is given below:

They need to extend test time - 55 minutes is not enough, and sometimes the internet crashes. I also recommend that they provide feedback.

Lower student–lecturer ratio: Respondents suggested that the lecturers had to cater to a large number of students, and suggested assigning fewer students to lecturers to ensure that students got individual attention. One extract reflecting this theme ran as follows:

They should put fewer students in a slot. The system needs to work smoothly so that students can complete their tests without time being wasted by the computer buffering.

Announcement of test dates: One candidate felt that test dates should be indicated in a timely manner to enable students to prepare and make the necessary arrangements. This is especially important for students that do not own a personal computer or a mobile phone, as they will have to ensure they have access to a device to enable them to participate in the test.

For each and every test, dates should be announced two days or three days before the test starts. Clear notes with full explanations should be provided at all times.

Internet access issues: Several respondents indicated that they had difficulty with connectivity and suggested that the university needed to ensure students have access to the internet at all times.

Utilization of more devices such as computers to boost effective learning. More activities and assignments for practical purposes. Faster and free connection to be available to everyone.

Software Access issues: Some respondents reported that they do not own a personal computer, or have access to one at home. Even for those who own or have access to a computer, not all have access to the Microsoft Office package used in the Computer Literacy Course. They, therefore, recommended that the University takes responsibility for ensuring that all students have access to the required software to enable them to participate meaningfully in the course.

Moodle Training in the first week: Some respondents said they had faced challenges when accessing Moodle for the first time. They suggested a training course on how to use Moodle be conducted during the first week of classes, rather than expecting students to discover functionality on their own. This is reflected in the quote below:

Guidance on how to use Moodle in the first week classes start.

3.6 Analysis of Moodle Logs

Moodle provides a log tool that tracks users' activities on the LMS. The tool provides insights into users' day-to-day interaction with the different components of the course, and can be used both as a corrective measure to warn instructors of students who are lagging behind or in need of extra attention, and for postmortem analysis of course participation. An example of an activity log from the UNAM Moodle LMS is shown in Fig. 9.

For the Computer Literacy course, we used the Course Participation Reports tool to get a full analysis of system usage. A summary of the data computed from the built-in Moodle Log Analysis tool is presented in Table 5.

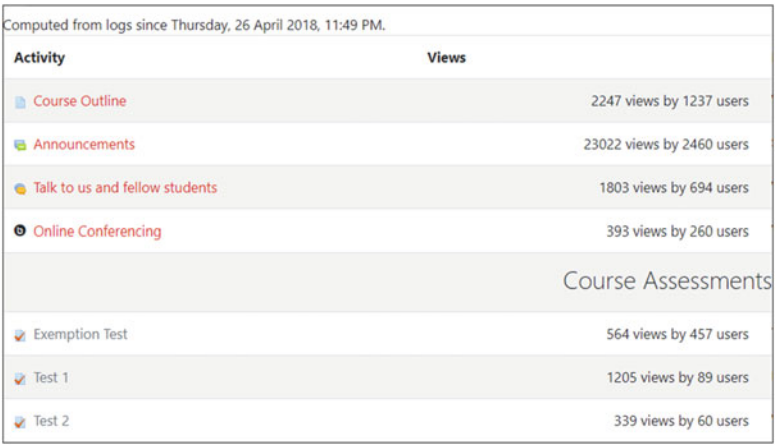

Fig. 9 Sample log for the UNAM Moodle LMS

Table 5 Data from Moodle Logs

Feature	Total activities	Total views	Percentage of users who accessed	Percentage of users not accessed
Announcements	311	2247	24	76
Course Outline	1	23022	76	24
BigBlueButton	1	393	1	99
Chats	54	1803	13	87
Unit 1: ICT Concepts	3	9485	49	51
Unit 2: Using Computers and File Management	2	6621	39	61
Unit 3: Word Processing	2	104	1	97
Unit 4: Spreadsheets	3	5134	33	67
Unit 5: Presentations	2	4096	30	70
Unit 6: Internet and Emails	2	4807	33	67
Test 1	1	1205	2	98
Test 2	1	339	1	97

As Table 5 shows Unit 1 was the most accessed item on the online Computer Literacy course. The Unit had 9485 views in total, and 49% percent of all students registered for the online course viewed the course content. However, 51% of participants did not access this item at all. Table 5 also shows that the videoconferencing feature (called BigBlueButton in the UNAM Moodle LMS), Unit 3, Test 1, and Test 2 were the least accessed features, and were accessed only by 1% of the participants.

It should be noted, however, that students who opted to do the online course were not prevented from participating in face-to-face sessions. Those who did not struggled with the online component may therefore have switched back to the alternative face-to-face sessions offered at the campus during that time.

4 Discussion

The results show that most students had never used Moodle or any other learning management system prior to enrolling at UNAM. This is consistent with the results showing that access to and ownership of ICT facilities, especially at primary and secondary schools in Namibia, is very low. It is also consistent with similar findings by Byungura et al. (2018), indicating that Rwandan students are not familiar with technology or LMSs in their first year of study. Worldwide, it also supports the findings of Yuwanuch and Barbara (2018) that many students in Africa encounter learning management systems for the first time at the university and will thus require training to enable them to use LMSes.

Additionally, our findings that most students do not own a desktop computer or laptop are consistent with the findings of CRAN (2019). Those who own computers

and laptops indicated that they own these devices mostly for academic purposes. This is in contrast to Yuwanuch and Barbara (2018), who reported that first years tend to use ICT devices for entertainment, including socializing on social media platforms. This finding is significant for the UNAM context, as it has other implications for course access and the planning of assessment activities. It is important for lecturers to provide alternative ways of accessing content, such as printable documents, to enable students who do not have full-time access to their own devices to engage with it. In addition, assessment activities may require students to reserve devices, which means that assessment dates need to be communicated to students in a timely manner.

Several respondents also indicated that they had problems using Moodle for this course. In addition to challenges relating to access to devices, they also raised issues relating to connectivity and lack of competence with the LMS. Analysis of the system logs also revealed that students who participated in this course did not consistently access all the course features provided by Moodle, which could be due to lack of skills. Previous studies reported that the lack of access to computers, coupled with lack of skills, can lead to computer anxiety and low self-efficacy among first year students (Schlebusch, 2018). As suggested by Hoffman and Vance (2008), therefore, the design of the Computer Literacy course needs to evolve to adapt to the changing circumstances in which the students find themselves. Mindful of students' limited resources, some institutions have initiated programs to ensure their first year students have access to or own devices (Byungura et al., 2018). This may not be affordable in all contexts, but UNAM could still consider dedicating a computer laboratory to online learning, to ensure that all students have access to online courses. UNAM could also consider creating "informal, practical workshops and demonstrations" (Schlebusch, 2018) for all first year students, to ensure that those students know how the LMS works before they start online courses.

Although students did not specifically indicate any challenges associated with accessing content itself, some participants indicated that they did not have access to the software packages used in the course. This indicates an assumption that UNAM has made about the students participating in this course, namely, that they all have access to the relevant Microsoft Office package. However, students may not necessarily have Office packages installed, and they may find it difficult to accomplish the tasks as performance of individual tasks could differ depending on the devices used. The decision to use the Microsoft Office package for the Computer Literacy course, therefore, needs reconsideration, since not all students may be able to engage in all course activities without this package. UNAM could adopt an open-source software suite for use by all students participating in the course. Since open-source software such as Open Office is freely available for download, this option is also affordable for students. Alternatively, UNAM could also consider adopting an institutional subscription to the Office365 package in order to provide all students with access to the required software regardless of their physical location.

Most respondents felt that it was not easy to use Moodle across devices. This has several implications for the overall perception of the usability and usefulness of

Moodle as observed in this study. Participants' inability to use cloud services hinders them from working on their assignments regardless of device and location, for example. It is therefore important to ensure that students are aware of the various storage mechanisms available in Moodle to minimize disruption to their course and assignment work when working across different devices. Another example is the addition of objects such as images and charts to documents when preparing a word processing or presentation assignment. We found that students were not able to do this on all devices. While adding an object to a document may be an easy task to accomplish on a computer, it may be complicated for first time users using a mobile device. To complete assessment activities in the course, however, students need to be able to add objects to their documents, regardless of the device they are using. The usability of an LMS may therefore not be entirely dependent on the user interface, but also on the capacity of the device used to access the course.

Apart from the findings that were directly attributable to the LMS, respondents also indicated other issues that need to be addressed to ensure a satisfactory student experience with online courses. Firstly, respondents indicated the need for students to be given individual attention. This was implied in the high student-to-lecturer ratios reported by respondents. In addition, the implied delay in responding to student issues and the emphasis on providing timely feedback to students also point to a disconnect felt by course participants. Course lecturers, therefore, need to address the issue of continuous engagement with students to improve students' perceptions of lecturers' social presence (Lowenthal & Dunlap, 2018).

5 Conclusions

This paper aimed to investigate the suitability of the Moodle LMS for teaching the Computer Literacy course to first year students. It used online delivery of the Computer Literacy course to first year students in the first semester of 2019 at the University of Namibia as a case study. Based on the Unified Theory of Acceptance and Use of Technology (UTAUT), a questionnaire was devised and distributed, and completed by 98 respondents. The study identified and analyzed students' computer literacy profiles, including their access to specific technological devices and their reasons for owing them. It also analyzed participants' perceptions of the usability of the Moodle LMS.

The study revealed that most participating first year students at the University of Namibia do not own a computer or laptop, although those who do own one are utilizing it mainly for academic purposes. It confirmed the findings of previous studies that typically, first year students in Africa do not necessarily have the experience of being digital natives that is common in the Western world, and will thus still need the Computer Literacy course at university. Furthermore, the findings revealed that most students had not utilized an LMS prior to coming to the University. Previous studies have shown that there is a difference in the perception of the LMS between students who have previously completed an online course and those

who are taking it for the first time (Dobbs et al., 2009; Hixon et al., 2016). Previous studies have also shown that it is user satisfaction, rather than system use, that is the strongest predictor of success in an online course (Freeze et al., 2010). It is therefore important to ensure that users are satisfied with the delivery of online courses.

Our findings suggest that it is possible to offer an online Computer Literacy course to first time students using Moodle. However, situational analysis in order to match the delivery with the local context is essential. In the UNAM context, limited ownership and access to devices and essential software requires the University to provide access to resources or make adjustments in order to deliver the online course successfully. The heterogeneity of skills levels and exposure to online learning requires that some form of LMS training be given to first year students before they start learning online. Although previous studies found the Moodle LMS highly usable, our results seem to suggest that students' perceptions of the suitability of the LMS may not be solely dependent on the user interface and the availability of features, but may also depend on the capacity of the device in question and the delivery context.

This study has several limitations. Firstly, the implementation focused on the Moodle LMS customized for the University of Namibia. Different Moodle LMSs will be differently configured, and may offer other features not available at UNAM. Secondly, the results focus on evaluation of the delivery of a single online course for students who also had the option of switching to face-to-face delivery. If students did not have this option, their participation in the online component might have been different.

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Part II
Formats

Transformational Sustainability Entrepreneurship: Encouraging Students to Become Real Change Agents

A. Alcorta de Bronstein and J. -M. Timm

1 Start with the Why

Scholarly studies show how entrepreneurial education has become more and more relevant in higher education around the globe (Bauman & Lucy, 2021; Ratten & Usmanij, 2021; Albornoz Pardo, 2013). Entrepreneurship is increasingly considered a university's third mission and there is a tendency toward universities becoming entrepreneurial themselves, i.e., entrepreneurial universities (Forliano et al., 2021; Compagnucci & Spigarelli, 2020). Moreover, the goal of educating students on entrepreneurial thinking, including entrepreneurial skills, e.g., critical thinking and creative thinking, instead of focusing on how to write a business plan has become reality in more university classrooms (Peschl et. al., 2021; Neck & Greene, 2011). Still, when taking the grand societal challenges seriously it is necessary to take entrepreneurial education to a new level. To be able to achieve the Sustainable Development Goals (SDGs) (UN, 2015), we need to encourage students to become societal change agents. Students need to understand the current and future grand societal challenges of our time and to think outside the box in order to be able to contribute to solving them (Bohlayer et al., in review). It is essential to provide students with tools and methods that ignite their entrepreneurial thinking. Teaching the knowledge and enhancing the skills about how to start a business cannot any longer be the only goal of entrepreneurial education. Students need to recognize the possibilities that open up with entrepreneurial thinking to transform the world as

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change agents, not only as entrepreneurs but in any other occupation they work in the future.

With this in mind, we developed the concept of the seminar called: Transformational Sustainability Entrepreneurship (TSE).

The seminar's goals are:

- To develop an understanding of a form of entrepreneurship and intrapreneurship that contributes to solving the grand societal challenges.
- To create (business) ideas that align with this kind of understanding.
- To recognize that this form of entrepreneurial thinking is not limited to creating businesses.

The authors of this chapter have conducted the TSE Seminar eight times at two different German universities during the last three years. In this chapter, we introduce the seminar concept itself and our experiences and learnings so far. We want to encourage explicitly you, as the reader, to use this concept, and where necessary, to adapt it to your specific needs.

We start with a brief explanation of the setting where and in which way the seminars have taken place. This is relevant for the reader's adaptation of the seminar. Followed by the seminar's structural setup, which is divided into three main phases: understanding, creative thinking, and pitching, as well as the overarching reflection process. In the next section of this chapter, we present our five fundamental elements for implementation of the TSE seminar. Finally, we present a list of our learnings and takeaways based on the student's reflections and feedback.

2 The Setting

Thus far, we have conducted the TSE Seminar at two different German universities: Hamburg University and Leuphana University Lüneburg. The first two seminars took place at Leuphana University with Master's students from different disciplines and it took place in English. Five times we offered the seminar at Hamburg University, both at Bachelor (in German) and Master levels (in German or English). The seminar is currently being conducted at these two universities.

One observation from our experience so far is that when the seminar is in English, it opens the opportunity for international students to take part. This international perspective and the interdisciplinarity in the seminars with students from different fields of studies are a great added value for the discussions in class and the student's actual learning On the other hand, when the German students participate in their mother tongue, they have the possibility to dig deeper into the discussion. For a comparative table of all seminars, see Table 1.

Table 1 Comparative table of TSE Seminars taken place between Winter Semester 2018/2019 and Winter Semester 2021/2022

University	Leuphana	Leuphana	Hamburg	Hamburg	Hamburg	Hamburg	Hamburg
Level	Master	Master	Bachelor	Master	Master	Master	Master
Semester	W 2018/2019	W 2019/2020	S 2020	S 2020	W 2020/2021	S 2021	W 2021/2022
Study Program	Students from different study programs	Students from different study programs	BA Socioeconomics	MA International Business and Sustainability	MSc in Interdisciplinary Public and Nonprofit Studies	MSc in Interdisciplinary Public and Nonprofit Studies	MSc in Interdisciplinary Public and Nonprofit Studies
Language	English	English	German	English	German	German	German
International Students	Yes	Yes		Yes			Yes
Location	At University	University + external locations	Digital	Digital	Digital	Digital	Hybrid
Guest Entrepreneurs:	HeyHo, TipMe, Soulbottes & Correlaid	HeyHo, PremiumKollektiv, TipMe	HeyHo, Myzelium	HeyHo,, Myzelium	HeyHo, Myzelium	HeyHo, NRNY wardrobe	HeyHo, Myzelium
Guests Pitch Jury:	Prof. Halberstadt, PremiumKollektiv, WirGarten	Impact Hub Hamburg, Tomorrow Bank, Geldfrau, PremiumKollektiv	Impact Hub Hamburg, Tomorrow Bank, Geldfrau, PremiumKollektiv	Impact Hub Hamburg, Geldfrau, PremiumKollektiv	Impact Hub Hamburg, Geldfrau, PremiumKollektiv, Hackerschool	Impact Hub Hamburg, Factory Hammerbrooklyn, Geldfrau, PremiumKollektiv	Impact Hub Hamburg, Geldfrau, PremiumKollektiv
Excursion and Pitch Training	Berlin Excursion + Pitch Training	Berlin Excursion + Pitch Training	Pitch Training integrated into class	Pitch Training integrated into class	Pitch Training integrated into class	Pitch Training integrated into class	Pitch Training integrated into class
Award for Group Work Space at the Impact Hub HH		Yes		Yes	Yes	Yes	Yes
Examination Tools	Learning Diaries	Learning Diaries	Reflection integrated in assignment	Reflection integrated in assignment	Reflection integrated in assignment	Reflection integrated in assignment	Reflection integrated in assignment
Research	Discussion Groups	Discussion Groups		Discussion Groups			

3 TSE Seminar's Structural Setup

As can be seen in Fig. 1 the seminar is structured into three phases and an overarching reflection process:

Understanding: Students are to read scholarly articles about different concepts of entrepreneurship, exchange with peers and understand the phenomenon of a form of entrepreneurship that aims at contributing to solving the grand societal challenges through transformative action.

Creative Thinking: Students start daring to think differently from their usual paths of thinking, explore their passion and creativity, cooperate, consciously learn from each other, and go jointly through trial and error while creating their entrepreneurial ideas.

Pitching: Students learn to professionally and creatively pitch their ideas and finally take part in a pitching event with real-life entrepreneurs as the judge giving them feedback.

Reflection: The students are motivated to embark into a self-reflection process about their learning process during and after the seminar.

3.1 Phase 1: Understanding

The first phase starts with students reading diverging academic articles on understandings of different kinds of entrepreneurship (e.g., social entrepreneurship, sustainable entrepreneurship, and transformational entrepreneurship). This theoretical approach is complemented by students researching enterprises they personally consider to be examples of transformational sustainability entrepreneurship. With their particular knowledge from the article they read in mind, students first discuss these texts with a group of students who read the same articles (between four to six

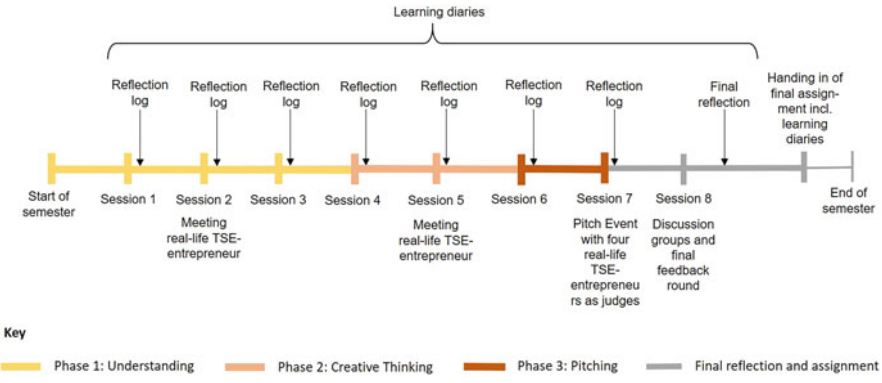

Fig. 1 Seminar structure and examination tools throughout the semester

people). The goal is to agree on the text's key points to convey to the other students of the entire seminar group. Thereupon, students discuss the understanding of entrepreneurship within groups consisting of one "representative" of each article read. Hence, students experience different conceptual views. By discussing in groups they become aware of the phenomenon's complexity and its different research realms, for example, social, sustainable, sustainability, and transformational entrepreneurship.

With this knowledge in mind, they meet a real-life entrepreneur who is considered to help to solve societal challenges with his/her entrepreneurial endeavor. Students get in-depth insights into the practical perspective outside the conceptual world.

The final open discourse about what TSE may encompass is taking place within the entire seminar group. The final goal is to come to a consensus on an understanding of "transformational sustainability entrepreneurship." Within this discourse session, we as seminar instructors facilitate the discussion about the relevance of different aspects that characterize TSE. This consensus is illustrated in a flower shape. The flower's petals show the main characteristics the students decide will be their understanding of TSE. Each characteristic was discussed lengthily to make sure the group had the same concept in mind. Worth noting is that within all seminars, the discourse on these characteristics showed similarities, e.g., in considering different dimensions of sustainability, but also differences, e.g., in their consensus about profit making. Thus, the flowers of the different courses are not looking the same in the integrated characteristics (see Fig. 2). This shows how diverging perspectives of different people that are coming to a consensus form different understandings.

This approach is of high value to students' learning process as they realize that there is no one "right" definition of TSE, rather it is each seminar group that defines its individual understanding of TSE, depending on the background knowledge they bring in and the knowledge they have built throughout this phase.

3.2 Phase 2: Creative Thinking

The creative thinking phase is based on Design Thinking (DT), particularly the stages: (1) understanding the problem and empathizing, (2) ideation, and (3) rapid prototyping. Furthermore, iteration is also a vital aspect of DT which we highlight and apply during class. Through the different stages of the process, we use diverse tools and methods.

Students are asked to think about a societal challenge they have personally been confronted with and would like to solve. At this point, we emphasize the importance of student's personal connection to the problem. In the session, each student briefly introduces the challenge they want to work with and we build small groups of 3–5 students based on the similarities of the proposed challenge or if someone felt inspired to work on a particular topic.

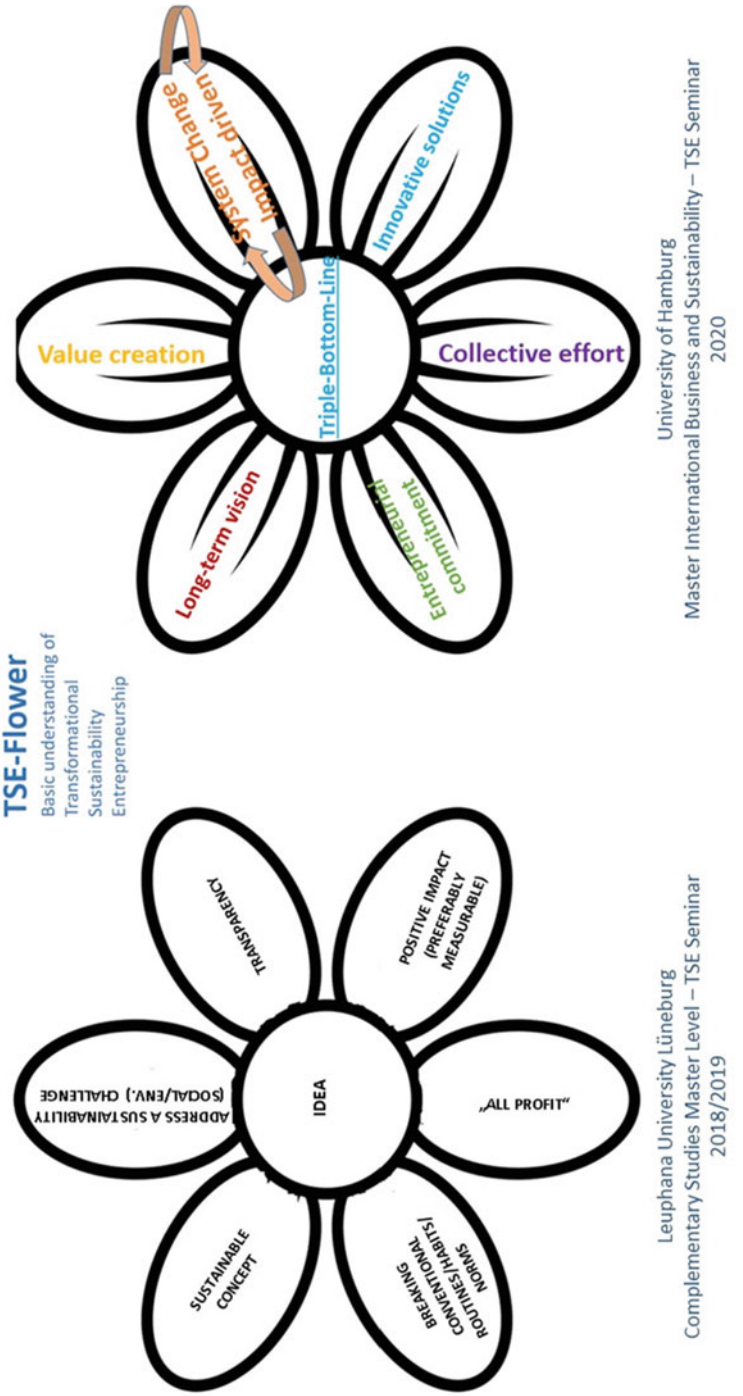

Fig. 2 TSE flower examples from two different seminars

We encourage the teams to do thorough research about the selected challenge they will be working on during the seminar. The goal is to avoid the "Heropreneurship" pitfall (Daniela Papi-Thornton, 2016). This is when the entrepreneur develops an "ideal" solution from their own point of view without actually knowing well about the situation of the people affected by the problem and thus lacking an accurate understanding of the challenge. Papi-Thorton considers that aiming at being a hero and getting social acknowledgment of their peer group, but not being a real system changer is when entrepreneurs fall into the pit. By not considering the surroundings and not having an understanding of what the problem is about, the entrepreneurial solution could end up not helping the people affected by the problem to solve, or even worse, having a negative effect. The participants independently develop entrepreneurial-transformational ideas and elaborate on them creatively. In order to do so, we as the facilitators guide the students through a creative thinking process.

In the first stage of understanding the problem and empathizing, we introduce different tools: the impact gaps canvas, semi-structured interviews with the people who are concerned with the challenge approached by the students and/or experts, the classic DT tool "persona" and a stakeholder analysis. Through this process realistic entrepreneurial ideas come to life.

Since most of the mentioned tools might be well-known, we would like to briefly introduce the impact gaps canvas. It was designed by Daniela Papi-Thornton (n.d.) during her time at the Skoll Centre for Social Entrepreneurship. The impact gaps canvas reminds students that to get to know their topic in depth, part of their research needs to include not only the problem itself and its characteristics but also the solutions already at hand and when possible the failed solutions too. It is about finding the gap between the problem's characteristics and the actions implemented so far to solve it. This gap is where they work to find creative solutions also with the goal of changing the system when necessary. Second, there is the ideation stage, in which we use different creative methods, for example, association (pictures, objects, words), different forms of brainstorming (brainwriting, crazy 8s), and mind mapping, to mention a few. We also integrate our surroundings, for example, with a session at a museum. During this period, many students are surprised when they realize how randomly writing words could develop into real solutions for their challenges.

Third, through rapid prototyping, which is characteristic of DT, the students can determine differences among the team members' perspectives and develop solutions. The prototype is also used to get feedback outside the seminar room. Students prepare 3–5 questions about their prototype and go talk to people in the street or digitally via video call. Some students could feel challenged by going outside the classroom or by calling people to talk about their ideas. However, once they do, they agree on the feedback's high value and how it helps the group move forward.

Thus, with fast prototyping, students quickly become aware of mistakes and easily adapt their ideas. It is not very common to have a seminar in which the educators say, "it is fine to make mistakes and fail with your ideas." However, this understanding is essential in entrepreneurial thinking. Not to wait until perfection, go

out and talk to people, get their feedback, and be open to change and improve. Our guest entrepreneurs also talk about this perspective. To have the possibility of not being afraid to fail is a meaningful learning experience in general, but especially in this creative stage.

3.3 Phase 3: Pitching

In the third phase, the students have pitch training in which they learn about the different types of pitches, storytelling, and some do's and don'ts. The first two seminars included a pitch training as a voluntary extra session embedded in an one-day excursion to Berlin, in which external pitch experts conducted the training with the students. With the relevance of the training and the difficulties to travel in the years 2020 and 2021, the pitch training is now included as a fixed part of the seminar's program. Afterward, the students have the opportunity to present their ideas in a pitch competition with a judge consisting of representatives of the entrepreneurship community. An added motivator to follow-up with their idea(s) is a jury award for a three-month membership at the Impact Hub Hamburg. However, not all of the seminars included this award as seen in Fig. 1. Still, all pitching sessions include the opportunity of meeting and learning from entrepreneurs in an open conversation.

3.4 Reflection and Final Session

The theory of Mezirow's transformative learning describes how individuals transform their perspectives based on critical reflection of taken-for-granted assumptions (Mezirow, 2009). Transformative learning processes initiate the required change in perspectives and behaviors for tackling today's challenges. Cope (2003) suggests that learning outcomes are the result of an "inward" critical self-reflection, in which reflective processes are triggered by specific events, e.g., entrepreneurial failure. Pittaway and Thorpe (2012) refine this point of view and clarify that for effective learning, action must be followed by a high-level reflection. Transformative learning is consequently less about the content of learning, but instead more about how the individual critically reflects throughout the learning process itself.

Based on this knowledge, we provide different opportunities for the students to critically reflect on their learning process during all seminar phases. In all seminars, we recommend to write a reflection log after each session. At the end, the students are asked to do the following task as part of the final assignment:

> Please include into your written assignment a reflection of your personal learning process throughout the seminar and while writing the assignment. Please don't evaluate the seminar (i.e. what you liked or disliked), but rather which contents or discussions were new for you, what you have been thinking about for a longer time or more often, or what you are still

thinking about. What was difficult and/or easy for you to understand and how you felt about it.

The written reflections allow participants to report behaviors and feelings in their own words and encourage in detail reflection of individual learning experiences. The use of written reflections in educational settings is well known for understanding the learning experience from a student's perspective (Friesner & Hart, 2005; Sadler-Smith & Shefy, 2007; Steen-Utheim & Hopfenbeck, 2019) as well as personal developmental processes (Niemi, 1997) and changes in learner's perceptions (Lau, 2017).

The last session is a reflection session during which the students share their learnings and have space and time for constructive criticism. As seminar developers and educators, we consider this session vital for the seminar's further development. We also conducted discussion groups in three of the seminars, in order to further expand on the learning experience of the students, As parts of the learning take place within student interactions, we aim at creating a research setting that additionally allowed us to focus on those group dynamics. The premise behind this was that a confrontation with a contrary point of view to the familiar one triggers a transformative learning process, which—with the opportunity to participate in a sincere discourse—includes iterative reflection of one's own and others' points of view.

4 The Five Fundamental Elements for Implementation of TSE Seminar

In the following section, we present five **fundamental elements** for successfully implementing the Transformational Sustainability Entrepreneurship seminar. A course that aims at real learning impact for students and toward entrepreneurial thinking that can potentially contribute to solving the grand societal challenges of our time and transform our society toward sustainable development.

The entire seminar design had the students' learning process in focus. Thus, it was planned from a learning rather than from a teaching perspective. We designed the seminar to initiate transformative learning within the students, according to Mezirow (2009, 1997). With this intention in mind, we integrated three central interventions that were supposed to trigger disorienting dilemmas to encourage transformative learning. The examination tools are also heading toward the learning of the students. Furthermore, we try out new pedagogical ideas. For instance, in the second seminar, we arranged two sessions outside the university classroom. One session took place in a local museum, another at a climbing gym. From this follows that we see ourselves as educators rather than teachers.

Moreover, we understand the seminar concept development as an iterative process, in which the concept is constantly evolving. Therefore, within each of the seminars we enable a space for constructive feedback from the students with, for example, discussion groups, questionnaires, and individual written reflections.

Based on this information, and after a personal reflection process of the educators' team, we continuously review the concept and, if necessary, adapt it accordingly. In the following, we present the five elements that we have carved out as being fundamental in the last three years to make this seminar being a successful and inspiring learning journey for students. We welcome other educators to use this concept, adapt it to their realities, and grow with it.

4.1 Be Educators

It is necessary to consider the seminar's goal and become clear about the type of course instructor we are or want to be. Our understanding of ourselves in that role is crucial to creating a viable and meaningful learning environment. According to Greenberg et al. (2007), there are too few opportunities for management and entrepreneurship instructors to reflect upon their teaching practice and, in particular, their role as course instructors. Although the article was published more than a decade ago, we still observe the same dilemma. In the literature, we, as management and entrepreneurship scholars and instructors, can find numerous articles describing and discussing different teaching settings. However, the role and the philosophical self-understanding of the instructors are falling short. For that reason, we continuously give ourselves space for reflection and will share these with you at this point in a condensed form:

(A) For us, the term "educator" (instead of, e.g., teacher or lecturer) as used by Mezirow (2009) is key. Thus, we refer to two primary sources in our self-understanding as educators. First, we follow Jack Mezirow's specification of the role of the educators. He argues that their role is to:

1. Assist learners to bring the transformative learning process into awareness.
2. Help them improve their ability and inclination to engage in transformative processes.

   He believes it is not the educator's role to somehow predefine a particular decision or norm for action. Mezirow underlines that "Transformative learning focuses on creating the foundation in insight and understanding essential for learning how to take effective social action in a democracy" (2009: 96).

(B) Second, we refer to the inspiring research paper from the colleagues Greenberg et al. (2007) in which they introduce three teaching professors' archetypes (see Table 2):

1. The Athena: Classic lecturer, hierarchical thinking, transfer knowledge from expert to novice.
2. The Prometheus: Educator/facilitator, whole-person approach, considers ethical and philosophical aspects.

Table 2 Instructors' interpretive frames of their roles (based on Greenberg et al., 2007: 450)

	Athena: The role of wisdom	Prometheus: The role of enlightenment	Asclepius: The role of healing
Underlying educational philosophy	• To be successful in business, students need to learn the models and theories of the disciplines.	• To be successful in business, students need to develop broadly as whole people. They need solid interpersonal competencies combined with an ethical, global mindset.	• Students can not engage in other learning if they are not emotionally centered.
Learning goals	• Cognitive development of the language, concepts, and models of a particular discipline. • Educate students on the theoretical concepts that are outlined in a course syllabus.	• Facilitate students' interpersonal and leadership development as well as ethical reasoning and global citizenship.	• Help students become emotionally centered. • Develop students' awareness of the relationship between emotions and management.
Instructor's functional stance Relationship with students challenges	• A discipline expert. • Hierarchical relationship of expert and novice. • Narrow definition of student learning that may hinder students' development of interpersonal competencies and ethical basis.	• A facilitator, coach, and role model. • Egalitarian relationship of co-learner or guide. • The teaching approach may violate students' instructor expectations, and the course may be inconsistent with their educational goals.	• Monitor emotional health. • Hierarchical relationship of parent and child. • Faculty may not have the training, background to respond to these issues. Students may not be interested in obtaining help.

3. The Asclepius: Emotional coach, hierarchical thinking, like a parent helps students become emotionally centered.

We understand ourselves as facilitators, educators, and at times as role models. We follow an egalitarian relationship with the students and see ourselves as co-learners and guides. Although the Greenberg, Clair, and MacLean emphasize that all three archetypes are inherently interlinked, our self-understanding shows the most cross-over with the Prometheus archetype. Moreover, we expand the understanding of educators not only in the role of the professors but include also in other kinds of teaching staff at universities. Our entrepreneurial education's philosophical background is characterized by the belief that students need to develop as human beings. Their mindsets need to be strong in interpersonal, ethical, global, and interconnection aspects. Thus, we aim at facilitating students in the development of interpersonal, emotional, ethical, and systems thinking competencies (Bohlayer et al., in review; Ploum et al., 2018; Wiek et al., 2011), in order to not only support them in becoming "good" future entrepreneurs but also "good" global citizens.

As societal demand for education is continuously increasing, it is necessary to question how far entrepreneurship education for TSE requires us, as educators, to transform "for what we teach, how we teach, and how we relate to students" (Greenberg et al., 2007: 439). Recent studies in educational settings have started to move beyond a "teacher perception" (Birdman et al., 2020; Brandt et al., 2021; Konrad et al., 2021). As we position our seminar as an innovative entrepreneurial educational endeavor, our role perception is pivotal to implementing our educational setting. This holds particularly true as the consequences of the grand societal challenges exceed the solutions yet found and implemented. We as educators require different or additional perspectives and alternate tools compared to our standard ways of educating, particularly in business studies (Akrivou & Bradbury-Huang, 2015; Ferraro et al., 2015; Tracey & Phillips, 2007). It is now for more than a decade, scholars have been criticizing current management and business education. They argue for a shift in the paradigms of education. The reason is that paradigms that form the educators' worldviews and the applied education methods have an impact on students' subsequent business behavior (Ghoshal, 2005; Giacalone & Thompson, 2006; Lawrence et al., 2012; Marshall et al., 2010; Starik et al., 2010).

Still today, students are often experiencing the Athenian teacher archetype. This type represents the traditional lecturer role. She/he focuses on teaching students models and theories of the specific discipline while aiming at the cognitive development of students' language and concepts. Typical is a rather hierarchical relationship with the students, in which the instructor is the expert and the student the novice in the field. With this kind of understanding, students experience definitions determined by certain books and articles that the instructor assigns to be the "right" ones to refer to. These pre-definitions by the instructor may hinder the students' interpersonal and ethical mindset development (Greenberg et al., 2007).

Hence, we would like to encourage our colleagues to reflect on their role and clearly see ourselves as educators that follow a Prometheus' role view.

4.2 Create a Learning Setting That Is Always Open for Different Perspectives, Discourse, and Individual Value Reflection

There are many different understandings of entrepreneurship that consider more than profit-making and scaling up of entrepreneurial endeavors. Still, students tend to expect the instructor to determine which one will be the understanding in literature the seminar group will be referring to.

In our seminar, we approach the process of understanding the phenomena differently as explained in Sect. 3.1. Unlike in other seminars or lectures, the readings and open discourse among peers and with real-world entrepreneurs do not end by announcing one precise, correct definition. On the contrary, and in line with the transformative learning process, the goal is that students engage in an open

discourse with clashing conceptual understandings within the group. Then they reflect on their view compared to others' perspectives. In a first step, this may result in students feeling "irritated" (student quote, LMA27), "confused" (student quote, HBA54), or "frustrated" (student quote, HMI61). After some time and reflection, they usually realize that they are learning through this kind of open discourse.

> *I was a bit confused as I noticed that there were no precise definitions on the subject. This made me feel a bit unsafe, as there were no demarcations like in other seminars or other topics. After that, however, I found that it changed the way I think. For me personally, it was like discovering a new world. In the same breath, I realized that I had a limited perspective beforehand. (HBA54)*

In line with this notion and building upon our experience as course developers and educators, we propose a learning setting where students are encouraged to think outside the "wrong and right" paradigm. The grand societal challenges are highly complex problems with norms and values of various stakeholders conflicting with each other (Blok et al., 2016). Therefore, we insist that it is essential to continuously question the legitimacy of teaching specific mind habits or points of view regarding, for example, sustainability. Thus, we emphasize the role of (higher) education in supporting individual value reflection without teaching particular points of view, as sustainability- and transformation-oriented they might be. Inner transformations, defined by Wamsler (2020: 112), are "changes related to people's mindsets, which are made up of their values, beliefs, worldviews and associated cognitive/emotional capacities." These are considered essential leverage points for societal change (Ives et al., 2020; Woiwode et al., 2021). However, this kind of transformation can only be accomplished when learners have a safe and open space to get into deeper learning processes (Frank & Stanszus, 2019). Learners need support to dare to think differently from their usual points of view and shape the entrepreneurial world with their ideas. We argue it is (higher) education's task to support learners in developing their values for shaping the world entrepreneurially. This way, they can contribute to solving today's grand societal challenges.

4.3 Facilitate Open, Transparent, Authentic, and Eye-to-Eye Level Conversations with Different Real-Life Entrepreneurs

Real-life entrepreneurs are the best inspiration and encouragement in the students' learning process. We invite entrepreneurs who are already implementing transformational sustainability thinking and entrepreneurial action in their everyday practice to speak in class. The goal is to make students familiar with this kind of entrepreneur, who share their vision of contributing to sustainable development of society by entrepreneurially approaching grand societal challenges.

At three time points different entrepreneurs introduce their entrepreneurial endeavors, mission, vision, and individual entrepreneurial story (see Fig. 2). The

points in time have been chosen purposefully: The first encounter with an entrepreneur takes place after students have read, reflected, and discussed in groups about the entrepreneurship literature and examples. The second is the session in which they learn how to pitch their ideas. The third encounter is during the pitch event itself, during which 3–4 jury members are real-world entrepreneurs who briefly introduce themselves and their biographical journey. Meeting these entrepreneurs at those time points enables the students to compare their conceptual understanding and learning how to pitch in the real world.

Something that is special within this field of teaching is that all of the guest entrepreneurs communicate authentically and at eye level with the students and share sincerely and transparently their experiences as well as their struggles as entrepreneurs. With these unconventional conversations, seminar participants challenge their assumptions about what it means to become and be an entrepreneur. They start to reflect on and form new perspectives about taking entrepreneurial actions. Before meeting with the real-world entrepreneurs, our research shows that most of the students thought of entrepreneurs as exceptional individuals who are very capable of implementing their ideas (Bohlayer et al., in review). When meeting the entrepreneurs personally, students realized that "founding is nothing that only 'super crazy people' can do" (student quote from our study on the seminar, LMA08). They see that they are human beings with similar concerns like them.

Hence, students of the TSE seminar, start questioning their belief that they cannot develop entrepreneurial ideas that are "good enough to start an enterprise" (student quote, LMA21). The study of Bohlayer et al. (in review) shows that the TSE course participants realize that starting something and being creative without making a plan in advance felt like a barrier. However, as they hear from the entrepreneurs that becoming an entrepreneur is not following a clear line, a new perspective opens in front of their eyes. Contrary to a perfectionist planning process, students realize that entrepreneurs can work according to the credo "learning by doing" (student quote, LMB34). Thus, by talking to real-world entrepreneurs, students understand that entrepreneurship is about taking action on a problem, and strategically planning for the perfect idea may even hamper it. Ironically enough, strategic approaches also in connection to entrepreneurial action have been part of their management studies and thus hindered them from daring themselves to think creatively and entrepreneurially:

> *I learned, (. . .) that the founding process is not always straightforward. . . . I must honestly admit at this point that this is not an approach that was brought to us during my management studies. That's why I think it's all the better that you've heard such statements from entrepreneurs who founded their company in exactly this way.* (student quote, LAM11)

The very open and transparent live reports of real-world entrepreneurs help students realize that entrepreneurship is inherently about taking action and that entrepreneurial (strategic) preparations are connected to getting involved in responsible actions.

4.4 Use Creative Thinking Methods

"I am not a creative person" is a common statement among university students when introducing the creative thinking phase. Afterward, they realize that this is not the case.

> Another important outcome from that experience is that I have more faith in myself now, and I believe that I can be creative and artistic as well! (LMB35).

We confirm every time in the seminars that everyone is creative, it is just a matter of the methodological approach to creativity, as explained in Sect. 3.2. Moreover, the students learn that the creative thinking process begins before they start coming up with ideas. Creativity starts when they begin to understand the problem, i.e., the challenge they want to solve in the TSE course. Without this essential step of understanding and researching the challenge, the rest of the creative process will be limited by previous knowledge.

Students who start the seminar with a set idea in mind learn that they should "not be married to their ideas." Because when taking TSE seriously, first, it is about getting deeply familiar with the societal challenge and finding valuable solutions. Second, in this process, it is about developing ideas. After acquiring more profound knowledge about the problem and working with their peers in open discourse, students learn to bring in different perspectives and start with the problem instead of focusing on the solution. In some cases, even a completely new topic area replaces the previous one. Part of getting familiar with the problem is to talk to the people who are concerned with it. By learning more about people's stories, their concerns and emotions about the problem, and in some cases, solutions, students gain expertise in the topic they are working on. Finally, students can fill in the persona, describe one or more concerned persons, and profit from a new solution to the problem.

4.5 Combine Different Examination Tools: Pitch, Learning Diaries, and Reflection

A common aspect in all the times the seminar took place are some of the evaluation elements. Even though the requirements might differ depending on the university, faculty, or study program, we keep two components because of the learning effect for both students and us, as educators.

First, the students' pitches in a real-life scenario, with three to four actual entrepreneurs as the judges, served as one evaluation instrument. The pitch event has a multi-perspective learning effect. The pitch in itself, the preparation, telling a story, and being precise to keep time are tools that are valuable for students for their further career, be it as, for example, entrepreneur or manager. The practical feedback of the jury of entrepreneurs gives them awareness about the real challenges their

ideas might encounter and get them to answer questions in real time. Furthermore, there is the learning from the peers, since all get to see the development of that initial challenge into a possible solution and see an outcome of the creative thinking process. Finally, based on the seminar input, students receive theoretical and methodical feedback from us as the educator(s). We suggest the pitch counts for 40% of the student's course grade.

Second, there is the reflection process. More often than not, students go through university, acquire large amounts of information, pass exams, and write assignments without stopping and considering what their learning from the particular seminar or lecture is and how this can be put into practice. Usually, neither students nor educators take the time for this kind of reflection. Therefore, it is fundamental to schedule reflection time during and at the end of the seminar. With simple questions, such as "What were your AHA moments of the session?," which the students answer in a learning log, up to discussion groups, students experience different kinds of reflection, both orally and written. Using a learning diary is a useful examination tool. It allows the students to reflect on the content, methodology, and the effects during their learning process. For us, as educators, we can learn from the students reflections what and potentially how to improve our learning setting. One possibility—which we apply in some seminars—is integrating the assignment and the learning reflection as the final examination, counting 60% of the individual student grade. In this combination, students had a written assignment about a specific topic of entrepreneurship plus a two pages reflection at the end of the assignment. Please note that with the reflection diary we are not referring to the commonly used evaluations form, which is also relevant, but has a very different purpose and content.

5 Final Recommendations

In all, we can see in the following quotes that this seminar helps students to have a new perspective on entrepreneurship or learning and even on their mindsets. These highly motivate us to follow this path of education and looking forward to exchange with you as our colleague scholars:

> *[T]his lecture has truly enriched my understanding of what entrepreneurship is. Personally, this is a big deal because the lecture has broadened my understanding of what entrepreneurs can do. Before, whenever I thought about entrepreneurship, my cognitive circuit would immediately associate entrepreneurship with financial benefits, big exit deals, and so on. I believe that my past experience of what entrepreneurship is has been skewed and misguided or at least was too narrow-minded for what entrepreneurship accounts for.* (LMB38)

> *I finally experienced how to embrace mistakes, which was so far only a theoretical part of my management studies. Working in such an open-minded and dynamic surrounding, which does not force any result but supports the process itself, was the best condition to learn and practice failure management. This also includes the courage to start an imperfect project and adapt as well as improve it in the following process (working adaptive and iterative).* (LMB48)

> *But somehow, the TSE module chained my mindset not only in questions of entrepreneurship but also in everyday consumption and behavior. I find myself taking care of buying more sustainable commodities and cosmetics as well as actively and critically deliberating my way of living. Especially facing my vocational search after my master's thesis, I started to prioritize social instead of financial profit as a criterion of decision making.* (LMB48)

With this chapter, we share our experience in designing, conducting, and improving the TSE seminar. We would like to encourage you as an educator in this field to implement it. When doing so take into consideration the following recommendations:

1. *Set up a goal-oriented surrounding in entrepreneurship education.* That is to educate students to contribute to tackling the grand societal challenges of our time by thinking and acting entrepreneurially. Our seminar is not about starting another new business, we aim at educating future pioneers that think entrepreneurially in all realms of society.
2. *Apply the seminar's five key elements:* As explained in Sect. 4, the seminar was designed upon five key elements. The reflection on your role as educator is the starting point, which will enable you to move forward with creating a diverse, open, and protected space for learning, as well as facilitate an environment for creativity. Encourage the students to dare step outside accustomed ways of looking at the world. This will enable them to enter into a transformative learning process developing entrepreneurial competencies for tackling the grand challenges. In this process do not underestimate the importance for the students to understanding the real problem and research on this. We highly recommend to include real-world entrepreneurs in the seminar schedule. Finally, the examination tools should also give the students the possibility to reflect upon their learning process.
3. *Include an official open-doors pitch event*. Allow students to professionally pitch their entrepreneurial ideas to an actual diverse jury. With this, students can experience real-world feedback, besides the instructors' feedback.
4. *Co-teaching:* From our experience, it is beneficial to implement and offer the seminar together with at least one co-educator. This opens up the opportunity for you as the educators to reflect upon the seminar's setting and learning of the students, and thus helps you to optimize the seminar in order to enable a fruitful learning experience for the students.
5. *Adapt to your own reality:* We bring forward our recommendations for the implementation of the TSE seminar in order to present you with an attractive starting point. As we are aware that there exist different educational realities, we encourage you to adapt these to your needs. In this process, always keep in mind students' best learning experience within your educational reality.

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Insights into an Action-Oriented Training Program to Promote Sustainable Entrepreneurship

Carina Bohlayer

1 Introduction

The increasing awareness and importance of social justice and environmental impacts has expanded the role of entrepreneurship to integrate social and environmental goals within traditionally financially motivated business activities (Anand et al., 2021; Cohen & Winn, 2007; Dean & McMullen, 2007; Muñoz et al., 2018). While researchers and politicians alike regard entrepreneurship as an effective means to counter unfavorable market conditions and reduce poverty (Van Praag & Versloot, 2007), its potential extends toward creating sustainable outcomes for an even wider range of fields (Bacq et al., 2020; Doh et al., 2019; Markman et al., 2016, 2019). Tackling today's "large, unresolved problems" (Colquitt & George, 2011, p. 432) and contributing to sustainable development requires society to have actors capable of recognizing and implementing unconventional ideas (Eisenhardt et al., 2016; George, 2016). Entrepreneurs possess the ability to find and implement innovative solutions, and are seen as key players in creating these necessary impacts.

Entrepreneurship training has been identified as a leverage point for increasing the number and quality of entrepreneurs; meta-analytic evidence has confirmed its effectiveness (Martin et al., 2013). However, findings have also demonstrated that training programs need to be adapted if sustainability or responsible thinking, in general, are to be integrated into current curricula (Akrivou & Bradbury-Huang, 2015; Tracey & Phillips, 2007). Rather than increasing the total number of business start-ups as their ultimate goal, training courses should aim at raising awareness for sustainability and enabling the generation of environmental and social value (Gast et al., 2017; Neck & Greene, 2011; Shane, 2009). With sustainable entrepreneurship training being seen as key to promoting the recognition and exploitation of

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sustainable opportunities (Kuckertz & Wagner, 2010), it is necessary to transform existing entrepreneurship programs and develop courses that empower individuals to contribute to sustainable development.

2 Framework

2.1 Sustainable Entrepreneurship

Sustainable entrepreneurship has been recognized as a means to address social and environmental problems through the implementation of innovative solutions (Schaltegger et al., 2018; Schaltegger & Wagner, 2011). It stands for a business-driven concept of sustainability, whereby entrepreneurial activity contributes to meeting "the needs of the present without compromising the ability of future generation to meet their own needs" (World Commission on Environment and Development, 1987). Sustainable entrepreneurship specifically relates to the three fundamental components of sustainable development: economic growth, environmental protection, and social equity (the so-called triple bottom line, Elkington, 1997). While economic goals (i.e., financial profit), the focus of traditional entrepreneurship, remain an integral part of the venture, sustainable entrepreneurs simultaneously create social and environmental value. Hence, sustainable entrepreneurs have been identified as "those individuals with entrepreneurial intentions who aim to manage a triple bottom line" (Kuckertz & Wagner, 2010, p. 527). Two core challenges of systematically integrating the triple bottom line are the identification of sustainable business opportunities that "provide development gain for others" (Patzelt & Shepherd, 2011, p. 2) and finding "ways of organizing business processes in a sustainable way" (Lans et al., 2014, p. 37).[1]

Sustainable entrepreneurship training, therefore, needs to explore the recognition of sustainable opportunities, challenges encountered, and the ways in which entrepreneurs implement their ideas to contribute toward a more sustainable future. In this context, it should encourage nascent entrepreneurs to see social and environmental responsibilities as a backbone for developing innovative solutions rather than as a burden (Dean & McMullen, 2007; Hockerts & Wüstenhagen, 2010). Sustainable opportunity recognition is a core step in the entrepreneurial process and has received considerable attention in current research (Choongo et al., 2016; Eller et al., 2020;

[1] I chose the triple bottom line as an overarching concept for defining sustainability because of two advantages in the context of designing an entrepreneurship training program. First, it is directly applicable along the entrepreneurial process as it encourages entrepreneurs to frame both their business opportunity (starting a venture) and their business processes (running a venture) in terms of environmental, social, and economic impacts. Second, because environmental, social, and economic impacts have to be taken into account by every enterprise that considers itself or at least its processes sustainable, it is applicable to a broader range of ventures (that might come up in the training context).

Shepherd et al., 2013). Patzelt and Shepherd's (2011) opportunity-recognition framework indicates that individual-level factors such as knowledge and awareness of sustainability issues are important for recognizing sustainable opportunities, and should therefore be considered in training programs. As sustainable entrepreneurs pursue social and environmental aims as well as financial goals, they face additional challenges and increased complexities within their business activities. Often perceived (at least to some extent) as opposing factors (DiVito & Bohnsack, 2017; Kraus et al., 2017; Pacheco et al., 2010), sustainability and profitability cause trade-offs and complexities with regard to integrating the triple bottom line (Davies & Chambers, 2018; Hoogendoorn et al., 2019; Poldner et al., 2017). For example, decisions on using sustainable resources have implications for production costs as well. Existing curricula, therefore, need to be reworked to factor in these complexities (Lourenço et al., 2013; Tracey & Phillips, 2007) and enable individuals to implement sustainable processes while managing potential trade-offs when operating their businesses.

2.2 Action-Oriented Entrepreneurship Training

The process of entrepreneurship is primarily based on entrepreneurial action, not on passive behaviors or accidental events (Frese et al., 2007, 2016; Shane & Venkataraman, 2000). Thus, research has highlighted action as a key element within the entrepreneurial process (Frese, 2009; McMullen & Shepherd, 2006). A particularly effective way to promote entrepreneurial action is through the implementation of action-oriented training, which is popular in the field of entrepreneurship education (Barr et al., 2009; Frese et al., 2016; Gielnik et al., 2015; Honig, 2004; Martin et al., 2013; Pittaway et al., 2009; Rasmussen & Sørheim, 2006).

Action regulation theory provides a framework for developing such action-oriented entrepreneurship training (Frese & Zapf, 1994; Zacher & Frese, 2018). Training programs should allow participants to follow an action sequence of setting goals, forming action plans, executing and monitoring their implementation (action), and receiving (positive and negative) feedback. Participants learn relevant knowledge and skills for performing actions, and should be encouraged to actively practice these target behaviors during the training course, processing the training's content and turning it from abstract into practical knowledge. Action-oriented approaches have been shown to be particularly effective in enhancing the learning of complex tasks, as well as in complex and dynamic contexts that require adaptive thinking (i.e., the ability to adapt what has been learned to new situations) (Bell et al., 2017; Keith & Frese, 2008; Kozlowski et al., 2001; Smith et al., 1997).

To develop a course that fosters sustainable entrepreneurship, I build on an action-oriented entrepreneurship training program that has been successfully implemented in several countries around the world (Frese et al., 2016). In the next section, I introduce the methodological approach of the existing program and explain

how I developed the training program to integrate sustainability as a crosscutting theme.

3 Course Design

3.1 Key Features of the Student Training for Entrepreneurial Promotion

The Student Training for Entrepreneurial Promotion (STEP) is a 12-week course aiming to train young people, particularly in low- and middle-income countries, entrepreneurial skills, and knowledge that facilitate entrepreneurial action, i.e., starting and running a successful business. It is grounded in action-regulation theory (Frese & Zapf, 1994; Zacher & Frese, 2018) and emphasizes the use of (1) *action principles* and (2) *active learning* for allowing participants to follow the action sequence of action-oriented training (Gielnik et al., 2015).

Using *action principles* means that entrepreneurship is conveyed in an evidence-based, yet practical, way. Evidence-based entrepreneurship training is grounded on a solid theoretical foundation (Frese et al., 2012). Building upon current scientific knowledge on entrepreneurial success factors, STEP covers 12 three-hour long sessions with topics from the disciplines of entrepreneurship, psychology, and business administration. Within these sessions, participants learn fundamental skills through action principles. Action principles are applied theory and can be understood as science-based "rules of thumb" that provide practical guidance for dealing with specific tasks (Drexler et al., 2014). They inform the students about what and how they have to accomplish entrepreneurial tasks in the start-up process, helping to apply the knowledge and skills learned to real-life situations (Frese, 2009; Gielnik et al., 2015). An overview of the sessions and action principles can be found in Gielnik et al. (2015).

Active learning indicates that STEP trainees are not passive training course recipients. On the contrary, students engage in concrete entrepreneurial actions in a real business environment. As part of small groups, they start microbusinesses during the 12 weeks of STEP, and go through the entire entrepreneurial process of preparing, launching, and managing a business. Each group receives starting capital of approximately US$100, which has to be paid back at the end of the training course. The groups identify and evaluate business opportunities, acquire materials and equipment, and deal with suppliers and customers. The goal is that their business generates profit within the 12 weeks of the program. During the training sessions, the groups learn action principles, work on exercises geared toward their businesses, present the progress of their business, and receive positive and negative feedback from both other trainees as well as the trainer. Through this, action principles are linked to concrete behavior, and participants receive real-life feedback on their

entrepreneurial actions, hence developing a refined understanding of how to apply the knowledge gained (Frese & Zapf, 1994).

Certified local lecturers facilitate the weekly sessions, guiding learners through exercises and presentations, giving feedback, and sharing their own experiences. Specifically, local lecturers can contextualize the knowledge, thus facilitating trainees' learning processes and increasing training transfer to real-life situations. Each facilitator is certified in a three-day "train the trainer" workshop to learn the action-oriented and evidence-based approach of the training program from STEP master trainers who are experts in this didactical approach. The workshop provides knowledge about the training content and educates how the materials can be applied in an action-oriented manner (Bischoff et al., 2014).

STEP has been successfully implemented at several institutions in various countries in Africa, Asia, Latin America, and the Middle East. Scientific studies have confirmed the positive effects of STEP on students' short- and long-term entrepreneurial behavior across different cohorts and countries (Bischoff et al., 2014; Frese et al., 2016; Gielnik et al., 2015, 2016, 2017). Using randomized controlled trials to assess the impact, the studies demonstrate that STEP has a significant effect on training participants versus a comparable control group that has not received the training. Randomized pre-post-test designs with a control group allow controlling for biases and methodological artifacts so that differences between the groups after the training can be attributed to STEP (Campbell, 1957; Reay et al., 2009). Short-term evaluations have shown that the training program increases participants' entrepreneurial confidence, intentions, and action planning. Long-term evaluations have indicated that STEP trainees perform more entrepreneurial actions, have a higher start-up rate, and create more jobs, even in spite of unfavorable labor market conditions. Thus, STEP strengthens participants' entrepreneurial action regulation and their subsequent success in entrepreneurship (Gielnik et al., 2015).

3.2 Integrating Sustainability at the Core of the Entrepreneurship Training Program

Building upon the proven methodology of the original training program, I developed STEP Sustainability (STEP S) by applying a multistep approach. After deciding on the new program's focus and goals, a colleague and I engaged in the evidence-based development of the training materials. Following this, we collected feedback in workshops with both German and African partners and conducted pilot studies in Uganda and South Africa. After each phase, we performed reiterative revisions of the materials. In the following, I present the core features of the course design at the current stage (i.e., after having conducted the pilot studies) before discussing the results of the pilot studies.

Similar to STEP, STEP S is an action-oriented 12-week training course. Its focus is twofold. First, it aims to educate about how to pursue a sustainable business idea,

i.e., by identifying and profitably implementing business opportunities with an environmental and/or social benefit. Second, students learn how to set up sustainable processes and management practices within their businesses, irrespective of the nature of the venture they are engaging in. These processes and practices aim to jointly consider and improve the environmental (e.g., waste management), social (e.g., employee health and welfare), and economic (e.g., profit) performance of a venture. Within the same active learning approach as described for STEP, students in STEP S engage in setting up their own ventures in groups of four to seven members. They can choose their business idea freely. Note that the ideas, therefore, include both ventures that follow a sustainable vision and mission (i.e., providing solutions to existing environmental or social problems) and "regular" businesses that integrate sustainable processes and practices within a more typical business set-up. The range of the different ventures pursued illustrates to the students that sustainability is important in all kinds of businesses.[2]

The goal of STEP S is to create a sustainability-oriented, entrepreneurial mindset:

- Students gain knowledge about and awareness of sustainable entrepreneurship, potentially challenging assumptions about how business works (create value beyond profitability).
- Participants are better able to identify and evaluate business opportunities that can contribute to solving social and/or environmental problems.
- Students gain a better understanding of how businesses and their processes impact society and the environment, and learn about sustainable management practices.

Rather than teaching sustainability in an extra session—and potentially promoting sustainability as a mere add-on—STEP S integrates sustainability into all aspects of the business process, establishing it as a crosscutting theme in all STEP S sessions. A colleague and I added additional content and action principles based on the evidence-based revision of the material. We furthermore conducted workshops with German and African partners from Uganda and Kenya, who also took part in developing the original STEP training materials. They have been successfully implementing STEP for several years now, and were able to give feedback on the proposed adaptations. While STEP S is still a 12-week training course, the structure of the sessions has changed to account for the importance of problem identification and sustainable opportunity development, as well as the increased complexity caused by managing the triple bottom line. We especially reworked the training program to not only cover content on economic (financial) topics, but integrated information and exercises regarding the environmental and social impacts of entrepreneurial activities at the core of the training course as well. Moreover, we scheduled ten minutes at the beginning of each session, in which the groups on a

[2] As mentioned within the framework section, applying the triple bottom line as an overarching concept for the training allowed sustainability to be integrated along the entrepreneurial process and more broadly within different kinds of businesses.

Table 1 STEP S training structure and description of sustainability-oriented content

No.	Session title	Description of session and sustainability-oriented content
1	Problem Identification	New session, which focuses on the identification and analysis of social and environmental problems.
2	Sustainable Opportunity Development	Students form groups based on identified social and/or environmental problems and develop solutions to/business opportunities from these problems.
3	Triple Bottom Line Goals, Plans, and Action	Groups set goals on all aspects of the triple bottom line and develop indicators and action plans accordingly. Increased anticipation of potential risks and problems, stronger focus on strengthening persistence to prevent mission drift (i.e., switching to a non-sustainable business).
4	Sustainable Marketing I	Differentiation between customers and beneficiaries, and discussion on sustainable processes and production conditions.
5	Strategic Management and Acquiring Resources	Visit by a sustainable entrepreneur to talk about his/her venture. Students discuss challenges in acquiring resources (e.g., funds) for sustainable businesses, and facilitators provide insights on access to funding (within a country's context).
6	Triple Bottom Line Accountability	Stronger focus on ethical behavior and how to manage accountability on each of the triple bottom-line dimensions.
7	Overcoming Barriers	Discussions on common barriers for sustainable enterprises and how to deal with them on a factual and an emotional level.
8	Triple Bottom Line Bookkeeping I	Participants learn how to do bookkeeping for financial, environmental, and society-related indicators.
9	Triple Bottom Line Bookkeeping II	
10	Sustainable Marketing II	The traditional marketing mix is complemented with sustainability inputs, e.g., product lifecycle (cradle-to-cradle). Moreover, discussions on sustainable supplier and customer relationships are integrated.
11	Sustainable Business Model Canvas	New session that focuses on economic, social, and environmental value propositions, and on how these aspects can be combined within a viable business model. Supplemented by information on how to write a business plan.
12	Registering Sustainable Enterprises	Introduction of legal and regulatory issues for legal forms of sustainable enterprises (e.g., cooperatives) within the country.

weekly basis reflected on their business decisions and experiences with regard to the triple bottom line. Our aim was for students to gain a better understanding of the interconnections, i.e., how their entrepreneurial decisions influence the environment and society.

Table 1 provides an overview of the training structure and a description of the sustainability-related content of each session. Of note is how this description corresponds to the main changes compared to the original STEP training program.

4 Pilot Studies

4.1 Uganda

STEP S was piloted for the first time in cooperation with the Makerere University Business School in Kampala, Uganda. The main goal of the pilot was to test the adapted training materials in terms of its practical applicability. We did not conduct a "train the trainer" workshop since this material had not yet been reviewed and tested. A colleague and I, both certified master trainers for STEP, and involved in adapting the material, facilitated most of the sessions. Additionally, a local lecturer conducted the session on legal and regulatory issues, providing valuable country- and context-specific knowledge. Moreover, local lecturers also attended most of the sessions to provide feedback on the training course.

Local lecturers informed business students about the opportunity to apply for a free training course on sustainable entrepreneurship. Students that were interested in the training course completed an application form and a baseline questionnaire. The participating students took part in eleven three-hour teaching units over two weeks in February 2019. An additional and concluding session took place after ten more weeks at the end of April 2019. The students developed (sustainable) business ideas in groups and implemented them between the first and second project phases. Every group received starting capital of approximately US$100, which had to be paid back after the last meeting in April 2019.

A randomized control group design was used to evaluate the effectiveness of the training program. Both training and control group members completed a questionnaire before (T1) and after the two-week training course (T2). The control group was a waiting control group, and received a training program by the entrepreneurship center of the university after the T2 evaluation. Moreover, we asked students to fill in short daily reflection logs, and provided anonymous feedback sheets for suggestions on how to improve the training program. STEP S was a voluntary offer and not part of the regular curriculum. Although participants did not receive any credits or grades, they were awarded a certificate attesting their successful participation.

In total, 87 undergraduate students from different bachelor programs in the field of business administration filled in the application form and completed the T1 baseline questionnaire. They were randomly assigned to the training ($n = 40$) or the control group ($n = 47$). Thirty control group members and 33 STEP trainees, who attended most of the sessions and thus successfully finished the training course, filled in the T2 questionnaire.

The results show significant effects on the entrepreneurial mindset and sustainability orientation of STEP S participants. After the training course, STEP S trainees planned and performed significantly more entrepreneurial actions than members of the control group. Entrepreneurial actions measured included, e.g., doing market research, outlining a business plan, or conducting marketing. Moreover, STEP S had a positive effect on sustainable opportunity recognition, with trainees identifying significantly more sustainable business opportunities (addressing environmental

and/or social problems) than control group members. However, because of the small sample size, the results should be treated with some caution.

Our pilot experiences and qualitative analyses of the material gathered also indicated that changes and further adaptations were needed. Because we integrated sustainability as a core theme throughout the training program, but only slightly reduced the existing input, we ended up with too much content to teach within the pilot, and reworked the training materials accordingly. Some participants struggled with overcoming challenges related to setting up and running a sustainable enterprise (e.g., working outside of the "traditional" enterprise paradigm, finding suitable suppliers), and as a result switched to non-sustainable business ideas. We, therefore, adapted the training structure by increasing the focus on potential risks during the third session (*Triple Bottom Line Goals, Plans, and Action*) and conducting the *Overcoming Barriers* session at an earlier point in time (for the seventh instead of the tenth session, as it was prior to the pilot). Moreover, we realized that we had to obtain further contextual insights into the understanding of sustainable entrepreneurship and its associated challenges.

4.2 South Africa

Prior to our pilot project at the University of Limpopo in South Africa in 2020, and as a means to further revise and adapt our training materials to the context, we conducted interviews with seven local sustainable entrepreneurs. The aim was to advance our understanding of the complexities of sustainable entrepreneurship in South Africa. Our findings helped us to incorporate in the *Overcoming Barriers* session specific information on (how to deal with) the complexities and challenges of the sustainable entrepreneurial venture (e.g., lack of awareness and understanding of sustainable enterprises among market participants). Moreover, we contextualized the *Problem Identification* and *Sustainable Opportunity Development* sessions by integrating local knowledge. On top of that, the findings highlighted that "sustainable business" was understood differently than what we anticipated. Quite contrary to our definition, a sustainable business was not seen as a business that addresses the triple bottom line, but as a financially viable venture that can sustain itself in the long run. This finding helped us to adapt both the training materials as well as our evaluation measures toward a more comprehensive wording. We ran a separate test training session with 24 students of the University of Limpopo prior to the pilot project to gain further insights into the understanding of sustainability in the local context (i.e., of students who are not sustainable entrepreneurs) and how to increase awareness of the connection of sustainability and entrepreneurship.

The implementation of STEP S started in February 2020 following these adaptations. This time, I used a research design incorporating a control group that received no training, a STEP training group, and a STEP S training group. The goal was to compare differential effects to answer the question of whether STEP S trainees might suffer losses on entrepreneurial outcomes (e.g., in terms of

entrepreneurial confidence) compared to the original STEP training program. Local university lecturers delivered the training sessions. The trainers were qualified and certified in separate "train the trainer" workshops (one workshop for STEP facilitators, one for STEP S facilitators) prior to the start of the training course. STEP/STEP S was advertised through announcements by lecturers, student research assistants who supported the implementation of the training course, and posters on campus (we did not separately advertise the two different training variants). Students from all disciplines were invited to apply for entrepreneurship training. As in Uganda, although participants did not receive any credits or grades, they were awarded a certificate attesting their successful participation.

In this pilot, participants were undergraduate and postgraduate students with different study backgrounds. 226 applicants completed the baseline questionnaire before the training course (T1). Due to capacity constraints, and to evaluate the impact of STEP vs. STEP S, 114 applicants were randomly assigned to the training group, and 112 to the control group that received no training. All members of the training group could choose one of two training days. After participants chose their preferred training day, we randomly assigned one day as a STEP S (54 students) and the other day as a STEP training day (60 students). Students within both training groups formed business groups and received approximately US$100 per group as starting capital. Unfortunately, the COVID-19 outbreak interrupted our program, allowing only five sessions to take place in person in February and March 2020, with the remaining seven training sessions conducted online via Zoom following a long interruption in November and December 2020. Only 22 STEP students and 20 STEP S students successfully finished the training course by attending more than eight of the twelve training sessions. In addition to these students, 47 control group members filled in our online questionnaire after the training course (T2). To gain further insight into STEP S, I additionally observed all training sessions and conducted multiple interviews with 18 STEP S participants over the duration of the pilot project (February–November 2020).

Statistical analyses showed that the training groups' (STEP and STEP S) entrepreneurial confidence increased, while the control group that received no training experienced a slight decrease. Moreover, there were positive effects for STEP S trainees compared to STEP members on promoting a sustainability-oriented mindset. Specifically, STEP S increased participants' knowledge of the environment and society as well as competencies (e.g., future thinking competence and normative competence) that have been identified as crucial for sustainable entrepreneurs (Lans et al., 2014; Ploum et al., 2018). Due to COVID-19 and the small sample size, future quantitative research is welcome to validate these results. Adding to the quantitative results, the interviews provided insight into learnings and experiences from the participants' perspectives, indicating positive takeaways from the training program.

"Being in the presence of entrepreneurs, creative thinkers, that's what I actually wanted. While also learning the means of running a business and also, in bonus, I actually also learned how to raise awareness, socially and environmentally. Which is also cool. I didn't think I would actually learn that, but it's cool. Turning into a superhero" (Interview with a STEP S participant).

5 Conclusion

Transforming entrepreneurship training is crucial to empowering individuals to create the impact needed for solving today's social and environmental problems. The developed action-oriented training program on sustainable entrepreneurship integrates sustainability as a crosscutting theme within the effective STEP entrepreneurship training. Pilot studies have yielded promising results, showing that STEP S can indeed change students' sustainability-oriented and entrepreneurial thinking and behavior. While these studies are just a starting point, and should be treated with some reservation, positive effects were visible in two very different pilot settings (e.g., university locations, participant backgrounds, length and setting of training courses), indicating that STEP S is very possibly an effective approach in facilitating sustainable entrepreneurship.

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Introducing an Innovative International Format for Experience-Based Sustainability Entrepreneurship Education: The YEEES Sustainability Camps

Antonieta Alcorta de Bronstein, Jantje Halberstadt, and Shaun Bissett

1 Introduction: Why International Sustainability Camps

With the sustainability issues society is facing, and the public sector apparently unable to solve these problems by themselves, the private sector is stepping up to play an increasingly important role (Kickul and Lyons, 2020; Fischer et al., 2012; Halberstadt et al., 2019a). This is why the interest in sustainability entrepreneurship is growing (Farny and Binder, 2021; Sarango-Lagangui et.al., 2018). Sustainability entrepreneurs can be defined as change agents that recognize, explore, and exploit entrepreneurial opportunities that address social and/or ecological issues, and provide social value as a result. They have vast potential for practice, research, and education (Biberhofer et al., 2019; Gast et al., 2017; Spiegler and Halberstadt, 2018).

Given this crucial role that sustainability entrepreneurs play for our future, the authors stress that fostering sustainability-oriented entrepreneurial thinking and acting is an important task for higher education (Conchado et al. 2015). Several arguments support the idea that universities should become more involved in sustainability-driven entrepreneurship. Some of these are described by Halberstadt et al. (2019b). Universities are increasingly being asked to include a "third mission" of societal engagement (Zomer and Benneworth, 2011), and an entrepreneurial university is one of the arenas in which this is being addressed. In addition, companies' structural changes sometimes lead to smaller businesses, business units within existing companies, and independent ventures being created out of organizations (Blanka, 2019; Kreuzer et al., 2017). Here, changes in innovation from closed innovation to open innovation continue to develop (Chesbrough, 2003).

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This leads to an increasing interest in entre- and intrapreneurship aspects, and a growing field of future work for today's students as a result. We furthermore see that the public awareness of sustainability continues to grow. Authors such as Erdil et al. (2018), specifically underline the increasing importance of sustainability in business and management contexts. This is also reflected in the interests of students. Last but not least, it can be stated that the world's sustainability problems are "wicked" problems requiring multidisciplinary approaches at scale, such as those facilitated by entrepreneurs (Walsh, 2017). Fostering the combination of sustainability and entrepreneurial skills development should thus be seen as one of the core topics at universities in the future. Universities should see it as a strategic task to create innovative solutions themselves—including new teaching formats in this field (Fidalgo-Blanco et al., 2014; Rodriguez Perez and Ordóñez de Pablos, 2003).

However, facing sustainability issues requires new competencies as well as new ways of competence management, and competence acquisition (Gloet, 2006; Lang et al., 2012). Today's students as future change agents should not only be aware of sustainability problems but also be able to find solutions to them. The question remains how to best support the acquisition of the relevant skills needed to develop and implement sustainability-oriented entrepreneurial solutions. Education research suggests several approaches for fostering sustainability-oriented entrepreneurial thinking and acting (entrepreneurship). Researchers as well as practitioners stress the value of experience-based entrepreneurship education. It is stated that involving individuals in entrepreneurial processes lead to entrepreneurial experiences which make them learn entrepreneurial practice "by doing" (Kassean et al., 2015; Williams Middleton et al., 2014). There are also a growing number of researchers calling for more experience-based learning settings, such as outdoor education, with regard to sustainability skills (Caniglia et al., 2016; Heiskanen et al., 2016). Studies such as the work by Probst et al. (2019) show the positive effects of experiences on sustainability attitudes, skills, and agency underlining the value of transdisciplinarity. Creating real-world experiences can thus be seen as a promising approach for successful sustainability-oriented entrepreneurship education.

Three subcategories of experience-oriented education are receiving increasing attention: challenge-based learning, service learning, and practical seminars. Challenge-based learning is an approach focusing especially on the formation of an entrepreneurial mindset by creating a set of (entrepreneurial) challenges that students accept and reflect upon. By dealing with and solving complex challenges, they are preparing for similar situations in practice, gain (entrepreneurial) self-efficacy, and may as a result tend to act more solution- than problem-oriented (see Hölzner and Halberstadt, 2022 in this book for more detailed information). Service learning brings together academic learning and real-world problem solving that creates a benefit for society. It includes a wide array of experiential education endeavors from volunteer and community service projects to field studies and internship programs (Halberstadt et al., 2019b; Schank and Halberstadt, 2022 in this book). Practical seminars in which students work together with external partners are another form of experience-oriented education (see Unger et al., 2022 in this book). For example, students can actively take part in researching a particular

question within a transdisciplinary research project. The Sustainability Camps are based on the idea of merging these approaches in an international context to strengthen entrepreneurial competencies.

This chapter will report on the Sustainability Camps as an innovative teaching and learning format that we developed within the YEEES Training Center. With our Sustainability Camps we aimed to design and implement a new concept for sustainability-oriented entrepreneurship education that gives participants the opportunity to obtain real-life experiences by solving sustainability issues in an international context. We integrated various challenges, cooperating with partner organizations from practice, most notably sustainability start-ups and NGOs, meaning that our approach also falls under the umbrella of service learning. The following will briefly introduce the overall concept and framework conditions provided by the YEEES Training Center. Following that, we report on the four Camps that we have realized to date, identifying some lessons learned as we have further developed and tested them in different settings. We finish the article by sharing our experiences and thoughts on how to further develop sustainability-oriented entrepreneurship education.

2 The YEEES Sustainability Camps: Background and Concept Development

In 2016, the German DAAD- and BMBF-funded YEEES project (Yields of Evocative Entrepreneurial Approaches on Environment and Society) began under the guiding principle of sustainability. The project sought to bring together German and African researchers and lecturers, university students, and local actors through the mission of exploring solutions to urban problems via ICT and entrepreneurship. With its academic research, publications, conferences, community initiatives, and teaching formats, the YEEES project aimed to make a positive contribution not only to project-related academic fields of study but also strove to make an impact "on the ground" with the up-and-coming entrepreneurs themselves. It was through the project's Sustainability Camps which were annually held by a different partner countries (Germany, Mozambique, South Africa, and Namibia), that the project was able to fuse academic research with real-world community-based entrepreneurial development initiatives. This chapter will focus on the experiences and learnings within the Sustainability Camps as an innovative learning format. Participating in the Camps was offered as an extracurricular activity to further advance international and interdisciplinary entrepreneurship education. Students from all partner countries were able to apply for these Camps, which took place once a year, rotating locations at the partner universities. The Camps had a mix of students from different countries working closely together to ensure international and intercultural cooperation and the exchange of ideas—supported by members of the YEEES training center as well as external experts. The Sustainability Camp was based on the idea of the

SCHub Camp, a format of the Social Change Hub (SCHub) which at the time was under the supervision of Prof. Halberstadt and the team at the Leuphana University of Lüneburg. This Camp format also was an extracurricular offer focusing on supporting students' social entrepreneurial activities by a composition of joint work (on specific ideas and existing student initiatives), coaching, and lectures taking place at a location outside the university, usually on weekends.[1] We experienced that intense work on a topic together with peers has several positive effects—including the generation of successful solutions and knowledge acquisition. This concept was futher developed in several ways.

We opened the format for students as well as junior researchers from any discipline and did not focus on student initiatives. We also broadened the focus to include various sustainability solutions, not primarily social aspects. The aim was to develop sustainability-oriented entrepreneurial mindsets and acquire related skills by being part of the development of real-life solutions for social and/or environmental problems using entrepreneurial approaches in an international context focusing on the southern African partner countries and Germany. We employed an experience-based approach (Andresen et al., 2020; Williams Middleton et al., 2014) and included entrepreneurial challenges as introduced in Hölzner and Halberstadt (2022) in this book.

Furthermore, we designed the Camps for a longer period of time, because they are international activities that require traveling and address specific issues in the partner countries. Personal trainings and team-building units were part of the concept before starting with the main program of entrepreneurial solutions for sustainability with the international and interdisciplinary teams. This is why we decided to offer three- to four-week stays. We wanted to achieve a close connection to practical partners and work with them on real-life topics. The plan was to involve partners mostly from industry, such as incumbent companies or (sustainability) start-ups, while also working with stakeholders from politics or society. These participants were to be included as speakers as well as practical cases. The experts' selection would depend on the ideas of the students and their actual needs (e.g., regarding expertise in the field of marketing or business development). The YEEES Sustainability Camp therefore also had a transdisciplinary character.

The original design of the Sustainability Camps aimed to train students and junior researchers in developing and implementing their own innovative approaches that achieve sustainable change. As an extracurricular activity, participants had to apply, and a jury selected those who were extraordinarily motivated to contribute to ecological and social progress—regardless of whether their work ultimately led to the founding of sustainability start-ups, organizations, or student initiatives. The development of sustainable products or services was also possible. As shown in Fig. 1, the basic concept was framed by an opening and closing event. The opening events were important to make the importance of the Camp clear to all of the partner universities while generating attention for the project and the joint teaching. Most of

[1] https://www.leuphana.de/portale/schub/schub-camp.html

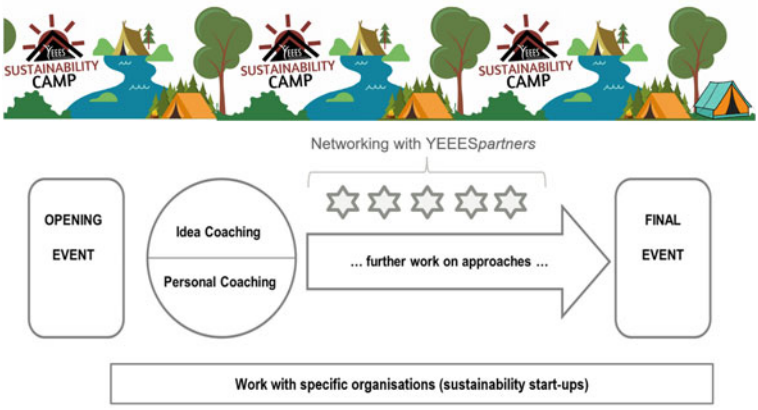


Fig. 1 Sustainability Camp—original/first structure

all, everyone got to know each other and the participating teachers and partners. After the opening event, we planned an intensive idea development phase and coaching where the participants received personal communication and presentation skills training. Within the next days (planned for about two weeks), the students had time to further develop their ideas and prepare for a final event focusing on presenting their concepts to a broader audience. These sessions were designed by drawing on pitch approaches, such as those found on popular TV shows where participants present their business ideas, with a prominent panel of experts evaluating and supporting the students.

The following section describes how this concept has developed over the years. We share not only experiences, but also provide learning cycles for a better understanding of the adjustments being made that have led to a new Sustainability Camp approach.

3 Experiences from the Camps in Four Countries

Despite all of the Camps being based on the same format, each Camp concept was part of an iterative process in which the learning from previous Camps were integrated into the next one. Given that each Camp took place in a new environment with new participants, each was unique.

The following section will offer brief summaries of the Camps, making special note of some of the distinctive aspects which made each one unique. Certain elements were present in all four Camps, which we will summarize here.

– *Intercultural Training:* A key element given the participants' mixed backgrounds. It helped to bring awareness about differences in communication,

perspectives, and expectations within the group, allowing participants to better understand the culture in the country they were visiting.
- *Intensive exchange of the international students:* In all four Camps, the international students lived in close proximity, either in the same building or hostel. This had two main reasons. First, it made the logistics for the mobilization, catering, and group work easier. Second, it increased the interaction of the students and learning from other cultures, for example as they worked and cooked together.
- *Entrepreneurial thinking and competences:* All Camps had the goal of their participants learning or improving their entrepreneurial thinking and competences. Therefore, all Camps worked with actual problems and used a design thinking approach for their solution development. Another important aspect in this process was to genuinely understand the problems being worked on, and the people affected by them, something of the utmost importance when coming up with useful solutions.
- *Pitch training:* As important as it is to have great ideas, they have to be effectively communicated. Here, all participants profited from pitch training. At the final closing event they put this training into practice as they pitched their ideas.
- *Final evaluation and reflection session:* One important aspect included constantly reflecting with the participants—on their learning progress as well as experiences. After completing a Camp, a systematic evaluation took place. During an approximately two-hour session the participants could freely talk about their experience and learning, and give suggestions on what they thought could have been better. This is relevant for the participants as a reflection exercise, as well as for learning awareness. For us, it helped obtain insights from their experiences, with the goal of integrating ideas and improving future Camps.

3.1 Camp 1: YEEES IDEA JAM

Leuphana University Lüneburg, Germany
January 23rd to February 9th, 2018
Participants: Germany 4 (rotating), Mozambique 3, Namibia 1, South Africa 2
Experts in the areas of: design thinking, intercultural training, ICT, entrepreneurship,
personal approaches to sustainable development

3.1.1 Overview and Key Content

The focus of the first Camp was an introduction to the partner countries, developing an understanding of different challenges, problem analysis, and generating first ideas to overcome selected problems (sustainability business concepts). Table 1 shows the general structure of the first Camp. The participants received input sessions from both university and nonuniversity actors on design thinking, prototyping, IT

Table 1 Time schedule Camp 1

solutions, pitch training, and personal approaches to sustainable development, all intended to spark their entrepreneurial creativity and refine their business acumen. Bringing together the African students with the local German students provided fascinating exchanges regarding their differing approaches to entrepreneurism. While the German students saw entrepreneurship as more of "personal interest project," or as an opportunity to do good in their community, the African students viewed entrepreneurship as a career path and as a path toward private success. Following the input sessions, and a discussion round about resilient cities and peri-urban areas, the participants talked about the different problems and challenges in each of the countries they come from. Based on this, they selected areas and issues they wanted to work with to come up with possible solutions. They furthermore broke into small groups where they devised a sustainability business concept that

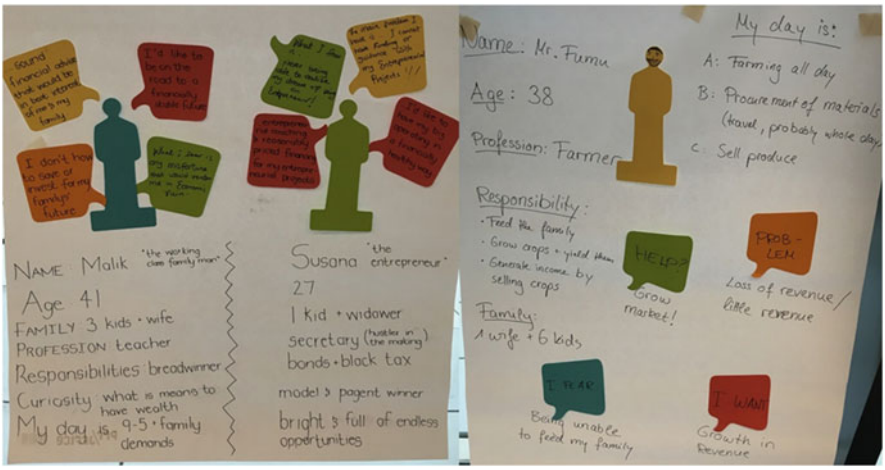


Fig. 2 Persona examples Camp 1

would be viable in one or more of the partner countries (Mozambique, Namibia, South Africa). All teams had a combination of students from different universities.

The students were able to develop the ideas via a design thinking process based on a user-centered approach by, e.g., creating personas (an amalgam of people affected by the problem in order to empathize and better understand the problem) as well as rapid prototyping (a method for visualizing the idea using different materials and quickly obtaining feedback on it). Figure 2 shows some examples of so-called "personas." The persona tool is used to better understand certain people and their views, needs, or behavior (Nielsen et al., 2021; West & Di Nardo, 2016). Personas should be clearly defined, memorable representations of people, e.g., (potential) users, or in our case selected representatives of people experiencing country-specific challenges that remain conspicuous in the minds of others (Pruitt & Adlin, 2010). By using personas, the social role of a person in a specific context is identified and described (Aoyama, 2005). Figure 2 shows the personas of two of the teams: a "typical" farmer, an entrepreneur, and a middle-class man with limited financial literacy. This was a key first step into understanding problems from a target-group perspective, and creating empathy with them. As the core aim of these sessions was to trigger creativity and motivate students to reflect on problems and solutions, we used a mixed method approach. The teams worked using a pen-and-paper technique, summarizing the core results generated by prototyping sessions.

Along with empathizing, problem definition, and ideation, prototyping and testing are the most common stages of a successful problem-solving process in design thinking (Sarooghi et al., 2019). According to Tschimmel (2012, p. 4), prototyping "is a visual manifestation of concepts, the transformation of an idea in a testable model." It is often used in (sustainability) entrepreneurship education contexts as a basis for concretizing and rethinking an innovation and receiving feedback from others (Brenner et al., 2016; Geissdoerfer et al., 2016). It is also shown to contain and

Fig. 3 Development of ideas and concepts

enhance creativity, while at the same time opening room for discussion and improvement (Bruton, 2011; Silveira et al., 2020). As seen in Fig. 3, each concept the teams ultimately developed was based on a goal the team wanted to reach, a short statement about their idea, and a prototype.

Following days of short presentations, observation/feedback sessions, and idea tweaking, the groups refined their concepts to a point where they could be presented. After a pitch training session, pitches were successfully made to a group of interested university professors and students, as well as local citizens. The final step was a feedback and a closing session allowing time for reflection and sharing the knowledge acquired.

At the end of the Camp, four sustainability business concepts were proposed that deal with different issues in the areas of education, agriculture, finance education, and health. One concept called "HIS" wanted to ensure that patients' medical information would be rapidly and readily available for the patients to share with their doctor(s), with the control of this information still remaining in the patients' hands via new technologies. Another team worked on the idea of a traveling school as they looked to tackle the problem of a lack of schooling in rural areas, particularly in Mozambique, and designed a fully equipped bus with all the necessary school

supplies that could be easily set up and taken down. This allowed teachers to travel to different rural areas and offer classes to children that otherwise did not have access to education. The so-called "FINC" concept looked into the problem of financial illiteracy and the need for credits. As a financial services company, they offered low-interest loans coupled with mandatory workshops designed to raise the financial literacy level in communities, while limiting the predatory lending practices sometimes seen there. "Agrinet" was the working title of a concept to create a network, both digital and locally, between farmers and other stakeholders to share knowledge to improve farming results and make the sale of produce more efficient.

3.1.2 Lessons Learned

The first Camp was conceptualized as an "idea jam," a starting point for looking into resilient cities and peri-urban areas to seek solutions to problems in these fields. We did this with a particular focus on the southern African partner countries and were generally able to reach our objectives. However, we also noticed that, being in Germany, we were not able to work directly with the people affected by the problems selected by the participants in the southern African countries in question. In other words, this was more of a thinking exercise than an on-the-ground endeavor. We, therefore, decided to integrate various nonacademic partners into our subsequent Camps. Since the future Camps were planned in the African countries, it was easier to integrate partners when working locally. In addition, we wanted to add video conferences and pre-recorded videos to allow for an even more international exchange. Since the Camp took place in pre-corona times, however, video communication technology as well as the willingness to use it were not as developed as they are now.

The reflections and evaluations showed that the participants were able to extensively learn from this experience. First, they were introduced to new tools and methods for problem solving and thinking entrepreneurially. Some stated that they can use this new knowledge for various future situations—in private as well as in job and study contexts. This is why we decided to stick with and strengthen ideation and prototyping. However, to better integrate real-life problems (as explained above), we changed the Camp concept toward selected problems being experienced in the countries of focus. Together with the host university, we selected manageable cases and arranged sessions around these topics and the participating partners, which enabled us to prepare meetings with people on-location. The students were prepared to talk to these people as a starting point, and had the possibility to arrange additional meetings with other local stakeholders (for more detail, see the description of Camp 2). Students were also able to increase intercultural competences by working together with international peers and discussing country-specific issues. The generation of normative competences and future thinking was furthermore enhanced via critically evaluating given situations and deriving future scenarios.

Expectations management was also a topic in which we learned from the participants' feedback. Some needed more information on the topics and content, while others asked for an even clearer structure. The latter was quite challenging, because

on the one hand, it is easier to follow a clear structure and work task by task, which may increase the probability of a successful outcome in terms of working entrepreneurial ideas and easy communication. On the other hand, this does not create a realistic picture for entrepreneurial problem solving. And as we aimed to foster entrepreneurial competencies that enable young people to act as future change agents, they must experience challenges and find their own ways through them. Life is full of challenges and opportunities to choose from; dealing with this can be seen as an essential entrepreneurial skill. This is why we decided to leave sufficient room for experiencing challenges within the seminar, and freed up capacity for self-organized work, while at the same time offering a more detailed program and information about what was happening in terms of content. We also provided information about the structure and the reasoning behind it to prepare students for the idea that it is "normal" and "calculated" that they themselves would face opportunities as well as difficulties throughout their stay, and that they contribute and decisively codetermine the Camp.

On the logistical side, we also learned from the experience with the shared housing, seeing that there were different values and understandings about it. Here, we made sure to set clear, well-communicated guidelines and rules.

3.2 Camp 2: YEEES Sustainability Camp—Solutions for Maxixe

Universidade Pedagogica (UP) – Maxixe, Mozambique
November 18th to December 12th, 2018
Participants: Germany: 6, Mozambique: 6, Namibia: 2, South Africa: 3
Experts in the areas of: intercultural training, the Portuguese language, education, history and business environment in Mozambique, ICT, social entrepreneurship, team mentors

3.2.1 Overview and Key Content

The second Camp took place in Mozambique and focused on existing entrepreneurial efforts and how students can further develop them to be more sustainable from all three sustainability perspectives. In other words, the students' task was to analyze specific problem areas and intensively work together with partners from the world of practice to enhance the partner organizations' (young sustainability start-ups) long-term success—in terms of their social or environmental impacts, as well as their financial stability. Here, we pushed the participants to get to know and critically discuss different perspectives on sustainability while experiencing and further developing sustainability-oriented entrepreneurial solutions.

As shown in Table 2, this Camp began with an extended cultural and language training input session to prepare the participants for their month in an Afro-

Table 2 Time schedule Camp 2

YEEES
Yields of Evocative Entrepreneurial approaches on Environment and Society

LEUPHANA UNIVERSITY OF LÜNEBURG · universität OLDENBURG · UNAM · NELSON MANDELA Business School

YEEES SUSTAINABILITY CAMP @MAXIXE 2018

	Location	Mornings	Afternoons	Evenings
sun 18	Maputo	Arrival	History & Culture	Tour Dinner
Mon 19	Maputo	Intercultural Training	Intercultural Training	-
Tue 20	Maputo / Maxixe	Intro to Portuguese	Travel to Maxixe	Team Dinner
Wed 21	Maxixe	Key Note & Problems Presentations w/guests	Problems Presentations w/guests	-
Thu 22	Maxixe	Teams Exkursions on site	Impact Gap Canvas Research & Presentation	Opening Event
Fri 23	Maxixe	Key Note Social Entrepreneurship & Input ICT Tools	Ideation	-
Sat 24	Maxixe	Ideation II	1. Pitch + Feedback	-
sun 25	Maxixe	Free day Optional: work on ideas	-	-
Mon 26	Maxixe	Fiedltrip to Related Institutions	Revision Problems / Ideas Ideation III	-
Tue 27	Maxixe	Prototyping	Social Business Model Canvas	Film Night: Pitch Videos
Wed 28	Maxixe	Pitch Training / Prepare Pitch	Rehearsal & Feedback	Pitch Event (+ Germany groups)
Thu 29	Maxixe	Fine Tunning	Mentoring	

	Location	Mornings	Afternoons	Evenings
Fri 30	Maxixe	Testing Day	Reflection & Fine Tunning	-
Sat 1	Local Town	Field Trip	Field Trip	-
sun 2	Maxixe	Free day	-	-
Mon 3	Maxixe	Implementation		-
Tue 4	Maxixe	Implementation		Peer Review
Wed 5	Maxixe	Implementation		-
Thu 6	Maxixe	Implementation		Peer Review
Fri 7	Maxixe	Implementation		-
Sat 8	Maxixe	Reflection Lessons Learned	Impact: Sustainable Contribution Perspective	-
sun 9	Maxixe / Maputo	Traveling to Maputo	Traveling to Maputo	-
Mon 10	Maputo	Social Entrepreneurship in Maputo	Presentations Preparation	-
Tue 11	Maputo		Presentations	Farewell Dinner

funded by: Federal Ministry of Education and Research · DAAD

Portuguese nation. Empowered with their new understanding of the culture, the entrepreneurial training sessions began. During this Camp, we attempted to find a reasonable mixture of input sessions provided by experts from academia and entrepreneurial practice, and real-life experiences working together with those affected by entrepreneurial challenges or trying to implement first solutions. A series of presentations by UP professors to the Camp participants aimed to increase their understanding of the educational, history, and business environment in Mozambique. A workshop on social entrepreneurship was provided by the YEEES coordinator from Germany. A series of guest speakers from different challenge areas talked about the daily difficulties faced, and the Camp participants were free to ask questions about their specific fields. Following the presentations, the participants divided into three groups by choosing one of three "challenge areas" that they would like to work on for the next three weeks. These were determined in advance by the YEEES project team, together with students of the University in Maxixe. One was how to improve the financial literacy of the women working at the local market. Another addressed the issue of waste and trash collection in Maxixe, while another task involved providing children with skills that will help them in their future development.

Each group was assigned a university professor with a background in a related area to serve as a mentor for the challenge chosen by the Camp participants. During this time, the participants visited organizations and individuals in the Maxixe area which were the case studies for their work in the Camp, such as the "market mamas" vegetable sellers at the market, a fledgling recycling business start-up at the beach, and a small bilingual primary school attempting to offer private school teaching at an affordable price. Over the next two and half weeks, the groups used the mornings to conduct field research, make observations, and in the final week, implement ideas. The participants also spent time with their case analyzing all aspects of the business, including the problems and challenges, to come up with ways to make the business more sustainable and ultimately more successful. The participants spent the afternoons at the UP Entrepreneurship Center where the working teams could come together as a group to analyze, strategize, and plan.

Peer review sessions were conducted during the implementation to gain input and feedback from the other teams and stay in touch with the rest of the participants. We always included reflection time for the learning and cultural exchange of the participants. We provided input and guiding sessions as well as field trips, such as a cultural visit to a rural town where the Camp participants witnessed a traditional ceremony. Presentation sessions where each group presented their sustainable solutions were included to strengthen the students' presentation and communication competencies. Here, the development of the concepts and ideas was not only theoretical; the students also pitched their suggestions and had the possibility to test their solutions in a real-life setting together with the partner (implementation phase). The final wrap-up event of the Camp saw the participants provide an oral presentation of their contribution to a group of local business people (including the partners they worked with) and university professors. The groups also had private sessions with the representatives of the cases they worked with, where they presented an extensive, written analysis of their findings and a road map to improvement, if they wished. The Camp ended with a reflection session.

Fig. 4 Field excursions connected to the three challenges

The concept ideas developed during the Camp included the following. For the first challenge area, the team came up with a practical, easy-to-use accounting system for the market sellers (see Fig. 4, left picture). This system will allow them to better control inventory as well as save for future investments. For the waste and trash challenge, the team presented a recycling strategy, making art out of bottles and cans. Figure 4 (the picture in the middle) shows a typical environment where bottles and cans can be collected. The remaining material can be sent to a recycling plant in Maputo. The team on the third challenge worked at the primary school together with the kids and teachers to develop an entrepreneurial mindset training for them. Figure 4 (the picture on the right-hand side) shows one of our students working with the children at the partner school.

3.2.2 Lessons Learned

The second Camp was conceptualized as a solutions-oriented format, addressing specific local challenges. Local students were involved in the selection of them, and also participated in the Camp. Here the participants worked on local problems, and were able to talk to the people affected, contributing added learning experience. In this sense, the priority set for this Camp was achieved. Evaluation and reflection have shown that the students specifically underlined that they gained entrepreneurial competences here. They learned how to deal with challenges from three perspectives: (1) tackling the overall challenges defined by generating entrepreneurial solutions, (2) dealing with specific daily challenges that the partners face, and (3) overcoming own challenges when, e.g., organizing meetings and preparing presentations. We as a result contributed to students' ability and willingness to act in a solution-oriented manner, while also increasing the participants' (entrepreneurial) self-efficacy.

However, expectations management was still an issue. On the one hand, the participants had more information and a clear idea of what the activities during the Camp were going to be. On the other hand, a challenge of working with actual people came up, since participants were hesitant to offer hope (financial support, opportunities) to locals, only to leave three weeks later. Feedback rounds showed that much of this "hope" was based on the local perception that the "rich" foreigners will inject money, something the students experienced difficulties dealing with. This was probably also in relation to the lack of clarity as to whether the business ideas they came up with should be pursued, with the hope that one day they could become a reality, or if they were simply academic exercises. This is a challenge that real sustainability entrepreneurs often also experience, since they might get hopes up, while also perhaps subsequently disappointing upon failure. But the question then arises: should we refuse to try for fear of failure? This is not entrepreneurial, and an additional question to discuss, or a lesson to be learned based on the experiences the students were able to make during the Camp. It is seen here that even more transparency and exchange are needed with regard to communication with local partners as well as students. As a side note, it can be stated that all the ideas developed and implemented have led to positive impacts and motivation by the partners. The training developed for the elementary school is still in use today. One of the project partners is involved in both the school and the Camp, making a long-lasting implementation possible. In sum, the Camp combined learning success for the participating students with societal impact generation. In this regard, the Camp can also be seen as a form of service learning format (Erickson & Anderson, 1997; Schank and Halberstadt, 2022; Speck, 2001).

The concept was again adapted for the next Camp. The goal here was to work with actual start-ups and the challenges they face. Instead of working on bigger local challenges by developing solutions for and with entrepreneurial partners, the partners' activities and challenges were the starting point for this Camp. By integrating established sustainability entrepreneurs, we aimed at enhancing the probability for the ideas to be implemented long-term after the Camp time, as we experienced in the case of the elementary school training. An international Camp in English in a Portuguese-speaking country was a challenge, albeit an add-on for the participants, both locally and internationally. The active participation of the local students was a key factor since they were able to communicate with the users and case personas, and translate for the international participants. Consequently, we tried to maintain this. On the logistical side, the set of living rules, and clearly communicating them before the participants arrived, as well as having two houses, were an improvement, which is why we decided to continue with this approach.

3.3 Camp 3: Sustainable Entrepreneurship in PE

Nelson Mandela University, Port Elizabeth (today Gqeberha) South Africa
September 9th to October 8th, 2019

Participants: Germany: 5, Mozambique: 3, Namibia: 1, South Africa: 0

Experts in the areas of: intercultural training, design thinking (including user research and tips for conducting interviews, ideation, and prototyping), ICT, gamification, storytelling, pitching and project management

3.3.1 Overview and Key Content

The third installment of the Sustainability Camp series took place in Port Elizabeth (PE), today Gqeberha, in South Africa, and was hosted by the Nelson Mandela University. The habitual input sessions as in the previous camps provided by university and practical experts were complemented by input in the areas of gamification, storytelling, a visit to a farm for a change in perspective, as well as user research tools and project management. The particularity of this Camp was that the participants worked hand-in-hand not only with a local challenge, but directly with two local start-ups (Figs. 5).

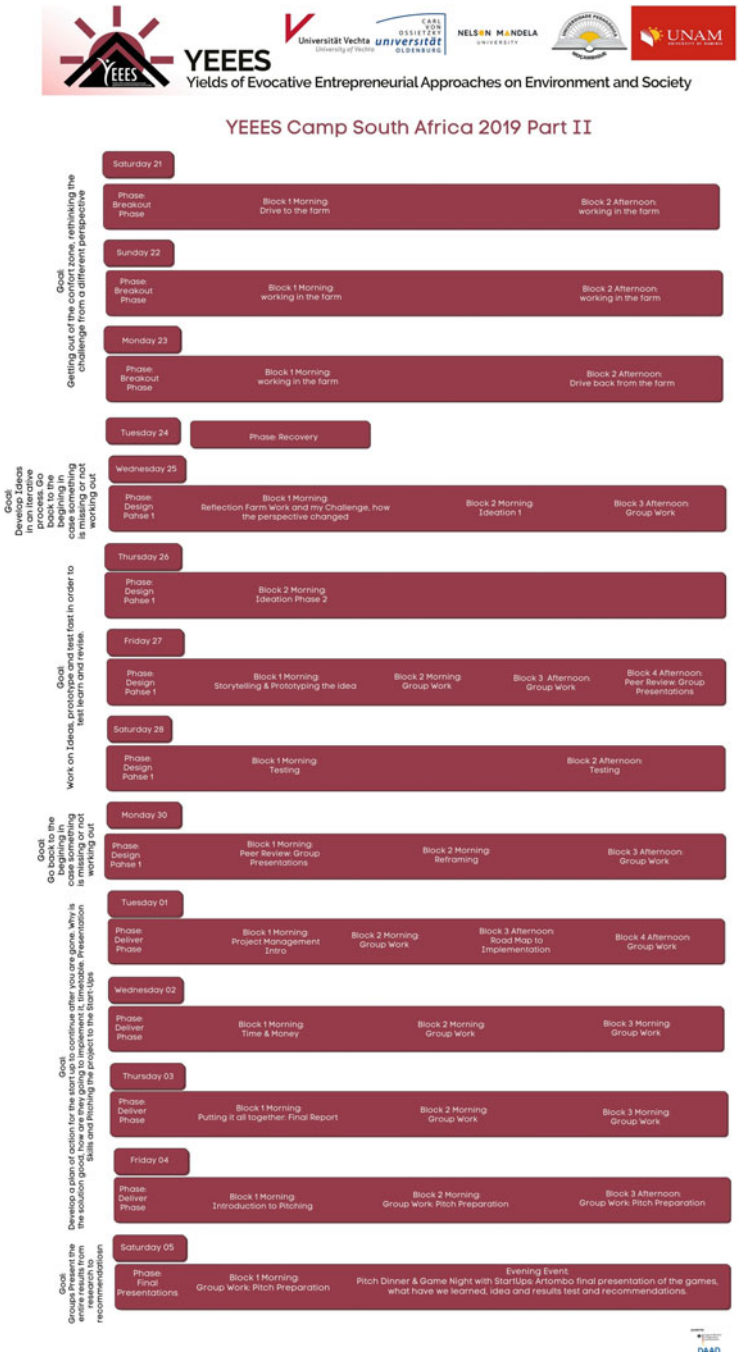
As shown in Table 3, we prepared a more structured schedule for the students. Even though we have argued that entrepreneurial competences are strengthened when overcoming challenging situations with less structured tasks, we were taking

Fig. 5 (Left) AfriKhaya Club: coding clubs in local township using the Tanks Children App designed and developed in PE (for more information on the Tanks App see Greyling, 2022). (Right) Red Band Barista Project: a small coffee shop start-up at the Nelson Mandela University attempting to offer better quality coffee to students at an affordable price

Table 3 Time schedule Camp 3

(continued)

Table 3 (continued)



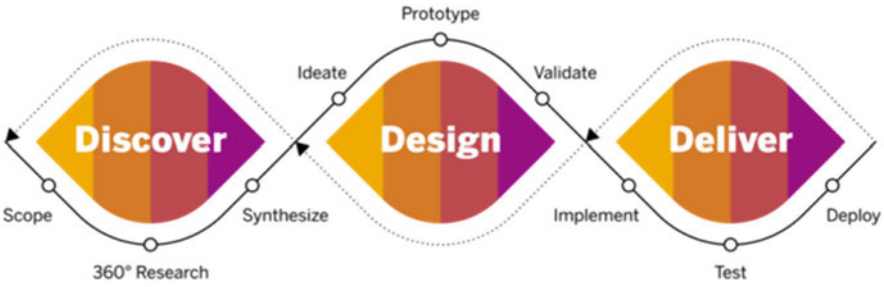


Fig. 6 The SAP design thinking approach. Source: Hauser (2019, July 1)

into account here the reduced amount of time and the particular need for a more detailed preparation when intensively co-working with external partners. The main steps we had in the previous Camps were now organized into stages based on the design thinking approach used by SAP as presented in Fig. 6. The discovery phase in which the goal is to understand the problem better, the background and possible solutions already being tested, followed by the design phase to develop ideas in an iterative process, going back to the beginning in case something is missing or not working out, including a prototype and testing phase to learn and revise, and the delivery phase to develop an action plan for the start-ups to continue after the end of the Camp. The plan includes a statement explaining why the solution is good, and how they are going to implement the solution as well as a timetable. In the last phase, as in previous Camps, presentation skills were taught, including a pitch training followed by a pitch event. As a key element of the Camp, there was a reflection and feedback session at the end. To integrate a personal challenge, we also included a "Get out of your comfort zone session" where the students visited a local farm to experience life there. This challenged them to see the problem of the start-up from a different perspective.

Working with the partners was the focus of the Camp. After the introduction of the participants to the two local start-ups, the students spent an entire day witnessing the daily operations of the start-ups, conducting interviews with both staff and customers. The Camp participants then divided themselves into two groups, choosing the start-up that corresponded best to their own personal line of interest. Over the following two weeks, they worked closely with the entrepreneurs, learning and analyzing the business operations, and looking for areas where they could make the business more efficient and sustainable. The following guiding questions were prepared for each partner start-up:

- Case 1 AfriKhaya: (1) How can the project be economically sustainable, not having to rely on grant money to survive? (2) How to monetize the project? (3) How to acquire more cell phones for the children? (4) How to further develop the game?
- Case 2 Red Band Barista Project: (1) How can an idea on profit sharing be further developed and implemented? (2) What can contribute to positioning the workers

Fig. 7 Transdisciplinary sessions with entrepreneurial core partners

and managers to becoming future owners (entrepreneurial thinking)? (3) How can the existing social business model be expanded beyond the university environment?

Both teams worked on these questions together with the entrepreneurs and had the added motivation that what they developed in the Camp had a good chance of being implemented by the start-ups. Figure 7 shows the students listening to the partners' presentations, and presenting their results to the partners in the final pitch event, as in the previous Camps.

As a result, the AfriKhaya team proposed a business strategy including for example an organization and management structure, a marketing plan, and a flyer for the coding clubs. The Barista project team worked in a twofold manner, further developing the business model, suggested a marketing strategy to gain more customers, and designing the Barista Ladder as a program to motivate employees to become owners themselves (Fig. 8). The South Africa Camp culminated in an event where the two groups presented the results of their work to the entrepreneurs, interested university actors, and other members of the business community.

3.3.2 Lessons Learned

The third Camp was also conceptualized to be solution-oriented, although in this case, the challenge was even more specific, coming from a local start-up, and not a general challenge in the community. Here the participants were able to work from a

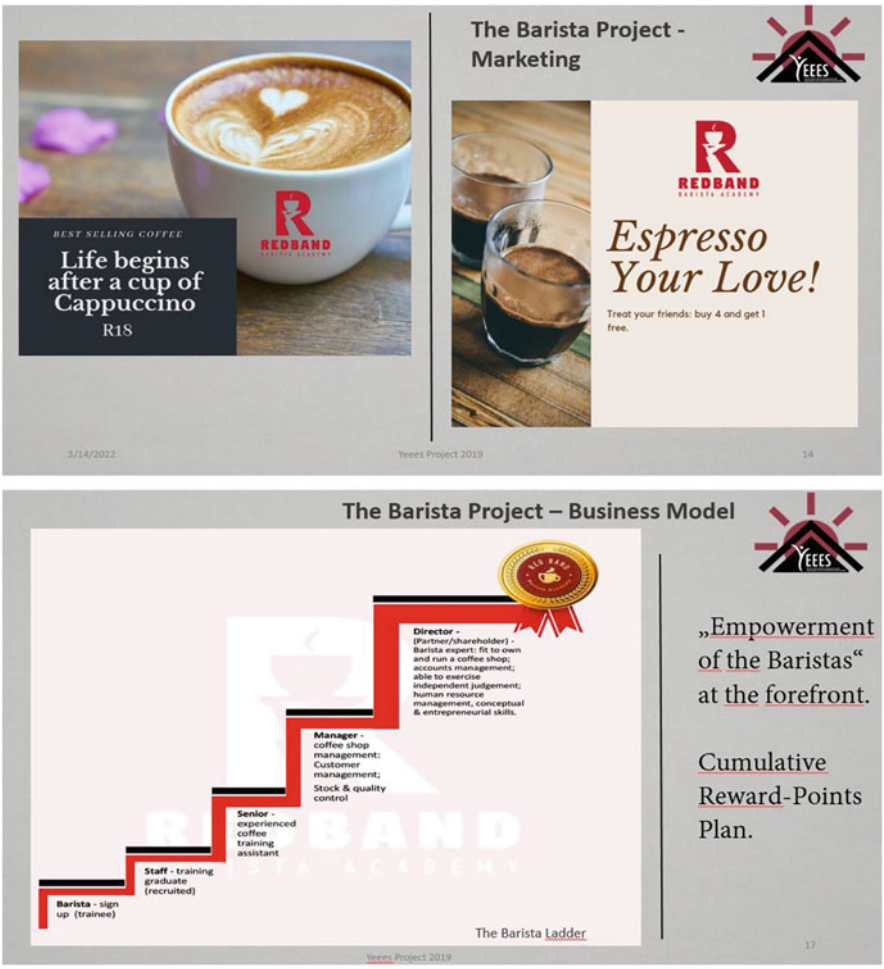


Fig. 8 Presentation of the Barista team results

more user-oriented perspective and were in direct contact with possible users. As for the other Camps, we obtained feedback that this structure allowed the participants to gain intercultural and communication competencies due to the intensive work and exchange with various international partners. Evaluation and assessment also delivered hints that the students (further) developed significant entrepreneurial competencies. They got to know and discuss with different sustainability start-ups. The main factor, however, was that they were involved in the challenges these start-ups were facing. The Camp participants had an intensive look at the existing business models and potential room for improvement. They developed and suggested innovative ideas. In addition, they contributed to areas such as marketing, strategy, and finances—all traditional, however, important topics in entrepreneurship education

(Johnson et al., 2006; Kirkwood et al., 2014; Njoroge & Gathungu, 2013; Van der Colff, 2004). By acting entrepreneurially within existing organizations (such as start-ups), the students worked intrapreneurially as well (Antoncic & Hisrich, 2003; Rule & Irwin, 1988). Next to entrepreneurial knowledge, we observed increasing entrepreneurial thinking, especially solution and innovation orientation. The students also reported a noticeable openness to entrepreneurial activities—some even expressed that they had started thinking about their own entrepreneurial solutions. By addressing selected fields of managing a start-up, we also found management competencies such as strategic planning to be appealing.

We also took into consideration the Maxixe Camp participants' feedback regarding the expectations of the locals, and worked directly with the start-ups. Doing this helped any fears of false hopes in the community to be alleviated, achieving a sense of continuity because the start-ups could directly implement the ideas; it turned out that they actually did what was suggested. The lack of clarity about the implementation that we had in Maxixe as a result did not come to pass, because we had a clear player to follow up on the ideas developed during the Camp. This Camp also saw the academic exercise brought to life. Both start-ups implemented ideas developed at the Camp, and were actively doing so until the corona crisis began. The AfriKhaya project is currently not active. The Barista project is still open, and has used different strategies and creative ideas to stay open during the lockdowns in South Africa, for example, allowing customers to buy coffee, which the Red Baristas serve to medical personnel working at hospitals. This is a good example showing how a social start-up uses a challenging situation to act entrepreneurially and solution-oriented as they display and prove their resilience.

On the logistical side, the set of rules and clearly communicating them before the participants arrived was again an important point. This Camp had a larger one-house accommodation which helped reduce transportation costs. The teams here could also work at the house and did not need to travel to the university campus to do so. The integration of local students into South African society was not as easy; the dates during which the Camp took place were not very favorable, which will be important to keep in mind for the next Camp.

3.4 Camp 4: (ICT) Solutions for Sustainable Tourism in Namibia

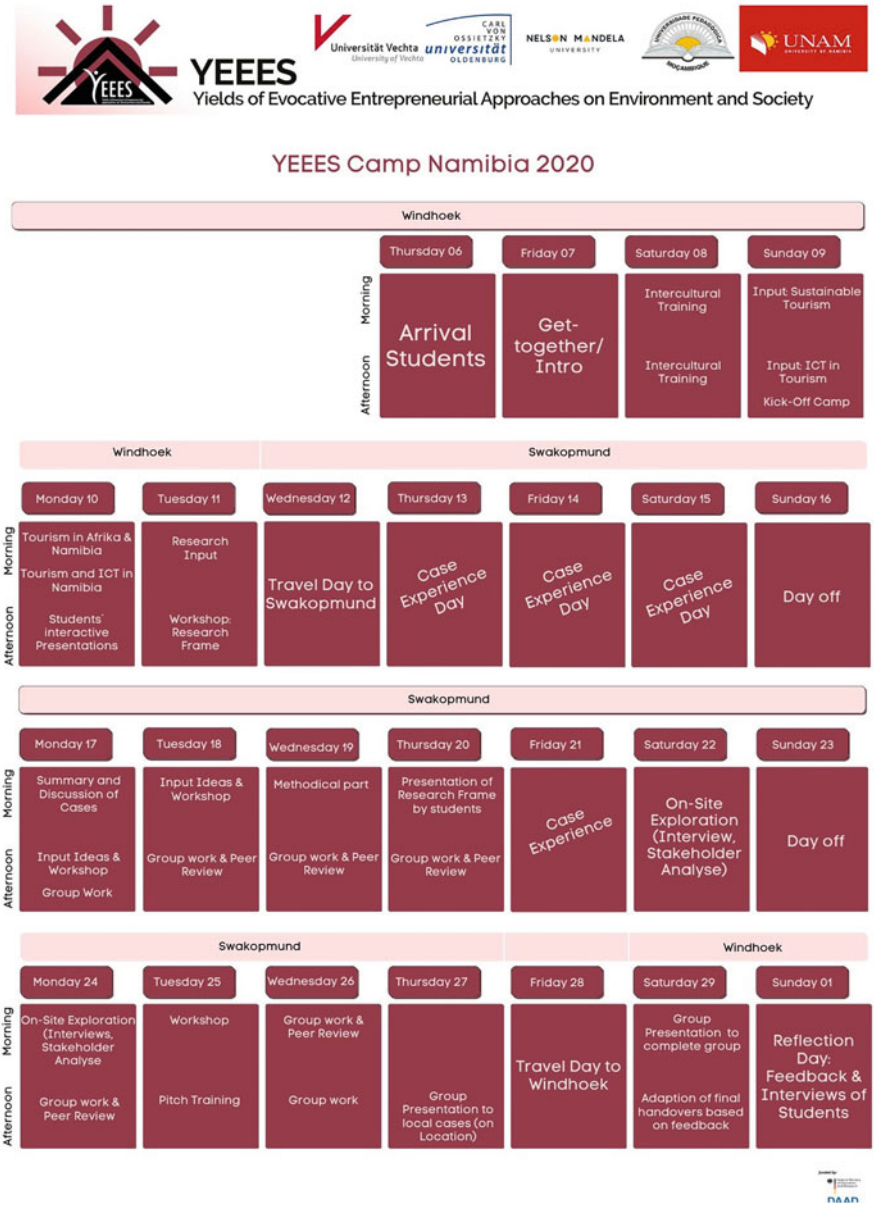
University of Namibia, Windhoek and Swakopmund, Namibia
February 6th to March 5th, 2020.
Participants: Germany: 6, Mozambique: 3, Namibia: 1, South Africa: 3
Experts in the areas of: intercultural training, design thinking, ICT, sustainability and tourism, digitalization and ICT in tourism, pitching, ethics and responsibilities in development approaches and ICT4D, gamification

3.4.1 Overview and Key Content

The fourth and final installment of the Sustainability Camp series was the first and only "traveling" camp, taking place in two different locations in Windhoek and Swakopmund in Namibia. Other particularities of this Camp included taking all the learning of the previous three (solutions for local challenges, working together with start-ups and their particular challenges, developing solutions) and focusing on one topic area. We chose sustainable tourism as the main topic because tourism is an increasingly relevant topic in the Global South, and for Namibia in particular (Dowling & Pforr, 2021; Kavita & Saarinen, 2016). Tourism taking sustainability into account is of particular value here (Kimaro & Saarinen, 2019; Saarinen et al., 2013), and has been shown to attract more and more customers (Baporikar, 2022; Bagus et al., 2019). Tourism covers activities that directly influence the economy as well as the social and ecological environments. Information and communication technologies (ICT) are of growing importance to the tourism industry (Patwary et al., 2020). ICT innovations show the potential to transform the tourist industry, reaching new marketing channels, and providing new products and business models (Pencarelli, 2020; Ruiz Gómez et al., 2018). Beyond websites and booking systems, tourism start-ups can make use of social media channels for marketing to spread tourist-relevant information via mobile apps. This is why we integrated two post-doctoral students as experts and mentors into this Camp. One is an expert in sustainable tourism, and the other is an expert in digitalization and tourism. These individuals were both integrated during the Camp's conception development into the YEEES team, and were also part of the recruitment of the two start-ups we worked with, as done in South Africa. The group of participants in this Camp were the most interdisciplinary of all, given the particular industry being examined, as well as the particularity of the ICT solutions involved.

As shown in Table 4, the first week of the Camp took place at the University's campus in Windhoek, where the participants had their input sessions and the possibility to connect to other projects in the university related to sustainable tourism. This Camp also commenced with intercultural training. The students not only got to know each other and their countries or origin, but learned in particular about Namibia and its history, along with basic information about its tourism. There were additional input sessions that focused on tourism and the roles of sustainability and sustainable tourism. The didactical approach included those we experienced for developing, discussing, and structuring own ideas. Here, we allowed more time for meeting the company partners and experiencing Namibia and selected (sustainable) tourism offerings, while we shortened the problem analysis and ideation phases. Both teams still were able to present their ideas after their pitch training. Following this phase of the Camp, the participants traveled 200 km south to the seaside town of Swakopumund. In this integrated traveling format, we kept the focus on working with existing start-ups to achieve innovative solutions. The following two start-ups were selected as key partners:

Table 4 Time schedule Camp 4



- *Anchor Adventures*: is an agency providing historical tours of Namibia by local guides, exploring some of the local neighborhoods, including indigenous groups, where profits are split to improve their living conditions. The task for the students was how to implement corporate social responsibility (CSR) into their business plan and develop a communication strategy using ICT tools.
- *Aguagreens*: is a unique organic farming concept which sustains itself by the sale of its products, as well as consulting on their farming concept for others to use. The idea of providing farm tours and restaurant services to tourists interested in organic, sustainable agriculture was an option the entrepreneur was exploring, as she had recently received a piece of land. The main goal for the students was to look for ways to improve her business concept, particularly with ICT tools.

Morning trips to the start-ups were followed by rigorous afternoon sessions searching for ways and opportunities to increase their overall sustainability and business health. Once the participants had a strong grasp of the business operations and the ways in which they believe it could be optimized, they divided into two groups to work on each of the cases; other subgroups were created for, e.g., financing, market research, concept, or construction plans. The groups worked in constant communication with the mentors, the start-ups, and within their groups to obtain feedback while developing their ideas and not just at the end of the camp. The peer review sessions were used in this Camp to learn from the other teams, and provide active, constructive criticism. Furthermore, they received support from different international experts.

The participants returned to Windhoek where they polished their presentations under the guidance of the university staff. The entrepreneurs joined them in Windhoek for the final presentation session, where the participants presented their ideas to a group of university actors, local businesspeople, as well as to the start-ups themselves. The following figure gives some impressions from meeting the partners, and the in- and outdoor workshop sessions (Fig. 9).

This Camp also led to three concept ideas: In the case of Anchor Adventures, the team had the difficulty that, although the case was to come up with ideas for a communication concept for their services, the discussion about including indigenous Namibian culture as a tourism objective and its authenticity or remuneration turned into a more ethical and sustainability debate within the team. This was certainly a great learning experience, even though it made it difficult for the team members to be behind the service they were supposed to communicate. The team managed to present some ideas of other cases that might be applicable in Namibia, while also providing some interesting thoughts to the start-up, even though it did not present a communications plan using ICT tools. The Aguagreens concept development included ideas on how to integrate tourism into their concept to get the most out of the organic farming system. The focus turned to crowdfunding as a way to get investment to properly develop the farming system and the land.

Fig. 9 Impressions from the Namibia Camp

3.4.2 Lessons Learned

Evaluating the last Camp in Namibia also brought new interesting insights to the concept. This was the first Camp in which we picked sustainable tourism as the respective field, with specific preconditions and challenges. We found it difficult to find and select appropriate cases. Even though we carefully picked the topic and developed the input together with our partners from the University of Namibia (UNAM) and the two post-docs who worked with us as experts in the field, the acquisition of partners was difficult. We, therefore, recommend an even closer contact to local stakeholders and networks beforehand, being dependent on the very specific settings to ensure, or leaving the field and tasks more open so that the group of potential cases to work on would have a longer duration.

On the one hand, travel was certainly a highlight of this Camp, although it took its toll in terms of logistics and time, leaving less time for the teamwork and ideation compared to the other Camps. The main area of competences that were best (further) developed at this Camp was most likely the intercultural skills and knowledge. According to the students' feedback, the reflection and assessments from the participants underlined the experience they made with regard to getting to know the country. This may be traced back to the fact that the students had the possibility to see various places there. In addition, traveling together can have the effect of an additional intercultural training, making the participants experience different views and habits, and leaving time for private conversations. Interestingly, some participants and the mentors and trainers involved broadened the intercultural competence perspective by including cultural differences between areas of expertise. The

interdisciplinarity caused by the mixed group of students and trainers and external experts in the fields of tourism, entrepreneurship, sustainability, and ICT also contributed to a better understanding of other disciplines' perspectives, orientations, and approaches.

On the other hand, we saw mixed results concerning the (sustainability) entrepreneurial competence acquisition via our last Camp format. This can be traced back to the fact that we did not have enough time remaining for problem analysis, or for idea-generating workshops due to travel and additional meetings with partners. However, there were nevertheless positive results for entrepreneurship orientation and strategic thinking and planning competencies, although this appeared to be less pronounced than in the other formats. This is in line with the difficulties the students experienced coming up with and concretizing their ideas that they presented. However, we did observe growth in sustainability competences, as the participants discussed different perspectives of sustainability and the impacts of the possible effects in one area might have on another. For example, a tourism offer may focus on environmental sustainability, while not considering its possible negative social effects (or vice versa). As always, there were additional factors that might also have had an influence on the participants' competence development during the Camp—from personal factors (precondition, existing knowledge, and motivation) of the participants as well as the trainers (responsible organizers and external partners), to the environmental setting connected to the topic, or the mix of disciplines. What can be a plus for acquiring a specific set of competencies can at the same time be counterproductive with regard to others. The overall tasks might also have been too ambitious, given the reduced amount of time and the vast amount of preparation, knowledge, and skills needed. However, by adding the experience of this Camp, we were able to derive some implications for educational practice when comparing our experiences. It became obvious that preparing a format like this Camp needs to have an in-depth analysis of the preconditions and resources (with regard to personal expertise being available, as well as country-specific preconditions), a careful decision on what the main competencies are that should be developed, and what resources are then needed.

We also did not have the same type of accommodation in a house setting, so there was no easy access to certain things such as working rooms. This Camp had to deal again with the topic of expectations. In this case, the entrepreneurs, particularly one, had expectations about the results from the team, expecting them to have the same quality as those from a consulting firm, even though it was clearly communicated that this was a team of students performing the work. The students also had interesting discussions, debating in terms of tourism's authenticity when it comes to visiting tribes, not invading their culture or land, whether they should receive remuneration for tourism visits, and if doing so made this tourism inauthentic. A final lesson from this Camp was to have a follow-up with the start-ups. This was possible in Maxixe in the case of the school, and in South Africa given the direct contact from our partner. In Namibia, the cases were not directly connected to the partners, so there should have been a mechanism put in place to allow a follow-up

meeting with them. A helpful idea here might be for the entire Camp participants to revisit their learning after a time of reflection upon returning home.

4 Final Thoughts About Camps as Teaching Formats and Recommendations for the Future

After experiencing four Camp formats, we emphasize that the hard work was worth it. While developing and implementing innovative teaching in international contexts is always demanding and risky, it can contribute to improving competence development, as seen in our Camps. Testing new approaches also shows what works and what does not. Negative experiences help to further develop educational offers, and may also help others to avoid the challenges faced in early adoption phases of a format.

Our work showed that different competencies were stressed depending on how the Camp was designed. As expected, using a design thinking approach to (further) develop sustainability-oriented entrepreneurial ideas worked well. The students gained entrepreneurship knowledge about different forms of entrepreneurship, as well as tools and methods to use for designing, structuring, and discussing possible entrepreneurial solutions. They were pushed to critically discuss current situations and analyze selected problems (systems thinking and normative competence). This understanding is key to developing entrepreneurial answers. In the process, the students also had to discuss which kinds of societal contributions should and could be made (e.g., social, green, sustainability, and transformational entrepreneurship). This can contribute to further developing the competences mentioned above, as well as future-thinking competence. By deciding on the kind of entrepreneurial activity being used to address a societal issue, the students again gained entrepreneurial knowledge regarding, e.g., revenue or business models. Since we worked on real-time scenarios, the Camps included experiences in essential parts of business modeling and management, such as project management, financial planning, or marketing. The latter underlined the importance of targeting group definition and orientation, which is of particular importance because sustainability-oriented work often has to address different target groups such as the beneficiaries of social activity, as well as customers generating income to finance it.

We experienced that focusing on entrepreneurial idea generation works for free processes as well as intrapreneurial activities derived from working within existing organizations such as partner schools or start-ups. Integrating practical partners into real-life settings to design and test ideas broadened the overall understanding of sustainability entrepreneurship and its specific contexts, and allowed own entrepreneurial activity to be experienced in different forms. It also increased the students' motivation to act entrepreneurially. However, this requires an even more structured process that, on the one hand, leaves enough room for exchange with the partners and the entrepreneurial experience, but on the other hand leaves space for input

sessions that introduce and test selected methods, e.g., within the design thinking process in an effort to not forget to further develop entrepreneurial ideas. While for some formats, a free process without any basic or intermediate input (pure experience-based formats) can be the recommended choice, we feel that this does not suit a context that already is very complex and limited in time. Our Camp setting needed a structured plan and at least a certain amount of guidance when working with the ideas.

All Camps contributed to enhancing communication skills. This can be traced back to their pitch training sessions and several settings where the students had to present themselves and their ideas, and was also due to being pushed to talk to people with various backgrounds (different culture, different language, different field and stage of expertise, etc.). The format increased intercultural competencies in several ways: by experiencing different countries and the diversity of cultures within them, and meeting and getting to know and closely work with or even live together with people from different cultures. This was a great way to determine the differences as well as similarities between people, and reflect on own perspectives, values, and approaches. One interesting side effect seen here was how we not only spoke about international differences, but interdisciplinary cultures as well—because we provided interdisciplinary formats, we attracted and therefore formed mixed groups of participants for disciplines with noticeable cultural differences, e.g., students and researchers from management, sustainability sciences, sociology, and computing science. Therefore, along with the joint work with the partners and the guided entrepreneurial idea generation, a reasonable mix of side events, excursions, and spare time is recommended.

With regard to our experiences, we have derived some recommendations for further implementation of the Camp format:

Preparation

Designing a format like our Camps needs sufficient preparation time. It is critical to prepare a structured process with regard to the challenging tasks and the high dependency on external partners and structures within a limited amount of time. In addition, we had to rely on (new) international partners and plan for possible scenarios that the organizers would not be familiar with. Therefore, we stress that it is important to find the right partners (at the university cooperation level, as well as concerning the local practical partners to work with). On-site, responsible contact persons are also very important. We recommend pre-camp online meetings to discuss and determine the overall topic and related tasks, as well as the structure, responsibilities, and travel/accommodation. Pre-camp online sessions can also be offered to the participants to get to know each other and do some up-front preparation work. This is something that might be easier now that we have expanded the experience of and a willingness to use video conferences (one of the positive side effects of the corona pandemic). This by the way could also have great potential to further include experts into various settings during the Camps.

Communication and Expectation Management
A Camp format requires careful communication when preparing and implementing it. First, it is important to clearly define the overall topic, and state a clear and achievable goal and work on jointly developed sub-goals. For example, in our case we had to make sure to derive a common understanding of what sustainability orientation is or can be, and how entrepreneurial activity can contribute to it. To ensure that the communication between the students and the partners worked properly, additional agreements with the partners were required in advance. Expectations played a major role—including those regarding the expectations of others, e.g., students expecting their partners to ascertain a certain result from their work, and who were worried about disappointing them. This is why clear and transparent communication must be the basis of an educational format like this. This applies to participants as well as organizers, and should include partners from research and practice. What is my role? What are my tasks? What if I have a problem? We recommend creating room for exchange whenever possible, meaning that constant exchange and feedback during the whole process should be provided—not only at the end of a Camp. This is important for creating an open atmosphere, avoiding misunderstandings, and supporting networking.

Content and Arrangement of Sessions
The structures that we introduced here all had advantages and disadvantages. Depending on the core aim and the competencies the participants should develop, certain structures are worthwhile. In sum, we recommend a mix of input sessions and practical experiences. Our experience was that this needs time and guidance to lead the participants through the idea generation process, while it at the same time is necessary to leave space for interacting with local partners and experiencing entrepreneurial activity in a real-life setting. While idea-generating workshops, in general, can also be offered at home, the international experience is what counts in this format. Thus, the stay should be accompanied by supplementary events like dinners, excursions, and free time activities. It is also advisable to frame the camp with a starting event and an intercultural training at the beginning, and a closing session that, e.g., presents the ideas to a broader audience.

Timing and Flexibility
We suggest that a camp format should not be designed for less than two weeks. We expect a longer period of time to show greater positive learning outcomes. Four weeks sometimes still resulted in busy, full schedules. However, we are aware of the fact that the length of the stay depends on several factors such as financial support, structural specifications of the participating universities (e.g., nonoverlapping semester and vacation times), and available personal resources (time and expertise). If the duration is too short, we believe that it is then not sustainable—in terms of social sustainability (experiencing the country, building networks, and acquiring competences) as well as environmental and economic sustainability (relation between environmental as well as the financial costs of, e.g., flights compared to the expected outcome). In addition, even the best plans and structures sometimes do not work out as expected, meaning some level of flexibility is required, especially

when working in intercultural contexts. However, this can also contribute to experiencing and learning different ways of handling situations when plans do not work out; this is a great competency that can be developed by international work.

Since the core aim of this chapter was to introduce our Camps as an innovative format, it has to be stressed that the recommendations we make concerning the design and implementation of such a format, and the statements we make concerning the targeted competencies are based on our own experiences. Even though we executed feedback rounds with all stakeholders, and used assessments for observing the participants' competence development, these have yet to be systematically analyzed. Doing so will be one of the next steps toward contributing to research on entrepreneurship education done within innovative formats. We think that it is an important contribution to research as well as educational practice to conduct empirical work in this field, and therefore call for more attention to this exciting area. We look forward to seeing others following up on our work—especially as they further develop the Camp concept and/or adapt it to additional settings, such as other countries or with other topics. This format is not only relevant for business students, but for participants from all disciplines. Entrepreneurship is truly a relevant competence for everyone. Future change agents are needed in so many fields, and those having sustainably entrepreneurial competencies will not only be able to identify, discuss, and understand societal problems, but will also be equipped to derive solutions to overcome them and create positive social, environmental, and economic impacts as they do so.

Acknowledgments From the educators' and organizers' perspective, it was extremely rewarding to see our format contribute to facilitating life experiences for the students, lecturers, mentors, researchers, and practical partners involved as they built up long-term networks and friendships. This takes effort, persistence, funding, and risk. That is why we appreciate the many people who act entrepreneurially, and make this format possible. Our gratitude goes out to everyone involved. We also want to thank the organizations supporting us, including the universities and governmental institutions that act entrepreneurially, and who value and foster formats like this. Their motivation is essential for us to never give up on creating new ways of international teaching. Our thanks go out, especially to the universities involved, as well as the German Academic Exchange Service (DAAD) and the German Federal Ministry of Education and Research (BMBF). Without them, none of this would have been possible.

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Transdisciplinary Learning Experiences in an Urban Living Lab: Practical Seminars as Collaboration Format

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1 Introduction

Sustainable Development in general and energy transition, in particular, are goals in which Higher Education Institutions (HEI) play an essential role, as seen, for example, in Radinger-Peer and Pflitsch (2017)). Other stakeholders are also important players in achieving these goals, and when it comes to regional transitions, the collaboration between HEI and other stakeholders is particularly relevant. Teaching spaces offer one possibility for such collaborations (Hoinle et al., 2021). In this sense, transdisciplinarity research is understood as scientific cooperation between not only different disciplines but also with nonacademic actors. It has the explicit aim of finding solutions to complex societal problems. Its results are transferable to both society and academia, enabling mutual learning processes to become increasingly relevant (Jahn et al., 2012; Lang et al., 2012).

Therefore, conceptualizing teaching and learning formats that integrate content and questions from transdisciplinary research projects can be an innovative teaching approach that can help promote regional sustainability. In this way, students, project partners, and lecturers can benefit from collaboration and knowledge exchange. As we will see in Section 3, practice-oriented learning or experiential learning offers opportunities for students to apply their theoretically gained knowledge and prepares

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them for their professional careers (Kolb, 2014; Gentry, 1990). Project partners can profit from new and innovative ideas from a mostly younger generation, bringing in external views that can stimulate the project process. Finally, lecturers also benefit from an innovative and integrated teaching experience.

The transdisciplinary research project ENaQ [Energetic Urban Neighbourhood] (in German: Energetisches Nachbarschaftsquartier Fliegerhorst Oldenburg) aims at designing a sustainable neighborhood in the city of Oldenburg, Germany[1] and offers an ideal environment for this type of collaboration in teaching. *ENaQ* strives for a regional energy transition and social innovations. Participation plays a significant role as 21 project partners from industry, science, and local administration are part of the project. Furthermore, it takes place in the Helleheide Neighborhood, a hybrid urban living lab (Brandt et al., 2021). Thus, this chapter is based on the experiences from two practical seminars at two academic institutions that are partners in the project. One seminar was designed and implemented by the chair of Social Entrepreneurship at the Sustainability Faculty at the Leuphana University Lüneburg in collaboration with the Chair of Business Information Systems from the University of Oldenburg and the other by the chair of Ecological Economics also at the University of Oldenburg.

Taking into consideration that seminars are a teaching format that has existed for a long time and are well-known for its characteristic of active students' participation, with room for discussions, exchange, and learning from peers (Bates, 2014), we want to specify that practical seminars are those in which on top of the above mentioned characteristics the theory is not only discussed, it meets the real-world praxis. One goal is that practical seminars are oriented toward the professionalization of students since they take the theory out of the classroom and into the world, as seen in Germany with, for example, teachers' training (Dohrmann & Nordmeier, 2020; Krofta et al., 2012). Furthermore, such practical seminar formats align with the proposal of meaningful or deep approach learning. The students' interest goes beyond a grade or credit points, and a genuine interest in the topic, for example, motivates the learning experience. In this sense, approaches such as problem solving and critical thinking fit very well in this kind of learning (Bates, 2014) and are found in the practical seminars introduced in this chapter.

Furthermore, in the examples introduced here, we use extensive teaching models. The students work in compressed time periods, so-called block seminars, instead of the regular weekly sessions (Davies, 2006). This was particularly helpful in coordinating the work with the partners and the excursion to the project site. Furthermore, practical seminars could be categorized as a form of experiential learning (Kolb, 2014; Gentry, 1990). They are also very similar to how Halberstadt et al. (2019), describe as service learning approach: bringing the classroom and the real world together. However, in our examples, instead of working with community service, the collaboration is within a transdisciplinary research project in an urban living lab.

[1] More background information and insights into the project can be found in (Brandt et al., 2021).

The question remains what is then an innovative teaching format. We adopted the definition of Ferrari et al. (2009), in which innovative teaching goes hand in hand with creative learning. This best fits the seminar's goals and align with the project: "any learning that involves understanding and new awareness, which allows the learner to go beyond notional acquisition, and focuses on thinking skills. It is based on learner empowerment and centeredness. The creative experience is seen as opposite to the reproductive experience. Innovation is the application of such a process or product in order to benefit a domain or field—in this case, teaching. Therefore, innovative teaching is the process leading to creative learning, the implementation of new methods, tools and contents which could benefit learners and their creative potential" (Ferrari et al., 2009, p. iii).

In the context of the seminars, the students benefited from learning by being directly involved in research that engages with a real transdisciplinary project. The nexus of research and teaching, although sometimes criticized, is not recent. Humbolt already called for universities to always be in research mode; others claim that it is essential for the students' engagement and motivation, not only for the students but also for the lecturers (Healey, 2007; Healey et al., 2010; Griffiths, 2004).

In Sect. 2, we introduce the seminars' concepts, overall context, and the contents of the different sessions. Secondly, Sect. 3 summarizes the results derived from short surveys containing qualitative and quantitative questions which project partners and students answered after the course and which the lecturers used in their reflection. Thirdly, based on the reflections from all stakeholders, we have determined eight key takeaways for future seminars which can be found in Sect. 4. In these, you find what we believe is essential advice for those planning the same or similar formats. Fourthly, in Sect. 5 we introduce a collaboration process based on the experiences and the gained learning. We propose what a long-term collaboration between a transdisciplinary research project and HEI through such formats could look like, and we finalized with a summary and limitations.

2 Conceptualizing Practical Seminars

A key aspect of the transdisciplinary *ENaQ* project is to offer various possibilities for stakeholders to participate. The participation process design includes four dimensions that enables different participation formats. Incorporating project content and questions into teaching formats is found within the *Neighborhood Research* dimension, including seminars, student research projects, bachelor's or master's theses, or student projects. A thorough description of the participation process design can be seen in Brandt et al. (2021).

As academic project partners, the Leuphana University Lüneburg[2] and the University of Oldenburg offered practical seminars to create a space for exchange,

[2]The Leuphana University Lüneburg was partner until 2018, changing from 2019 to the University of Vechta.

cooperation, and learning. Both seminars were (partly) facilitated by researchers who were also working on the project. In this section goals, frameworks, and a description of the two seminars from each University are presented.

A summarizing table including some commonalities and distinctions can be found at the end of this section Fig. 3.

2.1 Practical Seminar at the Leuphana University Lüneburg

The seminar at the Leuphana University Lüneburg took place in the winter term of 2018/19, with 35 participants from seven different study programs, including, for example, Sustainability Science, Cultural Studies, or Management and Engineering. It was one of the elective seminars within the required module: Connecting Science, Responsibility and Society. As mentioned before, it was carried out by the Junior Professor for Social Entrepreneurship with her researchers in collaboration with the Chair of Business Information Systems from the University of Oldenburg.

As part of the seminar *Innovations and Inmovations for Energetic Neighborhoods* at the Leuphana University Lüeburg, students were actively involved in the *ENaQ* research project. The seminar aimed to get to know and experience the application-oriented approach of a living lab in Oldenburg. The lecturers facilitated a setting to conduct practical research in small groups, working closely with the project partners. The seminar offered the opportunity to gain insights into a flagship project in a smart city context and to enter into an active dialogue with various stakeholders and participating social actors to develop visions for sustainability in *ENaQ*.

The seminar was organized in the form of a block seminar divided into three sessions, plus up to two individual meetings with the project partners. The first session was half a day kick-off event in Lüneburg. In this session, we introduced the concept, framework conditions, and issues to be dealt with in the *Fliegerhorst* context. The seven participating project partners introduced themselves via video conference (Skype) and each presented a few slides on their role and task in the project as well as on the research question(s) or task(s) they wanted to collaborate on. Some of the topics were, for example:

- A lighting concept for the neighborhood considering the needs of the citizens
- A conceptual design for a common room based on scientific literature and further derivation of best practice examples
- How can citizens in the ENaQ area be more aware of energy (electricity, heat, mobility) in the neighborhood? How can measurement data (electricity, heat, mobility) be presented clearly?

The students were then able to select one of the various questions they would want to work with. The seminar facilitators ensured that the groups were as heterogeneous as possible, particularly in relation to the study programs. The team's size was three to four students, except for a team of two. The teams were then asked to use an Idea Canvas, as seen in Fig. 1. This canvas was designed by two of the

Fig. 1 Idea Canvas template

facilitators. It was inspired by the classic business model canvas (Osterwalder et al., 2011) and based on the facilitators' previous experiences with other seminars in which the canvas was very helpful.

The idea canvas goal is to record the first ideas for the respective question in ten fields: to define the goal, the direct and indirect target groups, to think about resources, potential partners, and communication, as well as first considerations on costs, profit, and a simple timetable with the next three steps for the team to define.

Following this first session, the ten teams independently contacted their respective project partners to clarify further details and expectations concerning the question or task. The lecturers informed the project partners in advance that a maximum of two individual meetings should be sufficient for the student research groups to start.

Seven weeks later, the second session took place as a one-day excursion to Oldenburg. The students could visit the site where the project was being developed at the former airbase site *Fliegerhorst* and personally meet the partners involved. In this context, the students gave a first short presentation on their ongoing results and presented questions essential to clarify for the final presentation. This task was solved very successfully and promisingly by all ten teams. Feedback was first collected in the plenary session, followed by an intensive exchange of the teams individually with the respective partner they worked with.

For this purpose, the students used a four-field feedback matrix, as it can be seen in Fig. 2, which was also designed again by two lecturers specifically for this purpose. It was inspired on a SWOT analysis matrix as seen in, for example Gomer & Hille (2015) but adapted and further extended to evaluate the intermediate status of ideas. On the one hand, it is about what previous results are and where

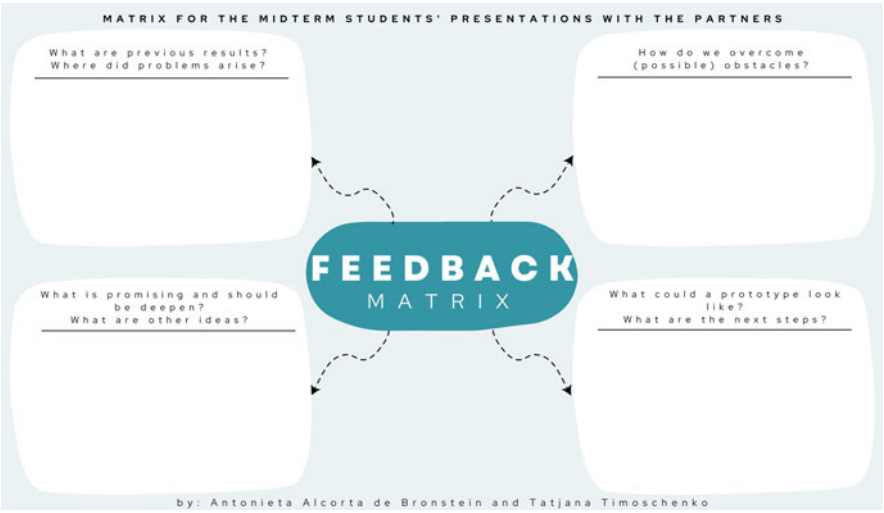

Fig. 2 Feedback matrix

problems may arise, how the stakeholders can overcome possible obstacles, what is promising and should be deepened, and finally, what a first prototype for the idea could look like and what next steps are.

With the feedback from this context, the teams were asked to refine their previous ideas over the next six weeks and, if necessary, to work out the first prototype. At the end of the semester, the final session took place in which all ten teams presented their results. For this session, we invited all partners in the consortium. The teams made 10–15 min presentations, followed by questions from the partners, lecturers, and fellow students. This session took place at the University, and the partners participated online via Skype. Finally, the students handed in a thorough report on their recommendations for action for the partners, which was also the assignment. The lecturers recommended including a reflection on the seminar's learnings in their final assignment, but this was optional.

2.2 Practical Seminar at the University of Oldenburg

The practical seminar at the University of Oldenburg took place in the winter term 2020/21, and researchers of the chair of Ecological Economics were the facilitators. The students that took part in the seminar were from the Sustainability Economics and Management or Landscape Ecology study programs.

The general seminar concept aims to give students a theoretical understanding and an idea of practical concepts of citizen participation. Additionally, the student groups had to develop a participatory format for the *ENaQ* project on a concrete topic or question, which they had to carry out by the end of the semester. Choosing an adequate participatory format according to the intention behind the topic was entirely the students' responsibility within the seminar time frame. Therefore, students applied the theoretical knowledge they had acquired in practice and reflected on their procedure afterward. The facilitators asked all project partners to submit possible topics that the students could address within a citizen participation format framework.

The semester started with an introductory session. The project partners presented their submitted topics to the students during the first part. After which, the students formed groups of no more than five people, according to the student's interests. One exception has been made with one group of six students. In the second part of the first session, the students joined a guided walking tour through the project area. Several project partners presented different project-relevant topics like housing and neighborhood or application fields for hydrogen technology. During the seminar, the lecturers offered two theoretical input sessions during the first weeks. The lecturers allocated the rest of the seminar time for self-organized group work. The lecturers provided consultancy hours upon request.

In the eighth week of the semester, the three student teams presented their interim results to the other groups and to the project partners who submitted the topics. The presentations included:

- Theoretical background information about the topic.
- The aim of the individual participation process.
- The definition of the target groups as well as an outreach strategy for those groups.
- The choice of the participation format.
- The selected method.
- Challenges the teams were facing during the preparation time.

During the online presentations, the lecturers used the digital tool Mural to collect feedback and questions from the project partners and their peers, which was helpful for the students to get feedback about the ideas they had developed. The student groups carried out their participatory formats within the last four weeks of the lecture time. One group developed and carried out an online citizens workshop on "Living without a car: How can we promote the use of car-free mobility concepts in Oldenburg? - Working out new ways together!" The two other groups designed and conducted online surveys on "Energy visualization and energy feedback" and "Guide to living in a sustainable neighborhood."

The students presented their results to the project partners and their peers in the last session. The lecturers again prepared the digital tool Mural to collect feedback remarks and questions on each student group's presentations. The students submitted a written assignment by the end of the semester, including a procedure

Table 1 Seminars comparison

ENaQ Practical Seminars		
	Leuphana University	**Oldenburg University**
Superordinate theme	No	Yes: Citizen Participation Processes
Research questions/ Topics	There were 10 different research questions or tasks from the partners	Three specific topics, all under the theme of citizen participation processes
Partners involved	6	2
Number of students	35	15
Groups size	3-4 (exception one team of 2)	1x4; 1x5, 1x6
Interdisciplinary (number of study programs)	7	2
In Person/Digital/Hybrid	Hybrid	Mostly Digital

description, results, reflection, and learning. This seminar occurred during COVID-19-related contact restrictions; all sessions except the first one were carried out digitally.

In Table 1, you can see the general information of each and which similarities and differences they have. In both seminars, the students had the opportunity and the time for a high level of independent and self-organized group work, experiencing project and team management and coordination as further learning.

We invite you to use the tools we introduced here in your seminars.

3 Reflection

The two seminars were evaluated by the students and the involved project partners by taking part in a short online survey that the lecturers conducted. We use some of the same questions from a general Leuphana evaluation survey which is conducted every semester. The survey contained qualitative and quantitative questions on a scale from 1 to 5. The results of this survey are used to derive learnings for academic–practice collaborations and especially for the involvement of students as academic actors in research projects. The results are additionally used to improve the concepts for future practical seminars within the ENaQ project.

3.1 Perspective of the Students

The survey outcome revealed different aspects of the students' motivation to participate in the seminar and the strengths and weaknesses of the seminar concepts. Furthermore, the students were asked to assess their experiences of the theory–practice interplay within the course. The two main aspects that sparked the interest in the seminars and motivated the students to select them were, on the one hand, their interest in the topics of renewable energies, urban living districts, or the local context of the Fliegerhorst district and the living lab Helleheide. On the other hand, the practical setup includes collaboration with real project partners.

The students highlighted the following aspects of the seminar as positive. Firstly, the practical context, working on an actual project, cooperating with project partners, and possible implementation of the results. Secondly, the students appreciated the freedom of making independent decisions on the selection and the design of the questions or tasks to work with or the participatory formats. Thirdly, the group work was also considered a positive aspect.

In contrast to these positive aspects, they were also asked to state the deficits of the course. The main points mentioned were that they perceived the communication between the lecturers and the project partners as not sufficient due to unclear expectations. Furthermore, they addressed the lack of introduction of a wider variety of participatory formats as a theoretical input to choose from, the lack of time for the presentation of the project, the concept, and partners, and for the discussion.

Apart from these qualitative statements, the students were asked to evaluate various aspects of the seminar by indicating to which level they agree or disagree with certain statements.

The statement "In the course, theoretical content was meaningfully linked to the practical topics/practical examples." was agreed on by 23% of the students, whereas 31% were indifferent and 46% rather disagreed. This outcome is reflected as well in the mentioned weaknesses of the course. Most of the students did not consider the theoretical inputs as relevant to the practical context. In addition, the following statement, "For me personally, the course offered the opportunity to apply what I had learned in theory practically." confirms the missing linkage between theory-practice compatibility as 15% rather agreed, 54 percent were indifferent, and 31% rather disagreed.

The following statement, "I was able to bring in my own practical experience into the course." was answered by 69% rather positive, 15% indifferent, and 15% rather disagreed. The comment "During the course I was able to acquire professional skills." was answered by 53% of the students positively, 38 percent were indifferent, and 8% rather disagreed. Both results show the overall positive assessment of the course in having created an open practical space where students could bring in their own competencies and at the same time acquire other relevant skills. In one free-text field, one student appreciated the "opportunity to try out practical things and make mistakes," which underlined the idea of creating an experimental space with own responsibility for students. The statement "I consider the content and methods taught

as well as the experience gained to be relevant to my (future) professional practice." was rather agreed on by 54% of the students, 31% were indifferent, while 15% rather disagreed. The majority perceived the course content as practically relevant, highlighting the beneficial setting of student-practice interactions.

Eighty-five percent agreed with the comment "I found the collaboration with practice partners to be enriching." while 15% were indifferent. This outcome points out the benefits of collaborations between students and practical partners.

It is relevant to mention that the number of students that took part in the survey is a limitation. In the case of Leuphana, out of 35 students, only 11 responded to the evaluation survey. In the survey at the University of Oldenburg there were 13 respondents.

3.2 Perspective of the Project Partners

The results from the project partners' survey show the strengths and weaknesses of the seminar from their perspectives. Furthermore, they were asked to assess their experiences in collaborating with students and the achieved outcomes.

As a strength, the partners mentioned the value of a critical view from outside the project to get direct feedback. Additionally, they described the active exchange with students as fruitful, which led to new ideas and ultimately usable results.

There were also some aspects which they considered as having a potential for improvement. These included: more time is needed, more interdisciplinary teams, and the communication between the lecturers and the project partners should be more regular.

Apart from these qualitative statements, the project partners were asked to evaluate various aspects of the seminar by indicating to which level they agree or disagree with certain statements. The results are as follows:

All involved project partners agreed on the statement, "I found the collaboration with the students enriching." which shows the overall satisfaction with the seminar. Fifty percent of the project partners rather agreed with the statement "New ideas emerged as part of the collaboration with the students." whereby 33 percent were indifferent, and 17% rather disagreed. The assessment of the comment "The results of the student groups were constructive and valuable." shows that 83% rather agreed with it while 17 were indifferent. Also, this demonstrates that the partners somehow benefited from the outcomes.

Sixty-seven percent of the partners rather agreed with the statement "The effort of accompanying the student groups was appropriate." while the rest did not respond to this question. "The effort of accompanying the student groups was worth it." was rather agreed on by 83%, whereby 17% did not answer this question. Ultimately, all project partners agreed, "I can imagine having students working on a topic as part of a practical project and supervising it content-wise."

The response quota was of six from eight partners that collaborated in one or both seminars.

3.3 Perspective of the Lecturers

From our perspective as co-lecturers, we believe that the cooperation with the project partners was fruitful. We were able to see the research project from different perspectives and have learned more in terms of content. Furthermore, it was possible to observe how the students became increasingly confident in communicating and working with their project partners and that they continuously expanded these skills.

Concerning the results of the student groups, the developed ideas were refreshing and positively surprising. From the partners' perspective, there were different positions, but for us as lecturers, a significant knowledge gain and options, which ultimately benefited the overall project, resulted from the seminars.

We completely underestimated the time required for communication with the students. The limited number of face-to-face interactions and exchange sessions prompted more questions from the partners and even more so from the students. Answering these appropriately and giving feedback on their work processes took enormous time.

The communication within the research project was more accessible for the Oldenburg seminar since the partners already had experienced a first practical project seminar at Leuphana and therefore already knew the procedure and the added value, therefore they could better estimate the effort and adjust their overall questions and topics accordingly. Thus, establishing a long-term and sustainable cooperation with the project partners could bring added value for all parties involved. Therefore, in Sect. 5. we introduce a collaboration process in which different student groups can work with research questions and ideas beyond the duration of only one semester

4 Lessons Learned

Based on the reflections in the previous Sect. 3, we have defined the following eight key learnings and advice for future seminars:

1. **Give your students a chance:**
   In exchanges with other lecturers, we sometimes hear that students may not yet have enough knowledge or experience to work independently and being responsible for actual project tasks. We want to emphasize that the results of the students' work often exceeded our expectations. The students are young adults who enjoy being taken seriously and, given the opportunity, will, in most cases, give their best. Therefore, have confidence in your student teams, and you will not be disappointed.
2. **More exchange with the project partners:**
   Additional interaction between lecturers and project partners could help with a smoother collaboration and might have led to even better results. For example, after the presentations mid-semester, it would have been a good time to point out again as a lecturer what the project partners noticed or to be able to provide

concrete assistance from the lecturer's perspective. The project partners did not complain that they had to give too much input. In this respect, this would surely be a worthwhile additional investment for the lecturers and the partners.

3. **Use of canvas model and feedback matrix:**
   Using an idea canvas at the beginning of the project has proven very effective. Thanks to the framework set up with the help of the canvas, the students quickly knew what was important when developing ideas, and the tasks were thus somewhat more comparable. Therefore, our recommendation would be to always use such a canvas as a framework that can guide the students and support the process of refining the topic further and further. The same goes for the feedback matrix. It is helpful when important aspects are summarized on one page and given a specific structure. Such canvases or matrices can always be adapted to the seminar's goals and needs.
4. **Incentives to create a prototype:**
   Unfortunately, the students did not create hardly any noteworthy (haptic) prototypes that would have made the respective ideas even more tangible. This may have been since the students were asked to analyze and make recommendations for action, which is primarily done in writing. An incentive could be, for instance, that the project partners provide a small budget or that the best prototype is awarded a prize at the end of the seminar. This would give the students the experience of how helpful and motivating the development of a prototype can be, which is particularly essential in business model development. A short input in one of the sessions or an extra session for this purpose should also be considered.
5. **Use comparable questions and evaluation criteria for the examinations:**
   We noted that the comparability of the different project groups and results and evaluating their performance was difficult due to the various questions. Here, our recommendation is to consider with the project partners at an early stage and determine how the tasks can be designed as similarly as possible in terms of scope and workload. This also affects the comparability concerning the examination performances. The students want to understand why their grades may differ. For this purpose, transparent evaluation criteria should ideally be defined jointly by lecturers and project partners in advance.
6. **Do not underestimate the time required for organization and support:**
   Potential for improvement and optimization was seen primarily in time management. Students recommended having an even more detailed presentation of the neighborhood concept and the partners to understand the research project's goals better. In addition, the need for more time for discussion in the individual meetings was made clear. Therefore, our recommendation is to plan more time for communication with students and project partners from the start and to include appropriate time slots in the seminar format.
7. **Courage to go digital:**
   The two seminars took place at different times: The Oldenburg seminar was in the middle of the COVID-19 pandemic when we were accustomed to using digital tools. The Lüneburg seminar took place when we could hardly imagine lockdowns and the mobility restriction to the extent we experienced in 2020/21

when the Oldenburg Seminar took place. Nevertheless, because of the different locations with a distance of 200 kilometers, around 50 percent of the Leuphana Seminar took place with the help of digital tools and phone calls. Therefore, long distances should not be an obstacle to holding seminars with project partners. On the contrary, given digital developments, these will be even better and easier to carry out in the future!

8. **Strive for long-term cooperation!**
   The effort for a practical seminar is particularly worthwhile if the cooperation with the partners can be repeated or continued several times. As we will describe in Sect. 5 the most significant added value of collaborating with research projects lies in the possibility of working with questions and ideas that different project teams over several semesters can further develop. Therefore, consider whether you can offer a seminar format over several semesters if possible.

5 Collaboration Process

After two practical seminars in two different universities within the living lab project *ENaQ* and after reflecting on the learnings from all three different perspectives, comparing both seminars, and looking into synergies that could be beneficial, we want to introduce a collaboration process in which universities and transdisciplinary research projects can further work together while profiting even further from the collaboration.

As we learned in the previous section, partners benefit from the input and ideas of the students. We also learned that a straightforward research question or task helps create a sound output. Considering that the seminar time is limited, it should always be kept in mind that finding answers to a very extensive or lengthy research question or task is not possible. Therefore, we propose an iterative collaboration process in which the research question is divided into smaller aspects that different groups can deal with and build upon during several semesters in an iterative process together with the project partners. After each semester, the students give a detailed report to the partner who uses the results, applies them, or develops them further. The following semester, or if required, two semesters later, a new group of students receives the first report from the previous group plus the development done by the partner and a follow-up research question or task they will work with. This process can continue for several semesters, as seen in Fig. 3. Each semester, a new student group works on a research question or task, building upon the students' work in the previous semester and the implementation or test by the partner.

Such a process has the following advantages:

- It is possible to work with broader research questions, which can be broken down into more minor aspects for each semester.
- There is a higher chance to use the work of the students given the iterative process, building upon the previous ideas.

Fig. 3 Collaboration process

- The students and the partners can see and learn from the evolution of the ideas and previous results.

Such a process requires a particular effort on the side of the partners: a longer commitment to work with students, the processing or evaluation of the results, and to make sure to have clear communication in the form of a report for the new group. On the side of the students, reporting and communication become even more critical since the following semester, a new group of students will be working further with the materials, information, and ideas.

Seeing how the ideas and results presented in the two *ENaQ* seminars in both Leuphana University Lüneburg and the University of Oldenburg, we are confident that such an iterative collaboration process would have been profitable for all parties, the learning experience would be richer, and the input for the project larger.

One concrete example within the *ENaQ* project in which we could visualize such a collaboration process is the energy signal lamp. This lamp could help or motivate the residents to improve the use of, for example, local energy (Klement et al., 2022). An initial student group can work with a survey asking users about the interest, needs, and likes of a visualization tool that informs households about their energy consumption. A partner who develops this technology can better understand which elements are considered relevant from a user perspective using this information. Having a first prototype developed next semester, a new group of students can

design workshops with users to test the prototype and develop the ideas further. In an iterative process, a partner can further develop the outcome of the prototype, and the third group of students can check the usability of the tool. After three semesters, a user-oriented tool, developed through citizens' participation and allowing students to be an active part of the research, has been developed and can be used in the living lab. The process can end here, or a fourth group can take the task of evaluating the use of the visualization tool or working on a business model.

As mentioned above, this collaboration process enlarges the options of research questions and tasks and therefore widens the possibilities. The iteration allows the lecturers to improve the seminar and gives the students the chance to work on an actual research project theoretically and experience it in practice. We believe such a process can be helpful not only in the context of living labs but in transdisciplinary research projects in general and has the potential to make the relationship between the partners, universities, and companies stronger, given a more extended time commitment of working together.

6 Conclusion

As we have seen in this chapter and in the description of the practical seminars, particularly with the feedback from the different stakeholders, it is clear that theory–practice interactions between student groups and partners in real transdisciplinary research projects offer great potential for experiential learning and exchanging new, innovative ideas. From our experiences, we formulated key learnings for those interested in trying out the same or similar formats. The eight key learnings in Sect. 4 provide valuable advice on successfully carrying out collaboration. Furthermore, Sect. 5 introduces an iterative collaboration process that would help involve more broad topics or long-term aspects to be developed during several semesters. With this process, feedback and new outcomes can be applied and integrated in between the consecutive semesters. Thus, the time-wise limitation to one semester can be overcome. Thus far, this collaboration process is an idea we would like to implement in the near future. Further development could also include cooperation between student seminars from different involved universities within a project. In this way, student teams can be, for example, more interdisciplinary. Apart from developing the content and research questions, the structure of the seminar can be adjusted by the lecturers according to the project partners and students' needs.

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Coding Unplugged—A Guide to Introducing Coding and Robotics to South African Schools

Jean Greyling

1 Introduction

Within the context of the Fourth Industrial Revolution and the scarcity of software skills in South Africa, the South African government has announced a drive to introduce Coding and Robotics in schools, from Grade R (Lindeque, 2021). One of the biggest challenges for rolling this out in the country is the fact that we have nearly 16000 schools without any computer labs (BusinessTech, 2018). In addition to infrastructure limitations, Dr. Mmaki Jantjies, a senior lecturer at the Department of Information Systems, University of the Western Cape's, mentions four other challenges: teacher training and support, localized learning content, technical support, as well as safety and security (The Conversation, 2019).

This paper follows on a series of workshops presented online in February 2021 (Bush, 2021; Gibson, 2021; Makoena, 2021; Oosthuizen, 2021). The focus of the workshops was on unplugged coding, aimed specifically at educators who had little prior experience in coding, as well as schools that do not have computer laboratories. The objective of the workshops was on demystifying coding and robotics, while also introducing computation thinking as critical to programming. Practical guidance as to pedagogical sound activities that could be conducted in the classroom was provided.

The paper provides some theoretical background, but mainly aims to serve as a teaching guide to educators who would want to implement unplugged coding activities. Consequently, it will be referring to specific unplugged activities as examples from different available resources. The paper concludes by introducing some computational thinking exercises as well as providing coding examples from

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the TANKS coding app which was developed at Nelson Mandela University (Batteson, 2017).

2 Background

Klaus Schwab (2016) stated that the powerful effects that digitization and technology have on different work areas are leading to a Fourth Industrial Revolution. He predicted that the effect new technologies would have on the digital, biological, and physical zones is extreme, letting all these zones merge and do greater things that were thought previously impossible. He expressed concern about how automation will get to replace certain jobs and how larger countries will be able to dominate the new economy. Technology could be the main reason for the income of many jobs stagnating or decreasing.

Xu et al. (2018) provide insight into what factors are leading to the Fourth Industrial Revolution. They see the Internet of Things and disruptive technologies as the main driving force behind it. With these new disruptive technologies, it is vital to have both the infrastructure and the workforce to be part of this revolution. They think that it will take longer to occur due to the gaps that exist in today's societies between those countries that are ready for it and those which are not.

In acknowledging this challenge, South Africa's President Cyril Ramaphosa (2019), in his 2019 State of the Nation Address declared that he had appointed a presidential commission on the Fourth Industrial Revolution. He placed importance on getting South Africa to be part of this revolution, preventing too many South Africans to be held back because of the digital divide in the country.

Within the context of the Fourth Industrial Revolution, computer programming and robotics are becoming essential to the economy of the future. To establish and build an economy in such a way to support this, people are needed who are able to develop and work with the latest technologies. Singh (2004) predicted this nearly 20 years ago already. To get a population that is comfortable with technology, children need to be enabled to programme and be comfortable with robotics. However, in South Africa there is a problem with this as the poorer and more disadvantaged communities lack access to computers. Due to their lack of exposure, they cannot be expected to have an interest in it and this implies that they will fall further behind in this economy. This is part of the problem known as the digital divide. The digital divide consists of four kinds of barriers to access (Deursen & Dijk, 2014).

- Lack of elementary digital experience.
- No possession of computers and network access.
- Lack of digital skills caused by insufficient user-friendliness and inadequate education or social support.
- Lack of significant usage opportunities.

A further challenge for South Africa is that software development is seen as one of the scarcest skills. According to the latest CareerJunction Index Report for February 2021 (Career Junction, 2021), Software Development remains one of the highest sought-after skills, with Information Technology the top employment sector. The CareerJunction Index analysis is based on comprehensive data gathered from the CareerJunction website—where around 3000 of the country's top Recruiters (both agencies and corporate companies) advertise their positions to millions of registered job seekers.

In addition to the implicit value of teaching coding, it is important to acknowledge that coding has wider advantages for learners. Marr (2019) identifies the following top skills needed for future work: **Creativity**, Emotional Intelligence, **Critical Thinking, Active Learning, Decision-Making, Interpersonal Communication**, Leadership, Cultural Intelligence, **Technology,** and Embracing Change. It is easy to note that the boldfaced skills are all related to coding activities in the classroom. DePryck (2016) says coding is about algorithmic thinking, where more complex actions are broken down into a sequence of instructions and computational thinking. The learner is taught to focus on problems and their solutions.

Section 3 provides an overview of some theories related to the work, with Sect. 4 introduces the concept of unplugged coding. Computational thinking (Sect. 5) and the Introduction of Coding (Sect. 6) are then discussed, combined with actual activities and exercises that can be implemented in the classroom. Some of the main resources of computational thinking exercises are introduced (Sect. 5), while it is shown how the TANKS coding app is used to introduce basic coding concepts (Sect. 6).

3 Educational Theory

In this section, the following three theories are discussed: Piaget's Theory of Cognitive Development, Vygotsky's Sociocultural Theory, and Kolb's Experiential Learning Theory.

3.1 Piaget's Theory of Cognitive Development

Piaget (1952a, 1952b, 1972) describes a developmental theory that is concerned with the different stages of cognitive development throughout childhood development. The *sensorimotor stage* is concerned with infants and their instincts, which is not relevant to this paper. The second stage of development is known as the *preoperational* stage. Piaget (1952b) formally defined the bounds of the *preoperational* stage as typically being between two and seven years of age. In this stage, words, images, and ideas tend to be presented by symbols. This is why children in this age group often engage in pretend play.

During the *concrete operational stage*, 7–11 years, children begin to perform mental operations such as problem solving and arithmetic. They begin to understand reversibility and conservational concepts; however, they do not always understand all of them.

The *formal operational stage* (starting around 11 or 12) is when children are able to hypothesize different solutions to the same problem. Children in this stage begin to think abstractly.

Based on Piaget's developmental theory it can be concluded that age is the limiting factor in understanding many programming concepts. It seems that children in the *concrete operational stage* should be capable of basic sequential logic, with the more complex logic being more suitable for the *formal operational stage*. The *preoperational* stage, however, also creates an opportunity to introduce children to coding through play. All of this is relevant to the exercises referred to in this paper.

3.2 Vygotsky's Sociocultural Theory

Vygotsky (1967) discusses play and its role in the mental development of children. He suggests that defining play as symbolic, could lead to a limited understanding of play in children. This implies that the imaginary situations children create during play have rules, which are based on reality. This directly relates to the interface metaphor in software development. Vygotsky's theory further includes a concept referred to as the *zone of proximal development,* which refers to the difference between a child's ability to learn when they receive guided supervision versus receiving no help at all (Kolb et al., 2000). A form of educational instruction, called *scaffolding*, is based on Vygotsky's theory and the concept of the zone of proximal development. Scaffolding indicates that a child should receive supervision when learning, but no more than necessary.

The aspects of play as well as guided supervision are closely related to the exercises focused on in this paper.

3.3 Kolb's Experiential Learning Theory

Kolb et al. (2000) describe experiential learning theory as a process whereby people learn through a transformative experience. One model related to experiential learning is the *Experiential Learning Cycle* (ELC), consisting of four components that make up a four-stage learning cycle required to learn effectively. *Concrete Experience* refers to perceiving new information through tangibility and relying on your senses. *Abstract Conceptualization* refers to thinking about new information and analyzing it without your senses. *Reflective Observation* is a personal reflection of what is experienced during the *Concrete Experience* phase. *Active Experimentation* refers to the application of newfound knowledge.

Once again experimenting through experiential learning is an intrinsic part of the exercises mentioned in this paper.

4 Using Unplugged Coding in Education

Unplugged coding makes use of games or activities that can be done offline using tangible objects, such as paper and markers. It could also be referred to as offline or tangible coding, which is a very hands-on approach**.** In the South African context, unplugged or offline coding could be seen as a "Plan B" where there are no computers available. Furthermore, it could be viewed as an easy way for teachers who do not have a coding background. Although these considerations are valid, there are, also, many good pedagogical reasons for introducing coding offline.

David et al. (2006) stated that a *hands-on* approach to learning could inform cognitive development through its kinesthetic involvement by going from concrete to abstract, which closely follows Kolb's Experiential Learning Cycle discussed in Sect. 2. Rogers et al. (2002) suggested that allowing children to use mixed realities (virtual or physical tools) in the context of play and learning allowed for uncharacteristically extended interest and reflection. The extended interest would be key for an introduction to programming concepts.

Marshall (2007) stated that tangible programming may increase collaboration between children, as learning on a single desktop with a mouse and keyboard would result in one or two children taking control of the application while others may only observe. Horn et al. (2009) compared educational tangible systems to graphical systems. The results were that both systems were equally easy to understand, but tangible systems tend to increase group participation. Children were also found to become more involved with tangible systems than adults.

Although it is mostly done on a computer, blocked coding is also often used to introduce learners to coding. Block code is when coding is done in a visual block format (Fig. 1) to minimize potential errors. Visual blocks representing text-based code are dragged and dropped into the code editor (Dodge, 2021). Scratch is the best-known block coding tool, developed by MIT.

At Nelson Mandela University postgraduate students developed B# over 3 years. It represents code visually using flowcharts and icons. B# aimed to address difficulties for new developers in handling language and IDE complexities by using a visual editor to generate the code for them (Brown, 2001; Thomas, 2002; Yeh, 2003). Block code was also used in the TANKS game developed by Batteson (2017) as a tangible coding tool, making use of image recognition and a mobile application. It was referred to often during the 2021 CODING UNPLUGGED workshops, and will be discussed in Sect. 6.

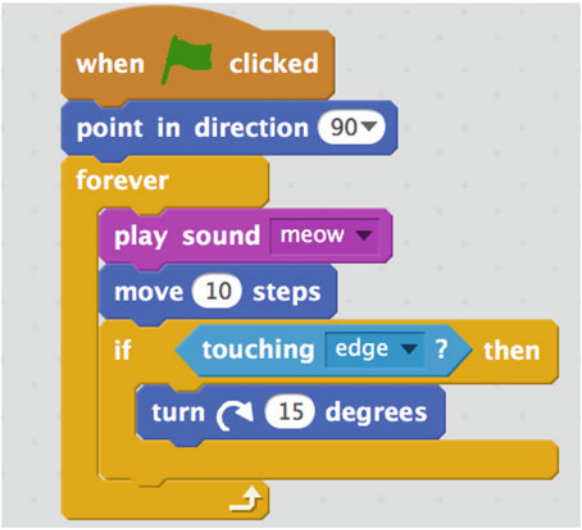


Fig. 1 Block coding in Scratch

5 Computational Thinking

The term "computational thinking" was first used by Seymour Papert and later popularized by Jeanette Wing (Oosthuizen, 2021; Wing, 2006). She defined it as "the thought process involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information processing agent." In addition to coding, it is used in various disciplines such as science, engineering, and mathematics. Furthermore, it is relevant in day-to-day problem solving.

It is generally accepted that computational thinking goes hand in hand with an introduction to programming. Therefore, it is critical that any introductory coding module at school level should include computational thinking exercises and activities. Section 5.1 provides an overview on three potential sources of such exercises. Section 5.2 will then provide an example of exercises focusing on specific skills that have been identified in computational thinking.

5.1 Computational Thinking Exercise Resources

There are numerous resources for computational thinking exercises (Gibson, 2021; Makoena, 2021; Oosthuizen, 2021), which are of great value to teachers. This section will focus on the following:

- Code.Org
- CSUnplugged
- IITPSA Talent Search Olympiad

5.1.1 Code.Org

They state their vision as expanding access to computer science in schools, specifically focussing on increased involvement of women and underrepresented groups. Although they are US based, their following goals are just as relevant to this paper within the South African context:

- Improve diversity in Computer Science
- Inspire students (learners)
- Reach classrooms
- Prepare new Computer Science (Coding and Robotics) teachers

They furthermore believe that Computer Science is foundational to all students (learners) and are committed to equity and access. Consequently, all their resources and tutorials are free to use (Code.Org, 2021).

5.1.2 CS Unplugged

CS Unplugged is a collection of free learning activities that teach computational thinking as an introduction to Computer Science through engaging games and puzzles that use cards, string, crayons, and lots of running around. The activities were developed to provide questions and challenges that programmers would face, without needing to programme first. Although it was first seen as a resource for outreach and engagement (science shows, talks for senior citizens, and special events), the activities are now widely used for formal teaching. Videos are available to show teachers how the activities work. All resources are open source and free to use.

The primary objective of CS Unplugged is to get them to find Computer Science interesting and thus would choose to study it. The specific aims are (Taub et al., 2012):

- To give students a rough idea of what Computer Science is.
- To promote the CS as a career for women.
- To help students make an informed career choice related to work in Computer Science.

It must be noted that Taub et al. (2012) found limited success in reaching these aims. Within the context of this paper, CS Unplugged, however, remains a valuable source of activities and exercises.

5.1.3 IITPSA Talent Search

The Institute of IT Professional South Africa (IITPSA) offers an annual Computer Olympiad, which is one of the oldest and biggest competitions of its kind in the world. The Olympiad takes on three formats:

- The Programming Olympiad is for learners who can programme.
- The Applications Olympiad is for computer literate learners.
- The Talent Search is an aptitude test using problem-solving tasks.

While the Talent Search is an online test, a pen-and-paper version is available for schools that do not have access to computers and the Internet. It is therefore relevant to this paper. This Olympiad identifies learners with computational thinking skills. Past papers can be downloaded from their website. The problems are classified according to levels appropriate to different ages and grades.

5.2 Computational Thinking Skills and Exercises

Four skills have been identified in computational thinking: Decomposition, Pattern Recognition, Pattern Abstraction, and Algorithm Design. This section provides an exercise related to each of these skills.

5.2.1 Decomposition

Decomposition has to do with breaking a larger problem into smaller parts. Exercises to practice decomposition, can be based on real life, as shown in Fig. 2, related to planning a vacation.

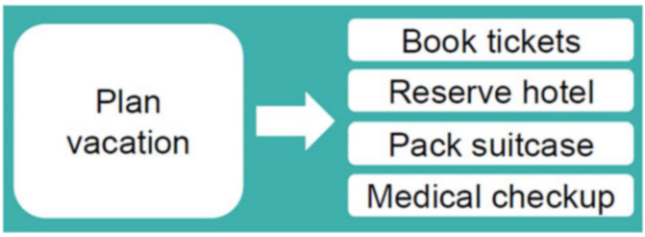


Fig. 2 Decomposition exercise (Oosthuizen, 2021)

5.2.2 Pattern Recognition

Pattern recognition is a very common exercise in mathematics, with most learners accustomed to follow examples where the next element in the sequence must be identified:

- 2, 4, 6, 8, 10, ...
- 30, 25, 20, ...
- A, D, G, J, ...

The Fibonacci series is a well-known series often used in introductory programming exercises:

1, 1, 2, 3, 5, 8, 13, 21, ...

Figure 3 shows the unplugged coding commands to draw a square. With closer inspection, it can be observed that the following commands are repeated 4 times:

- Draw a straight line
- Turn 90 degrees to the right

By recognizing this, the concept of a loop (where commands are repeated) is introduced as shown in Fig. 4.

5.2.3 Pattern Abstraction

Pattern abstraction has to do with focusing on important information only, and ignoring the extra information that does not help solve the problem. In other

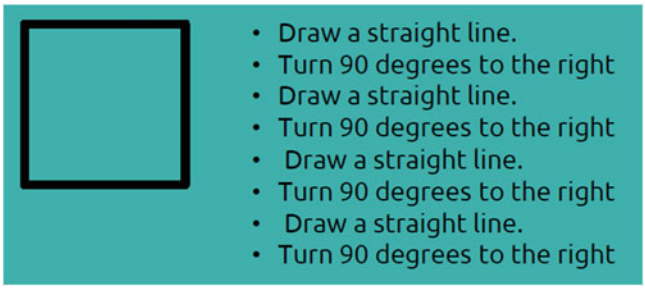


Fig. 3 Pattern recognition (Oosthuizen, 2021)

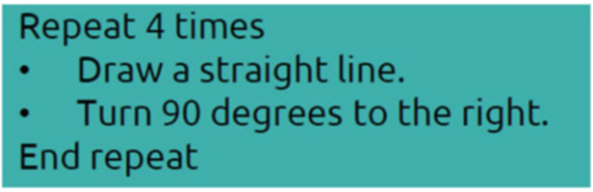


Fig. 4 Introducing a loop (Oosthuizen, 2021)

Fig. 5 Pattern abstraction (Talent Search, 2021)

words, it is about the ability to explain a problem or solution by removing unimportant detail.

In solving the problem provided in Fig. 5, the learner would have to do the following:

- Extract the most important features from the birdhouses.
- Filter out unnecessary details.
- Highlighting the similarities and differences in each birdhouse.

5.2.4 Algorithm

The final step in solving a problem would be to define an algorithm. This can be described as a series of steps that need to be followed in the correct order to accomplish a task. A very basic introduction of an algorithm could be to ask learners to write down the recipe for a cheese and tomato sandwich (or any other dish). They could also be tasked to give directions from the school to another building in town (post office or nearest Mc Donald's).

In Fig. 6, a crane responds to six different input commands: *Left, Right, Up, Down, Grab,* and *Release.* The learners are tasked to find the correct set of instructions to swop the position of the two crates. This set of instructions would be a typical algorithm.

6 Introducing Coding Without a Computer

This section introduces the TANKS coding app and proceeds to give examples from the app on how the following basic coding concepts are introduced: sequential instructions, loops, and nested constructs.

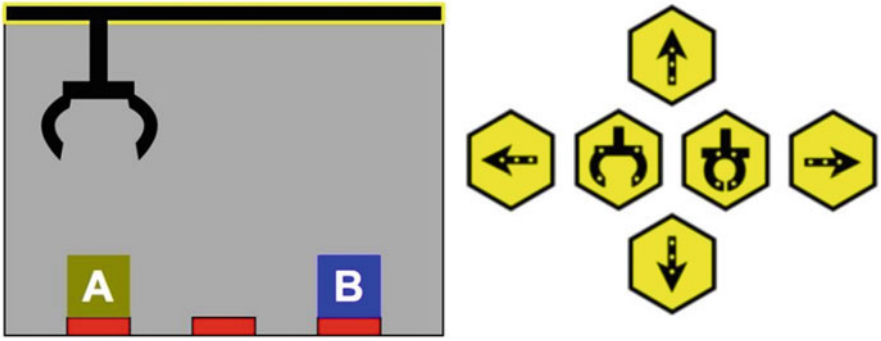


Fig. 6 Algorithm (Robinson et al., 2020)

Fig. 7 Coding in TANKS

6.1 The TANKS Coding App

TANKS was developed by 2017 Computing Sciences Honours student Byron Batteson (2017). It uses tangible tokens (customized puzzle pieces), image recognition, and a mobile app to allow learners to construct instructions that are executed on a mobile device (Fig. 7). No computers are thus needed to introduce coding concepts such as sequential instructions, loops (if and while), if constructs and nested constructs.

Since the launch of the app in November 2017, unplugged coding boot camps have been presented to nearly 30000 learners across South Africa, often in very disadvantaged areas (Willemse, 2019). Various schools and NGOs in South Africa have identified TANKS as a great tool to introduce learners to coding at a young age.

Fig. 8 TANKS workshop at Good Work Foundation (Makoena, 2021)

NGOs such Good Work Foundation (Fig. 8), Nemato Change a Life, and the Govan Mbeki Math Development Centre, as well as Johannesburg Libraries, are some of the most proactive implementation partners.

Kelly Bush (2019) from Hudson Park Primary School in East London has developed 7 lesson plans, aimed at introducing learners to coding through TANKS. This led to the launch of the TANKS School Kit in July 2019. This kit contains TANKS games, the lesson plans, instructional videos, solution sets, and various other resources which empower a school to start its own coding club. The great value of TANKS is that an introductory coding curriculum can thus be offered with literally 6–8 smart phones. The app has 35 levels of increasing complexity, and introduces various coding concepts that would be found in introductory coding modules.

6.2 Sequential Coding

Figure 9 depicts Level 3 from the app. At each level, the tank needs to reach the star as its final destination. For the initial commands, the following sequential commands are available: *Move Forward, Move Backward, Turn Left,* and *Turn Right*.

At first inspection Fig. 10 shows a possible solution for the problem. The *Move Forward* commands have, however, been limited to 3. Consequently, the player has to come up with an alternative solution (Fig. 11). At the end the tank turns left, and then moves backward toward the star.

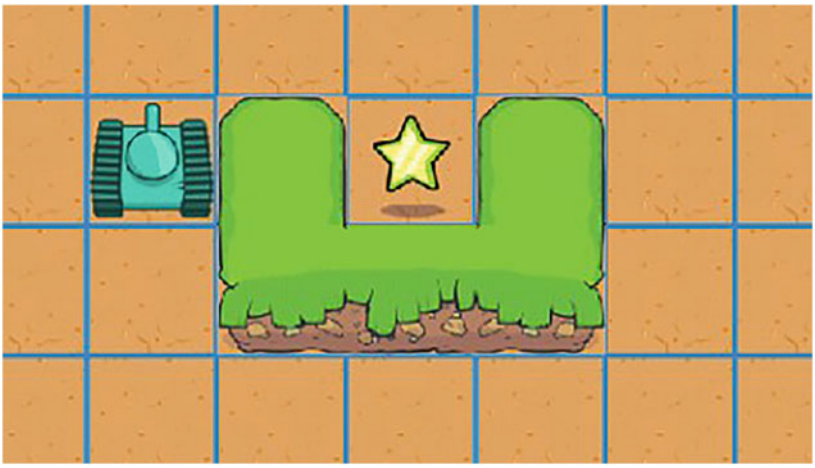


Fig. 9 TANKS Level 3

Fig. 10 Possible solution for Level 3

Fig. 11 Correct solution for Level 3

Fig. 12 TANKS Level 11

6.3 Loops

Figure 12 depicts Level 11 from the app. The basic solution would be to use 5 *Move Forward* commands. As stated in Sect. 6.2, there are only 3 allowed. To solve this problem, the *Repeat* command is introduced, which allows for loops.

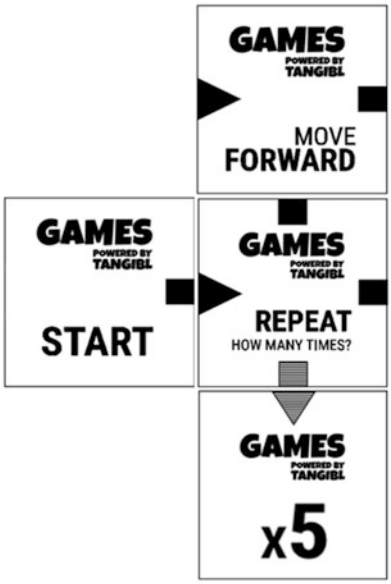


Fig. 13 First solution for Level 11

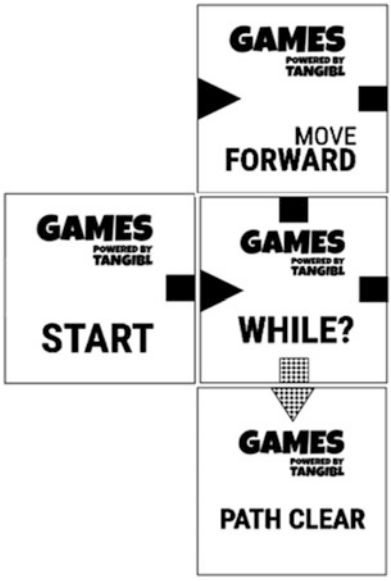


Fig. 14 Second solution for Level 11

Figure 13 shows how a basic loop is implemented. Below the *Repeat* token, the player indicates how many times the command above the *Repeat* token must be repeated. The *Move Forward* command is thus repeated 5 times. An alternative solution to Level 13 would be to use the *While* token (Fig. 14). The *While* command as shown in this solution says, "*while my path is clear, move forward*." The user would expect the tank to go all the way to the wall, but a special feature terminates

Fig. 15 Level 12

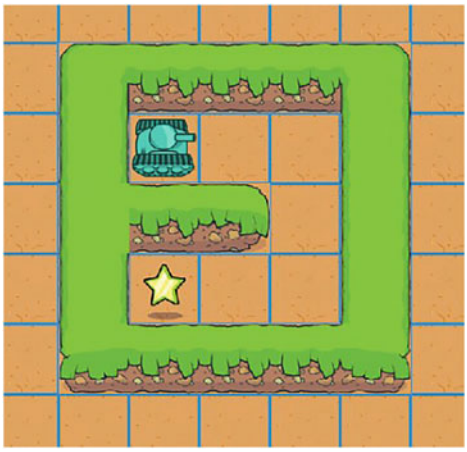


Fig. 16 First solution for Level 12

the activity once the star is reached. This "early termination" of a loop is a typical coding concept.

An important feature of TANKS is that the part that is repeated (referred to as the "*body of the loop*" in programming), can contain more than one command. Figure 15 depicts Level 12 from the app. At first inspection Fig. 16 shows a possible solution for the problem.

In addition to being a very lengthy solution, it has the additional problem of using 6 *Move Forward*. There is an alternative solution to, at some stage, turn the tank around and then proceed with *Move Backward*, but this is even more lengthy. Keeping in mind the early termination rule, as discussed earlier, one could add an additional (unnecessary) *Turn Right* at the end. Now, it is clear that the following set of commands are repeated 3 times: *Move Forward, Move Forward,* and *Turn Right*. Figure 17 thus shows an optimized solution, making use of three commands in the body of the loop (at the top of the *Repeat* token).

6.4 Nested Structures

Figure 18 depicts level 24 of TANKS. At closer inspection it can be noticed that the following commands are repeated:

- *Turn Left*
- *While - Path Clear - Move Forward*

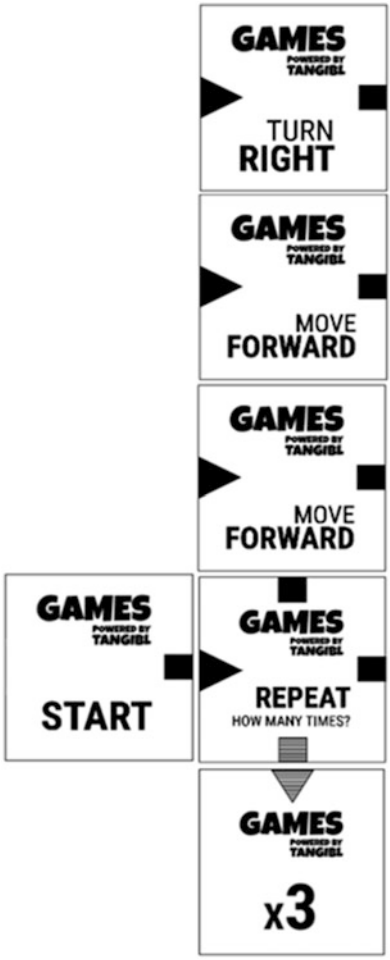


Fig. 17 Optimized solution for Level 12

This needs to be done 11 times, but the repeat only allows repetitions up to 6 times. A solution to this is the Infinite token. Combined with the early termination rule, a solution for Level 24 is given in Fig. 19. The main loop in this solution is thus the loop that "infinitely" repeats the *Turn Left* and the *While* command. Consequently, the *While* command is a nested loop inside the *Repeat* loop, and combined with the *Turn Left* it is repeated until the tank reaches the star.

6.5 TANKS—Summary

The further levels (up to Level 35) become even more complex, and introduce the *If* statement, which combined with infinite *Repeat* loops make for interesting solutions

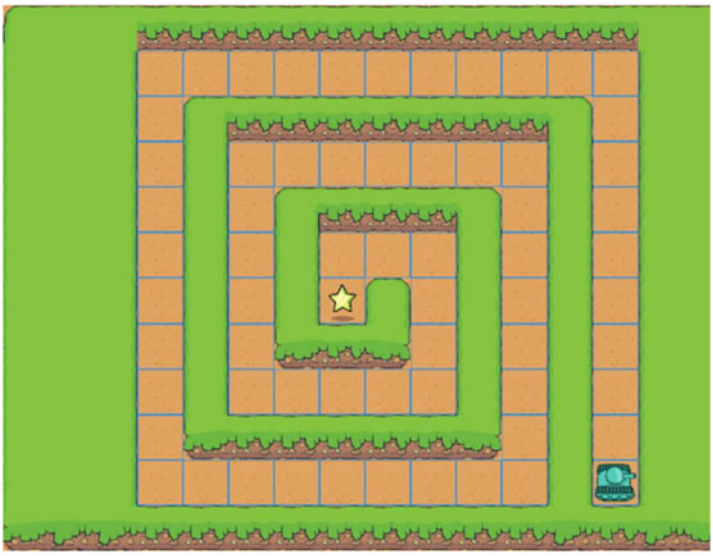
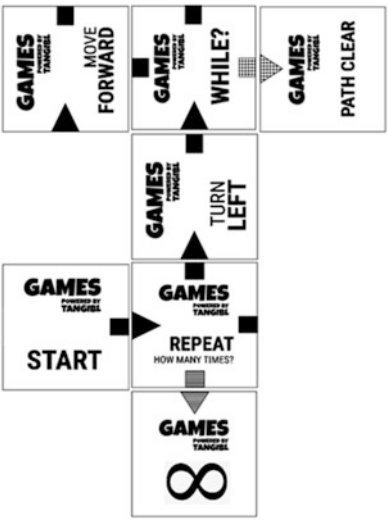


Fig. 18 TANKS Level 24

Fig. 19 TANKS Level 24



to very challenging problems. In addition to being an unplugged solution that only needs a regular smart phone, TANKS has many pedagogical aspects to it that make it an ideal tool to use in a class situation. These include the following:

- Teamwork
- Problem solving
- Scaffold learning

- Strategy
- Immediate feedback
- Conflict resolution
- Dealing with failure
- Fun

7 Conclusions

South Africa is a developing country which needs to guard against too many of its citizens falling behind during the Fourth Industrial Revolution. One way to address this is to introduce coding and robotics in the country's primary schools. With this goes computational thinking. A major challenge in doing this, is the fact that the vast majority of schools in the country do not have computer labs. Furthermore, teachers are not equipped to teach this subject.

This paper shows the importance of computational thinking, as well as coding and robotics. It then goes further to demystify these topics by introducing various resources, exercises, activities, and tools that any teacher could use, without coding experience, or without the need for computers.

The authors believe that the paper makes a useful contribution in empowering teachers to introduce their learners to the skills needed to survive the Fourth Industrial Revolution.

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Part III
Research

"I would help the lecturer with marking": Entrepreneurial Education Insights on Academic Resilience from the Perspectives of Engineering Students in South Africa

Curwyn Mapaling, Paul Webb, and Belinda du Plooy

1 Introduction and Background

South Africa is known for its high youth unemployment rate. The university, which serves as the site for the case study reported in this chapter, is located in a coastal city within the Eastern Cape region of South Africa. The Eastern Cape, for the period from April to June 2021, recorded the highest official unemployment rate across the country at 47.1% (Statistics South Africa, 2021). These alarming statistics relate directly to the employability prospects for young people, more especially students. This particular city is known for its manufacturing and automotive industry which has, in recent years, been impacted by economic constraints further preventing engineering students from accessing appropriate training and employment prospects. On the other end, higher education through the National Development Plan links education prospects to the labour market and industry as a whole.

Entrepreneurship education and resilience, at first glance, appear to be two unrelated concepts. However, we know that globally young people encounter adverse circumstances around their livelihoods and employability prospects. Furthermore, we remain cognisant that the effects of unemployment amongst young people in South Africa are compounded by poverty and a lack of access to education. These socio-economic aspects serve as risk factors that challenge the ability of young people to display resilience. The complexity of the relationship between

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economic and social exclusion on the resilience of young people has underscored the need for solutions that promote greater inclusion of socially vulnerable and excluded youth in higher education.

Within engineering education, recent years (from 2017 to 2018) have seen a change in the qualifications offered at traditional and comprehensive South African universities. The engineering curriculum has shifted from a National Diploma to the Bachelor of Engineering Technology degree. One significant difference is that the new qualification (Bachelor of Engineering Technology) does not include the year of experiential learning (often referred to as in-service training) which was a mandatory component of the National Diploma final-year. In other words, previous final-year students had access to practical experience which is currently overshadowed by the theoretical features of the new qualification. An implication thereof is that engineering graduates no longer enter industry having had prior experience of working in industry. This in turn has possible consequences for graduate employability and how sought after these graduates are when applying for entry-level positions in industry. Collectively, these experiences compound existing vulnerabilities for engineering students.

In the broader study on which the current chapter is based, lecturers have suggested that students have little training to facilitate a smoother transition into industry and the labour market. The reality is that engineering students are expected to enter industry having had prior practical experience; however, this is not happening as the practical component has been reduced to a capstone project. Thus, this chapter aims to provide a new interdisciplinary understanding of how entrepreneurship education may contribute towards the academic resilience of students, specifically engineering students. This chapter is presented as a resilience study and its contribution is made at the intersection of three gaps in the current body of knowledge. The first being the paucity of studies on academic resilience in higher education institutions. Secondly, there is a need to improve understandings of support mechanisms available to students who face adverse circumstances. This second identified gap is based on policy discourses in South Africa such as the National Development Plan (NDP, 2030; National Planning Commission, 2011) which recognises the importance of interventions aimed at supporting young people by adopting a "youth lens" to expand opportunities and reduce marginalisation. Along similar lines, the National Youth Policy (NYP, 2015–2020; National Youth Development Agency, 2015) places an equivalent emphasis on outcomes such as educational attainment, employment and health which are critical to the overall well-being of young people. Thirdly, and in line with the need to improve support mechanisms available for engineering students, there is a lack of literature that engages engineering students to draw on their own perspectives and lived realities.

There are few instances when resilience has been used within the broader field of entrepreneurship and entrepreneurship education. Within entrepreneurship, it has often been used to measure resilience quantitatively with the use of scales and hypothesis testing (see, for instance, Fatoki, 2018; Zhao & Wibowo, 2021). Similarly within entrepreneurship education, the published work is characterised by quantitative measures and experimental designs (consider, for example Prihadi

et al., 2018; González-López et al., 2019). Thus, emphasising the importance of this discussion of qualitative findings in this area of inquiry.

The argument for this chapter rests on both a knowledge and a social gap. The knowledge gap lies in that the available evidence on resources that support the transitions of young people points to a limited understanding of academic resilience as a process embedded in dynamic socio-cultural and socio-ecological contexts. The social gap is strongly linked to the overall aim of this publication on transforming entrepreneurship education. Entrepreneurship education can enhance resilience as well as the employability prospects of engineering students. As such, this chapter brings together the theoretical constructs of resilience and entrepreneurship education and provides insight into how resilience, specifically academic resilience, can be facilitated through entrepreneurship education.

This chapter begins with a brief overview of entrepreneurship education and resilience, in terms of their history and major key points. Although a number of studies have examined academic resilience, there has not been a strong focus on examining it in the context of a supportive intervention such as entrepreneurship education. The novelty of this chapter lies in its application of the youth development approach to education entrepreneurship, as a means to strengthen the academic resilience of engineering students. The next section of the chapter provides a description of the methodology used to draw perspectives from the participants. Finally, the last two sections of the chapter present the findings of the study and discuss several implications that these might have for how entrepreneurship education can be utilised through a youth development lens to enhance resilience amongst engineering students.

2 Entrepreneurship Education and Resilience in Higher Education

Entrepreneurship education and resilience are independently two comprehensive fields of inquiry, which have been brought together in the context of higher education for the current chapter. A brief overview to clarify and contextualise the use of these terms in the chapter follows.

There are varying definitions of entrepreneurship education or enterprise education as it is commonly referred to (Lackéus, 2015). These definitions exist across the different levels of education, from as early as primary through to higher education. In the context of this chapter, entrepreneurship education refers to learning through participating in entrepreneurship with a focus on personal development (Lackéus, 2015). The fundamental aim of entrepreneurship education is to focus on the needs of individuals and what they envision as economically valuable (Duval-Couetil, 2013). Moreover, the understanding which guides this chapter is consistent with that of other authors such as Shane and Venkataraman (2007). These authors stated that entrepreneurship can occur within an existing organisation such as the university in

the current case study and does not solely involve the creation of an enterprise. In his review article, Gedeon (2017) summarises the critiques of entrepreneurship education and states that authors in the field have been criticised for not being theoretically robust and for the absence of best practices and a shared framework.

Resilience is a popular and well-researched construct within the field of positive psychology. Allan and McKenna (2019) indicate that resilience is the capacity or the ability to absorb disturbance and to retain the same structure, function, and feedback. Gayles (2005) refers to resilience as being an individual's ability to successfully adapt to life tasks in the face of social disadvantage or highly adverse conditions. Resilience has also been defined as the capacity to recover quickly from difficulties and an individual's ability to bounce back from a negative experience with competent functioning (İkizer, 2014). Kuldas et al. (2015) assert that resilience can be learned and developed and is a process of individuation through a structured system with gradual discovery of personal and unique abilities. Longitudinal studies show that resilient individuals have gradually developed effective coping techniques that allow them to easily navigate around or through a crisis (Alcuetas, 2019). Individuals who demonstrate resilience are people with optimistic attitudes, positive emotionality, and in practice are able to balance negative emotions with positive ones (Theron & Theron, 2010). Moore and Westley (2011) explained that resilience research focuses on studying those that engage with life with hope and humour despite devastating losses and trials. Resilience is not only said to be about overcoming deeply stressful situations, but also about cultivating competent functioning and becoming more resourceful through these situations (Brown, 2015).

Whilst resilience has been researched in the context of primary school children and adolescent youth (see, for example Cortina et al., 2016; Dass-Brailsford, 2005; Theron, 2012; Van Rensburg et al., 2018), in youth transition (Van Breda, 2017; Van Breda & Dickens, 2017), and in community and family settings (see, for example Ahmed et al., 2004; Liebenberg et al., 2016; Mosavel et al., 2015), there has not been a strong focus on academic resilience at university level and in higher education contexts. For the purposes of this chapter, resilience is defined as the capacity to do well, despite risk and/or adverse conditions (Theron & Theron, 2013). Risk refers to the potential of harm, displacement or loss which may occur as a result of perceived threats within an area of daily functioning (Robinson et al., 2001). Academic resilience can be defined as the attainment of academic achievement despite adversity (Morales, 2008). Risk is often used synonymously with adversity, which has been defined as an unpleasantly bearable difficulty (Castejón & Zancajo, 2015). One of the critiques of resilience theory is that it ascribes value to individuals overcoming adversity as opposed to minimising or eradicating adversity (Van Breda, 2018). Adversity for the youth often takes the form of socio-economic challenges and related financial difficulties (Van Breda & Theron, 2018).

More commonly, theories used by South African universities to conceptualise students within higher education previously include (a) Erikson's theory, (b) Marcia's Ego Identity Statuses, (c) Chickering's Theory of Identity Development and (d) Schlossberg's Transition Theory (University of the Free State, 2018). Marcia's Ego Identity Statuses examine whether concepts of commitment and

exploration are present or absent. This theory specifically denotes four identity statuses; specifically identity achievement, identity moratorium, identity foreclosure, and identity diffusion. Chickering's Theory of Identity Development is viewed more as a circular process with the understanding that the student moves through various stages: developing competence, managing emotions, moving through autonomy towards interdependence, developing mature interpersonal relationships, establishing identity, developing purpose and developing integrity. Schlossberg's Transition theory, on the other hand, takes the view that the student transitions from the situation to the self, to finding support and strategies.

For the purposes of the research reported in this chapter, the term "youth" refers to young people that are of the age to attend university. By broad definition, youth has been defined by Statistics South Africa (2018) as those aged between 15 and 34 years. Youth resilience should be treated as urgent and cultivated. This is supported by evidence that structural disadvantages, hardships, degraded and degrading communities are at the frontline of resilience studies and are what set out to jeopardise wellness (Van Breda & Theron, 2018). Padesky and Mooney (2012) claim that the youth have cultivated adaptive psychological mechanisms of agency and mastery that assist them in self-regulating, problem-solving, meaning-making, and the capacity to either modify how they feel or their circumstances around them in order to keep persisting. Two issues highlight the importance of exploring the two seemingly unrelated constructs of entrepreneurship education and resilience in the higher education context. Firstly, in the South African context, the aftermath of the #FeesMustFall impasse was an added obstacle for students to cope with, and secondly the more contemporary challenge being posed to South African and international higher education is the COVID-19 pandemic. Working in the South African Labour and Development Research Unit, Mudiriza and De Lannoy (2020) found a significant prevalence of depressive symptoms and low levels of emotional lockdown amongst youth during the COVID-19 pandemic.

3 Theoretical Perspectives on Positive Youth Development

Positive youth development emerged as a response to dominant outlooks that problematised young people and their realities. In the 1980s and early 1990s, policy makers began to rethink approaches to youth development "to help young people learn and develop across a full range of developmental areas, taking into account cognitive, social, moral, civic, vocational, cultural and physical well-being" (Pittman et al., 2003, p. 6). This chapter sought to understand the voices of young students and in doing so, share their experiences of academic resilience with the support of an entrepreneurship programme. The chapter draws on a positive youth development to make the argument that entrepreneurship education could be instrumental in expanding the academic resilience of engineering students. Positive youth development is also referred to as youth development, although this chapter will make use of the term positive youth development going forward. The youth development

approach and its emphasis on youth engagement opportunities were especially useful in the analysis of this study as it allowed the author to unpack how personal character strengths (personal resources) and protective factors (social resources) could reduce existing vulnerabilities of engineering students whilst promoting academic resilience.

To this end, the youth development theory situates the individual lives of young people as those that are shaped by varying socio-cultural contexts. This standpoint is generative for grasping how entrepreneurship can indeed be instrumental in a field that, at first glance, focuses on the perceived weakness of engineering students. It is also here that this perspective and its attention to building capabilities and hope is of value for informing entrepreneurship education for engineering students.

Applying a youth development lens to academic resilience means that we need to grapple with the intricate connections between the developmental experiences of young people and the realities that challenge them. In opposition to developmental psychology which uses a deficit approach to supporting young people, Patel (2009) asserts that the term "youth development" has emerged as a counterbalance to the treatment approach. The view held by the latter authors was influenced by the work of Hamilton and Hamilton (2003) who enunciated that youth development can be understood in three broad categories. Firstly, they explain youth development as a process whereby young people grow and interact within their own environments. During this time, young people are developing key life skills to impact on their ability to lead healthy lives in areas such as work, education, and overall society. Secondly, youth development is guided by principles that encourage social inclusion by building on their existing strengths, whilst paying attention to existing patterns that shape the socio-economic and psychosocial needs of young people. Finally, youth development is also used to give a youth-centred language to programmes, policies and interventions that are designed for young people.

To summarise, this chapter takes a youth development approach that places the needs and voices of young people at the centre. Such an approach attempts to engage engineering students about their realities as they transition into higher education. It is important to note that a youth development lens allows us to recognise the strengths of engineering students and how these can be used to facilitate academic resilience using entrepreneurship education. As such, the youth development approach presented itself as a suitable theoretical perspective to support this study in light of the methodological choices which are discussed next.

4 Exploring the Case Study Data

The data derived from a broader case study which involved engineering students, engineering lecturers and student support staff at a comprehensive South African university. This chapter focuses on only one subset of data, namely the individual interviews conducted with the engineering students.

5 Research Paradigm

Through an interpretivist paradigm, this qualitative case study seeks to investigate the perceptions of engineering students' academic resilience in the context of higher education. Hesse-Biber (2017) proposes that "researchers working from interpretive traditions value experiences and perspectives as important sources of knowledge" (p. 23). By drawing on the voices of engineering students "meaning-making" responses will be generated as opposed to the existing methodological limitations under which academic resilience has been previously understood as mentioned earlier. The research question that guided the study is "How can entrepreneurship education facilitate the academic resilience of engineering students?"

6 Why a Case Study Research Design?

Case studies have further been recognised as commonly utilised by researchers in the interpretivist paradigm (Assalahi, 2015; Bertram & Christiansen, 2014). For the purpose of this study, the benefit of an exploratory case study research design (Yin, 2018), is that it allows for rich data gathering possibilities from those within a case.

7 Setting and Sampling

The perceptions shared by the participants are within a particular setting, namely South African higher education. Within this setting, the "case" or unit of analysis is the final-year engineering students in the BEngTech degree programme at one comprehensive university. To be included in the sample group, students had to be at least 18 years old and registered for a BEngTech degree in one of the following disciplines: Civil, Electrical, Industrial, Marine, or Mechanical engineering. Students at the selected university were recruited as a sample group based on institutional data demonstrating increased retention despite engineering students having had the highest dropout rate at universities in general, with half of them not completing their studies (Sunday Times, 2018). This is a resilience study and therefore two factors needed to be present to qualify as a resilience study. The 2020 cohort of final-year engineering students present multifaceted challenges as they transition through their university experience. The first factor being evidence of risk and/or adversity, and the second factor being an established positive outcome despite risk (Sanders et al., 2013; Ungar, 2015). Thus, the study made use of a purposeful sample of 10 final-year BEngTech students from this cohort.

8 Participant Profile

Six of the participants identified as Black African, two identified as Coloured (an official term used in South Africa for population classification, denoting a person of mixed race), one identified as White, and one identified as Indian. The age of the participants ranged from 22 to 28 years, and the mean age was 25.6 years. All of the participants self-identified as cisgender: seven of the participants self-identified as being male whilst the remaining three self-identified as being female. Participants were given the opportunity to volunteer other gender identifications. The sample consisted of four Civil engineering students, four Electrical engineering students and two Industrial engineering students. With regard to nationality, four students were international students whilst the other six were South African.

9 Data Generation Strategy

An interview protocol used by Morales (2008) in a study focusing on academic resilience informed the semi-structured interview schedule which was used as an instrument to generate data for this chapter. Individual semi-structured interviews were used to gather relatable core experiences from key informants (DeJonckheere & Vaughn, 2019). Participants were invited to provide an account of their experience of academic resilience by asking them, first, how they transitioned to university; then, how they understood the socio-ecological context in which their academic resilience occurred; and, finally, which factors contributed to their academic resilience. What is meant by "resilience" is the context of this study (the capacity to do well, despite adverse conditions; Theron & Theron, 2013) was explained to each participant beforehand so that a common understanding amongst the subjects of study would be reached.

10 Procedure

Participants were recruited electronically via email. They received a participant information sheet and an opportunity to ask questions regarding the study was given before interviews commenced. No incentives were offered to any participants to encourage participation. The semi-structured interviews lasted between 20 and 90 min, depending on how much information each participant was willing to share. Interviews were conducted online via Zoom. All interviews were audio-recorded on Zoom, transcribed by a third-party transcription service and stored electronically on a password protected computer. The Zoom platform was used because the COVID-19 pandemic, national lockdown and social distancing requirements made in-person interviews impossible at the time this study was conducted and this necessitated

electronic and remote interaction with interview participants. Limitations include remote interviewing via Zoom due to COVID-19 and the inclusion of data collected at one university only.

11 Data Analysis

The qualitative data generated from the semi-structured interviews was analysed thematically (Braun & Clarke, 2006, 2020). Thematic analysis allows the researcher to engage with the transcripts from the interviews in a reflexive and reflective manner (Braun & Clarke, 2006; Shaw, 2010). Furthermore, thematic analysis enables the inductive generation of codes and themes (Braun & Clarke, 2006). The use of an inductive approach enabled the researcher to draw out themes and patterns to categorise the data during the research process.

12 Ethical Considerations

Prior to the commencement of this case study, ethical clearance was granted at both faculty and institutional level. In addition, all relevant gatekeepers were consulted and subsequently granted access. Participants provided their written consent electronically prior to data generation and were informed that they could be referred for psychotherapy if the interview resulted in them experiencing any signs of emotional distress. In addition, confidentiality of participants was maintained, and no individual names of the participants were used as these were substituted by pseudonyms in order to protect their identities.

13 Researcher Positionality

The author, who identified himself as a doctoral candidate who was not part of the university staff, approached the participants via email. In addition, the author is registered as a clinical psychologist with the Health Professions Council of South Africa (HPCSA). The researcher is aware of their positionality in the study and how this impacts the existing power dynamic between them and the participants. Levels of trust inform existing power dynamics and impact the positionality of both the researcher and the participant. As such, Heath et al. (2009) suggest that building trust is critical when conducting research with young people as was reflected in the theoretical perspective chosen for this study. As such, participants were continuously reminded that they could withdraw consent at any point in time during the interview process.

14 Findings and Discussion

The premise of this chapter is that in order to better understand the academic resilience of young people, it is important to apply a youth development approach to academic resilience first. The argument provided in the introduction is that increased understanding of what is economically and socially valuable to engineering students could provide guidelines as to how entrepreneurship education can contribute to academic resilience of these students.

The section is organised according to three core acknowledgements, namely: that these participants possess inherent assets, character strengths and resilience; that young people should be assisted when asked for help and have the necessary resources made available to them; and that social inclusion is key to a sense of belonging and subsequent retention in higher education. The three main foci mentioned above translate directly to the following three themes, namely (i) personal character strengths; (ii) access to guidance, resources and information and (iii) a sense of belonging and social connection.

14.1 Theme One: Personal Character Strengths

The participants highlighted their personal character strengths. Anele, a female South African Electrical engineering student, speaks about being hard working and valuing how organised she is: *"Yeah, I'm hard working. Honestly, I don't give up. Like many people would say I'm like OCD, but I feel like I organized my plan"*. Similarly, Gavin, a male Civil engineering student from Zimbabwe, describes how his work ethic and being hard working enabled him to surpass expectations by passing even when he was expected to fail: *"I work very, very hard to actually manage to pass because…I was supposed to fail. But I managed to get some distinctions, and especially in… in computers"*. For us to fully appreciate Gavin's sentiments in the above quote, we may need to understand how his educational background and limited exposure to technology in high school negatively affected his transition to university: *"There's a lot that we have to cope with, like for instance, starting from understanding, how a computer works, how [to] operate [a] computer…"*.

The trait of self-determination is one that relates to that of hard work. As Beauty, a female Electrical engineering student from Zimbabwe, said: *"I am so determined to a point that if I tell myself that I would go for this, no matter how difficult it is, I will go for it"*. Jason, a South African Electrical engineering student, expressed his self-determination by saying: "*I'm not one to easily give up"*. Self-determination often requires an individual to be and remain focused. This can be seen in what, Randy, a male South African Civil engineering student said: "*I have a little page here from when I started. Focus and patience. Those two words I have written here on my wall"*. Beyond this Randy reflected on his growth and personal strengths by echoing:

> I've really grown as an individual, no longer so shy. I don't really care what people think anymore. So I've grown in that aspect, so it will be easy for me now. And given my previous work experience and all that to enter into the work environment, because I feel comfortable.

Interestingly, André, another South African male, Industrial engineering student, shared similar sentiments regarding his growth from his prior work experience: *"so that was one thing that boosted my confidence. It was it was really a challenge working there as the shy guy as a receptionist"*. André further expressed how he dealt with this challenge when he stated that*: "I think the most important thing is the motivation because there has to be something you can fall back on if times get challenging because you definitely gonna get tested"*.

However, for Naledi, a South African female Electrical engineering student, it was more a relational character strength. She described how being forthcoming and taking the first step to engage with others seems to have stood her in good stead: *"Being outspoken, I think that is the major one which helped a lot...I would speak, ask, talk, try and make friends everywhere I go. Greet someone, smile with them. Trying to be friendly and create that friendship. Greet lectures, like, after [a lecture] say hi, bye to them"*.

These accounts of personal strengths correspond to the concepts introduced by the youth development approach. As seen above, the participants demonstrated the value of different personal characteristics which comprised and enabled their academic resilience throughout their engineering studies. It is important that resilience research be contextualised, in this instance for the participants within the context of their engineering studies. Resilience research that is produced without critical analyses has a high chance of being decontextualised and not in direct engagement with the contextual and cultural influences required to put the system in a state of equilibrium in order to then further enhance its personal capacity to cultivate favourable outputs (Theron et al., 2012).

Moreover, individual or personal character strengths are part of Tinto's student integration model (SMI) (see, for example McGhie, 2017). Tinto's theoretical model also emphasised the role of past educational experiences, as is evidenced through Gavin's experience with computers. Tinto posited that negative educational experiences could negatively influence social or academic integration. The importance of student integration is expanded on more in the discussion of the third theme, a sense of belonging and social connection, which follows a bit later.

From this theme, we can see that participants resonated with the idea of inherent assets from the Positive Youth Development Approach through their perceptions of their personal character strengths (personal resources). Another key element drawn from the Positive Youth Development approach is that of protective factors (social resources). The participants' social resources are unpacked in the subsequent theme two.

14.2 Theme Two: Access to Guidance, Resources, and Information

For each of the participants, there were protective factors and social resources which could buffer them from some of the challenges they described.

Anele experienced the relationship with her lecturers as a protective factor: *"lecturers give you, like, personal contacts, email. Talk to me whenever we have a problem with this, just communication"*. Gavin expressed similar sentiments but for him it was his relationship with one lecturer that helped him: *"Mrs [X], the lecturer. Yeah, she's just been a mother to me"*. Taj, an international male Civil engineering student, expressed his overall sense of support from his particular engineering department in the following quote: "*you could go there with a problem and someone was there to fix it, help you out . . . there was a more humane factor to it"*. From the perceptions of these participants, it appears that a person- and student-centred department is protective.

Katlego, a male South African Industrial engineering student, on the other hand, speaks about formalised peer-related support and the importance of connecting with a senior student as a resource: "*the only thing from the University that was a starting point was the how to, the how to buddy programme"*. The buddy programme Katlego is alluding to here is the university's first year orientation programme which is an informational and relational resource for all first year university students. Following the intensive orientation period at the beginning of the year, the orientation leader is tasked to further guide the first year through the first semester. Beauty describes a more informal peer support and says that: *"having a friend from South Africa that helped you with the English enough to transition with the language . . . built confidence"*.

In the same breath Beauty stated: *". . .and also through tutoring and having to tutor in English, that also made you more confident"*. As final year students, the participants were eligible to apply for student assistant positions as mentors, tutors, orientation leaders and marking assistants. At times these positions are advertised and other times through an entrepreneurial spirit, students actively approached academic and student support staff to create such roles for themselves. Two instances of this entrepreneurial spirit can be seen in Beauty and Gavin. Beauty communicated the motivation behind her entrepreneurial drive by saying: *"I was waiting to raise my money for accommodation. I never had a chance to hold a book to study. So at some point lecturers they don't understand that we come from different backgrounds"*. Gavin similarly shared how he had to work as a student as a means to sustain himself so that he could retain focus on his studies: *"Now I had to find the money to put food on my table to actually be able to concentrate at the same time"*. He further explained how he did this: *"I would help the lecturer with marking so if you can imagine marking more than 120 scripts and then you have an assignment that is due. You have a test that is due"*. Another participant who tutored and that could relate to Beauty and Gavin was Tafadzwa, a male international Civil engineering student, who conveyed the following sentiments: "*You know the money*

wasn't coming in as they wanted. So yeah, I fixed the problem". The experience of these three international students have shown us how economic exclusion can threaten the attainment of fundamental human needs such as food and shelter.

On the other hand, for Taj, an international student included in this study, acknowledged his position of privilege: *"Financial stress I haven't had that issue."* He went on to emphasise that, *"social, financial, mental health, everything like that. I am fortunate enough to come from"*.

The protective factors highlighted by the participants illuminate the relational component of student success in that the protective resilience enablers reported by students seem to be closely associated with their relationships with academic staff and friends. What emerges from these findings is that how students perceive themselves and the support mechanisms available to support them is not fully reflected in the literature on academic resilience and education entrepreneurship. This finding emphasises the need for South African higher education to take a more assets-based approach to learning and teaching and student support as opposed to the traditional deficit view. The perceptions further suggest the academic resilience of engineering students in South Africa could be supported by introducing entrepreneurship education as a package of support that focuses on the whole individual as a student.

14.3 Theme Three: Sense of Belonging and Social Connection

When looking at the ages of the participants, we see that all of them fall within the period of young adulthood. For Erikson each developmental stage was characterised by a particular psychological crisis, for individuals aged 18–40 years, the psychological crisis was termed intimacy versus isolation. The focus here is on establishing meaningful relationships. Of all of these theories described earlier in this chapter, Erikson's theory speaks more directly to the theory of Positive Youth Development. Some of the participants mentioned their significant others and the protective function those relationships played in buffering them against adverse events. For Naledi, it was a sense of connection amongst female engineering students provided by a specific extracurricular programme and short learning programme (WELA) that made a difference: "*we're introduced to as female engineers in particular [to] WELA*". WELA is the Women in Engineering Leadership Association which aims to empower and develop young female engineering students in what is regarded as a male-dominated profession. For Gavin, his relationship with an academic staff member is what stood out for him, he captured the essence of the relationship by saying, "*Yeah, she's just been a mother to me"*. André had the following to say about how he felt inspired by his partner, "*She's this huge motivation for me. So that's also what I've used to feed that fire in me*". Whereas Taj, described how the relationship

with his friends had grown and the meaning that held for him, "*I was lucky to find a group of friends who are basically family at this point*".

Conversely, others spoke about the feelings of loneliness associated with moving to a new country or province and feeling excluded, both socially and economically. Katlego spoke about having to rely on himself and remaining intrinsically motivated: *"All my life I've practically been doing things for myself. Always been my biggest supporter. I've always been my own motivation"*. Tafadzwa from Zimbabwe could relate by saying, "*I was alone so there was that whole thing you know, like you, you are away from home. . .*".

It would appear that a sense of belonging would have helped certain participants and this could have been facilitated through an entrepreneurship education programme that presents itself as a packaged support system for students. In addition to fostering a sense of belonging, entrepreneurship education has been shown to, through the use of a simulation board game, improve resilience and self-esteem (consider, for example Prihadi et al., 2018).

A related notion to a sense of belonging and social connection is that of social inclusion and exclusion. Anele "*They just didn't like ask us. They just asked only white people"*. Randy, captured his feelings of exclusion when he said: *"...you don't necessarily feel like you belong there. You really think, what is this person thinking. Do they really want me here now?"* Naledi, too, communicated her difficulties with connecting: "*Like such diverse people so it made it awkward, when I try and speak this one is Xhosa, [and] this one speaks Afrikaans"*. Two participants revealed how they had to actively seek inclusion. André stated: *"You have to engage with people. If you don't, you can't get anywhere fast because you can't do everything on your own"* whereas Anele confirmed: *"You have to ask for help*".

Social inclusion and exclusion within higher education are not new to us. One example of this is some of the work by Chrissie Boughey. Nearly 10-years ago, Boughey (2012) reviewed social inclusion and exclusion in higher education. In her paper, Boughey recognises key concepts which bear relevance to this chapter, namely resilience and inherent deficiencies. She argues that greater emphasis on resilience is needed if South African higher education is to move away from the historical focus on inherent deficiencies. Furthermore, Boughey asserts that a move from these two juxtaposed concepts (resilience and inherent deficiencies) may provide a way forward for social inclusion in the changing higher education landscape. On the other side of the coin, is the notion of inherent assets (Nussbaum, 2001) which was discussed as part of the previous theme.

Beauty reflected the following sentiments concerning her experience of feeling excluded as an international student*: "It was a bit tough for me to even ask questions in class because I remember when we studied I was the only international student from Zimbabwe"*. She went on to express feeling excluded due to her gender: *"Especially female ladies, I would actually say especially females. It has a lot of a pressure on us"*.

Students experience pressure in different ways and due to varying reasons. Jason expressed experienced pressure due to the risk of economic exclusion and explained how it propelled him on the one hand:

> I don't have a desire to further my studies. I feel sort of pressured 'cause sooner or later I will be the one who...the others will depend on in terms of my family and so on, so...I feel it's best for me to get into industry now. Get established and things like that so that I can as soon as I can also help out.

On the other hand, the pressure also seemed to have prevented him from seeking help: *"I just sometimes felt I didn't have the time, like I'm under pressure in the hour or two that I would have spent [at] that student counselling. I could have actually spent on studying"*.

Other students did attend counselling, such as Naledi:

> I also went for counselling it also had a lot of impact. I went for mentoring. It did help me a lot. I went for tutoring. It helped me a lot. I attended WELA [Women in Engineering Leadership Association]... It helped me in terms of my inner strength, self-esteem, self-concept. You know in that sense because they all offered different support throughout my career.

Another student was Taj who had the following to say about his therapeutic experience: *"I don't remember her name but the lady... um, helped me so much that I managed to pull myself together after that"*. However, Anele's experience was quite the opposite to that described by Naledi and Taj as she mentioned how she struggled to find assistance: *"It's like professional, like cold" She further stated, "I feel like if I have a problem I have to go somewhere. I have to be able to go somewhere. There has to be a solution somewhere"*. Katlego expressed the tension between maintaining self-care and preforming academically "...you still have to take care of your mental health and try to be as social as possible so that you don't lose your mind at some point. It takes a big toll on us as students". These findings remind us that these students feel that they should be able to support themselves through their challenges without acknowledging that most of the difficulties they face are systemic and structural in nature. In his study on academic resilience, Morales (2008) considers the mental states of academically resilient individuals in contextualising resilience. This inclusion of mental health is significant as it was earlier alluded to as a risk factor. In this sense, the current investigation of the perceptions of engineering students' academic resilience should not be understood as a suggestion that the socio-cultural and socio-ecological contexts have no impact on the choices and opportunities that they have. Rather, it is to suggest that these possibilities are facilitated by mechanisms that enable and constrain students' learning outcomes and ultimately how they transition academically.

15 Implications and Recommendations

Insight into students' perceptions of their own resilience will help to foster deeper understanding of the intrapersonal construction and interpretation of academic resilience and may aid theorisation on the topic. For these participants, once they arrived at university, there appears to have been a clear need for increased

responsibility, independence and an intentional change of what may have previously worked for them to be successful within secondary education or high school.

The analysis provides insights from engineering students' and their understanding of how entrepreneurship may be able to contribute to their academic resilience. This is important in terms of targeted student support, especially in the changing context of new engineering qualifications. It is hoped that the findings will inform learning and teaching policies and practices pertaining specifically to student coaching and advising initiatives, as well as benefit prospective BEngTech students who envision studying at South African institutions of higher education. All the participants with prior work experience, worked outside of the field of engineering. This brings attention to the need for students to gain experience in their respective fields of study to better their chances of employment. Entrepreneurship education can provide participants with both work experience, support networks and the opportunity to better their financial income.

Entrepreneurship education is but one mechanism which must be supplemented by other support mechanisms that engage young people. What we found is that young people need a packaged support that speaks to their psychosocial, educational and economic needs. The successful transition of engineering students from the higher education sector is severely impacted by the lack of a packaged support system. What this means is that young people remain frustrated as they move from pillar to post looking for different kinds of support.

16 Concluding Remarks

In conclusion, a youth development approach to entrepreneurship education is one that would allow us to view engineering students as inherently capable. This chapter brought to the fore the importance of understanding that the transitions of engineering students are impacted by various factors that ultimately lead to exclusion in a myriad of ways. From a youth development standpoint, this is important as it speaks to the ways in which young people should be engaged. As such, a transformed entrepreneurship education is one that seeks to go beyond presenting itself as a standalone support mechanism. Instead, it is one that would engage the needs of engineering students on multiple levels to enhance their academic resilience.

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Prerequisites and the Success of Transformative Entrepreneurship Education

Jantje Halberstadt, Mark Euler, and Johann Bronstein

1 Introduction

As shown in this book, entrepreneurship education (EE) holds enormous potential to contribute to sustainable transformation in many ways. Several authors underscore the critical role that entrepreneurship and entrepreneurs play in supporting the sustainable development goals (SGDs) defined within the UN's agenda for sustainable development (Apostolopoulos et al., 2018; Moon, 2018; Pomare, 2018). This holds specifically true for sustainability entrepreneurship, which is seen as the answer to many 21st-century environmental and social challenges, such as climate change, poverty, and inequality. Greco and De Jong (2017, p.14) define sustainable entrepreneurship as "[. . .] the discovery, creation, and exploitation of entrepreneurial opportunities that contribute to sustainability by generating social and environmental gains for others in society." Due to the societal relevance of these entrepreneurial endeavors, and their ability to generate positive economic, ecological, and social impacts, EE is also being increasingly discussed within higher education institutions (Mets et al., 2021; Strachan, 2018). The entrepreneurial knowledge, in particular, that is provided by, and the skills developed within universities, have been identified as important sources of knowledge spillover and regional development (Andersson et al., 2010; Belitski & Heron, 2017).

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However, while almost everyone seems to agree on the relevance of entrepreneurship for society, and EE at higher education institutions, it remains unclear what exactly EE should aim to achieve, and how EE's success can be captured. Academic work discusses didactical approaches, methods, and specific courses, as well as curriculum development with regard to education for transformative entrepreneurial activity, as we have seen with the selection of articles in this book. We also see some attempts to show the effects EE has, even though there is a lack of work focusing on what the actual outcome of EE should be, and how entrepreneurship and sustainability-oriented educational processes work. What is relevant for generating which kind of entrepreneurial activity? In this chapter, we elaborate on what EE targets, what the success of EE can be, and how these might be measured. We furthermore carve out the need for future research in this field, and call for a stronger competence orientation.

Successfully designing and implementing EE, innovative courses, modules, or curricula require an environment that fosters entrepreneurial thinking and acting among those responsible for shaping and realizing progress in higher education. This includes lecturers and researchers, as well as university leaders on the dean and (vice) president levels. We therefore also call for building EE ecosystems, which we will briefly introduce in the following. We will also derive recommendations for creating an EE-friendly environment.

2 Measuring the Success of Entrepreneurship Education

In light of the growing amount of work on developing and implementing successful elements of EE, the question also arises of which impact(s) it should have and actually has. While single evaluations of individual projects and formats have taken place, research shows no consistent results concerning the success of EE. This has also been criticized by the OECD (2009) and the EU-Kommission (2012), with the latter stating: "It is important to ensure that Member States are not producing their own individual national measures, but instead that they will join forces to find ways to measure the broad impact of entrepreneurship education." Numerous studies and even meta-analyses have been carried out (e.g., Bae et al., 2014; Martin et al., 2013; Nabi et al., 2016; Pittaway & Cope, 2007; Rideout & Gray, 2013). We have carved out two areas of impact that EE focuses upon, mainly based on the work of Nabi et al. (2016), Henry et al. (2005), as well as Jack and Anderson (1998). We briefly introduce them in the following while stressing the findings that studies in these areas have shown so far.

2.1 Increasing Start-Up Activity

One field of research focuses on actual entrepreneurial action as the final outcome of EE, as well as the willingness to become a (sustainability) entrepreneur as prerequisites. There is extensive work on the influence of EE on the *attitude toward entrepreneurship* (Boldureanu et al., 2020; Lina et al., 2019). The majority of the work on the impact of EE on the attitudes of students toward entrepreneurship states that students see entrepreneurship and entrepreneurs more positively after participating in entrepreneurship courses, are more interested in the topic, and in some cases are even more willing to set up a company by themselves (Basu, 2010; De Clercq et al., 2013; Hegarty, 2006; Jones & Jones, 2011).

As an entrepreneurship-positive attitude alone does not necessarily lead to entrepreneurial action, other studies analyze the impact of education on *entrepreneurial intention*, because both are seen as valuable predictors of creating new businesses (Bilić et al., 2011; Krueger et al., 2000; Marques et al., 2018; Mugiono et al., 2021; Paray & Kumar, 2020). We can find two schools of thought among scholars arguing that EE is positively related to EI: human capital theory, and entrepreneurial self-efficacy (Bae et al., 2014). On the one hand, human capital can be understood as "the skills and knowledge that individuals acquire through investments in schooling, on-the-job training and other types of experience" (Unger et al., 2011, p. 343). Scholars of this school contend that EE improves students' human capital, which may in turn cultivate individual attitudes toward entrepreneurship and their intentions to engage in entrepreneurial projects (Liñán, 2008).

On the other hand, self-efficacy with regard to entrepreneurship can be described as "belief in one's ability to successfully perform the various roles and tasks of entrepreneurship (Bae et al., 2014) and it is a widely known catalysator of entrepreneurial intentions" (Fitzsimmons & Douglas, 2011; Scott & Twomey, 1988; Wang et al., 2002). Researchers in EE that support this view assess that EE can be associated with four determinants of self-efficacy: vicarious experience, enactive mastery, emotional arousal, and verbal persuasion (Bandura, 1982, 1986). These elements are facilitated by EE, which help maintain motivation and interest in entrepreneurial achievement, lead to greater expectations of success (Stumpf et al., 1987), and increase entrepreneurial self-efficacy as a result (Bae et al., 2014).

Li and Wu (2019) analyze the influence mechanism of entrepreneurial education on entrepreneurial intention from the perspective of cognition and emotion. These encompass both self-regulation and social cognitive theories to portray the reasons for EE to increase entrepreneurial intentions. In their research, Li and Wu (2019) found that EE increases entrepreneurial self-efficacy and passion. Team cooperation also significantly moderates the relation between both variables mentioned above. These researchers also determined that entrepreneurial passion and self-efficacy act as underlying mechanisms by mediating the connection between entrepreneurial education and EI. Their findings also highlighted that team cooperation has a significant moderating effect on entrepreneurial codependence between EE and EI through emotional and cognitive pathways.

In sum, empirical studies deliver mixed results. Many authors stress a positive effect of EE on the willingness to found an own business (Costa et al., 2016; Shah et al., 2020). Others criticize methodological deficiencies that limit these results, or point at other factors influencing entrepreneurial intentions that may not have been (sufficiently) included in some of the studies (Lorz et al., 2011; Pittaway & Cope, 2007). Furthermore, entrepreneurship intentions and orientation, and how EE influence them can depend on various factors. The age of students as well as the timing (the stage of their studies) may also play a role. For example, Florin et al. (2007) found that entrepreneurship intentions tend to be higher by the end of students' studies when they are about to graduate compared to the beginning of their studies. Others underline the importance of the motivation to attend an entrepreneurship course. According to Hamidi et al. (2008), it is critical that students voluntarily take part in EE. Their field of study also plays a key role (Maresch et al., 2015), as well as the way EE is designed and conducted. Piperopoulos and Dimov (2015), for example, state that EE has a higher impact on entrepreneurial intentions when it is more practically oriented than theory-driven. Recent work also elaborates on the moderating instead of direct effects of EE. As an example, Shah et al. (2020) show how EE influences the attitude toward entrepreneurship, subjective norms, and self-efficacy as predictors of entrepreneurship orientation. Nonetheless, some authors find a negative impact of EE on entrepreneurship orientation and intentions. This is justified among other things by the fact that students estimate a start-up more realistically as a result of EE (Fayolle & Gailly, 2015; Oosterbeek et al., 2010).

Finally, we also find studies that address actual job decisions and the founding of start-ups to measure EE's success (e.g., Donnellon et al., 2014; Gielnik et al., 2015; Premand et al., 2016; Jones et al., 2017). Most of these studies show a positive influence of EE on outcome, measured in terms of start-ups. Vincett and Farlow (2008) even show that between 25% and 50% of students who participated in EE started their own business in the years following graduation. When assessing whether EE leads to increased start-up activity, a wide variety of framework factors nevertheless need to be considered, e.g., the current state of the labor market (Støren, 2014). In addition, collecting data with regard to long-term effects is not easy. Long-term studies such as those delivered by Dutta et al. (2011), Burrows and Wragg (2013), or Matlay (2008) make this difficulty clear.

2.2 Developing Entrepreneurial Competencies

Assuming that founding new businesses is the only or final goal of EE, two questions arise: 1. Why do we find entrepreneurship courses being offered to employees of existing companies, as well as studies on the effect of EE on nascent as well as experienced entrepreneurs? 2. Don't we need entrepreneurial activity (from a broader perspective) in far more situations than just a business foundation? For example, can't extensive benefit be derived from the transformational potential of

entrepreneurial thinking and acting within existing organizations (intrapreneurship) or political systems (political/governmental entrepreneurship)?

In other words, entrepreneurial activity can be seen as far more than founding businesses. According to Barot (2015), entrepreneurial practice starts with actively creating any type of organization. Others use even broader definitions (Diandra & Azmy, 2020). One of the most famous working definitions is "the pursuit of opportunity beyond the resources that you currently control" (Stevenson, 2000, p. 489). Eisenmann (2013) presents the following arguments for this definition: "First, it sees entrepreneurship as a distinctive approach to managing rather than a specific stage in an organization's life cycle (i.e., start-up), a specific role for an individual (i.e., founder), or a constellation of personality attributes (e.g., predisposition for risk-taking; preference for independence). In this view, entrepreneurs can be found in many different types of organizations, including large corporations."

Entrepreneurship orientation for instance is based on a broader view, and understood as a factor positively influencing company success (Gans et al., 2000; Semrau et al., 2016). According to Hughes et al. (2018, p. 119), "EO can be defined as the nature of the decision-making mindset, behaviors, and processes underpinning the firm's strategy creation practice, competitive posture, and management philosophy and thus encapsulates the entrepreneurial tendencies of the firm." Based on the definitions of Miller (1983) as well as Covin and Slevin (1989), entrepreneurship orientation conceptualizations often include innovativeness, proactiveness, and risk-taking behavior. This work has long been established as a relevant research field, with the respective studies dealing with questions on how entrepreneurship orientation can be built up and applied. The field meanwhile also combines entrepreneurship and sustainability, most notably as they relate to sustainable transformation when, e.g., looking at social entrepreneurship orientation (Gali et al., 2020; Halberstadt et al., 2021; Kraus et al., 2017). However, while most of the work here deals with the entrepreneurship orientation of companies, we also find studies on the (social) entrepreneurial orientation of people (Ganjali & Bagherimajd, 2021; Satar & Natasha, 2019). In addition, the entrepreneurial orientation of a company is determined by the attitude and skills of the responsible leaders. This is also the case with decision makers in other settings such as societal and governmental organizations.

Using a broader definition strengthens the importance of entrepreneurial behavior and entrepreneurship because it highlights the increasing potential for entrepreneurs to act as an engine of global economic development, and a force for positive societal change (Eisenmann, 2013; Ratten & Usmanij, 2021). In other words, seen this way, entrepreneurial activity plays an important role in sustainable transformation—as seen in the various examples in this book. EE should thus contribute to enabling students to solve societal problems, or generate positive economic, social, and/or ecological impacts. Some studies have shown these effects, emphasizing that EE can increase the academic performance of students, and lead to a change in mindsets toward life and society (Nasrullah et al., 2016). Here, EE's main task is shifted toward developing entrepreneurial skills and expertise that enable students to act entrepreneurially in a broader sense—including but not limited to the founding of

businesses. The question then is: What are the relevant competencies that EE should focus on?

Entrepreneurship literature delivers five important sets of competencies (Lans et al., 2014):

- *Opportunity competence* (enables entrepreneurs to detect and exploit opportunities by systematically developing adequate problem solutions) (Companys & McMullen, 2007; Shane & Venkataraman, 2000).
- *Social competence* (helps entrepreneurs identify and adequately interact and communicate with relevant stakeholders [network building]) (Baron & Tang, 2009; Walter et al., 2006).
- *Business competence* (allows for the proper management of an enterprise covering the use of resources, decision-making, and business strategy development) (Brickmann et al., 2011; Chandler & Hanks, 1994; Foss & Mahnke, 2002).
- *Industry-specific competence* (includes experiences and knowledge that are relevant to a specific market) (Baum & Locke, 2004; Colombo & Grilli, 2005; Ucbasaran et al., 2008).
- *Entrepreneurial self-efficacy* (constitutes the ability to believe in one's entrepreneurial competence and counts as one of the strongest individual-level predictors) (Mauer et al., 2017; McGee et al., 2009; Rauch & Frese, 2007).

In addition, when focusing on a broader perspective, we find overlap, or even a fusion of sustainability and entrepreneurship competencies; without entrepreneurial thinking and acting, sustainable change would not be possible. Based on the key competencies in sustainability developed presented by Wiek et al. (2011), Lans et al. (2014) derived a set of seven key competencies for sustainable entrepreneurship. Ploum et al. (2018) aggregated these and other studies to arrive at six main competencies:

- *Strategic management and action competence* (consist of the ability to actively involve oneself in responsible actions for the improvement of the sustainability of social-ecological systems and the ability to collectively design projects, implement interventions, transitions, and strategies for sustainable development practices) (De Haan, 2006; Mogensen & Schnack, 2010).
- *Embracing diversity and interdisciplinary competence* (is the ability to structure relationships, spot issues, and recognize the legitimacy of other viewpoints in business decision-making processes, be it about environmental, social, and/or economic issues) (De Haan, 2006; Ellis & Weekes, 2008).
- *Systems thinking competence* (helps identify and analyze all relevant (sub)-systems across different domains (people, planet, profit) and disciplines, including their boundaries) (Wesselink et al., 2015).
- *Normative competence* (allows sustainability values, principles, and targets to be mapped, applied, and reconciled with internal and external stakeholders without embracing any given norm, but instead based on the good character of the one who is involved in sustainability issues) (Blok et al., 2016; Wesselink et al., 2015).

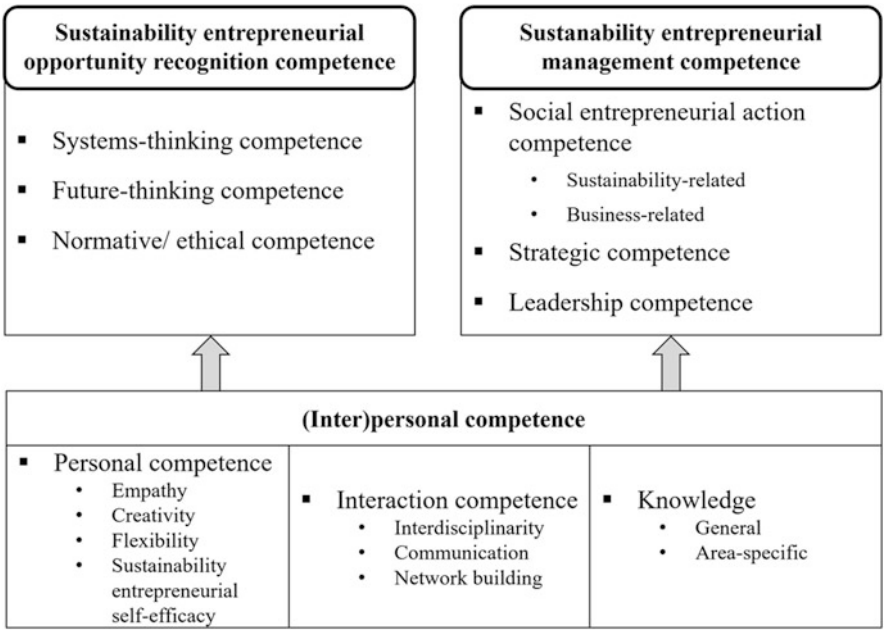

Fig. 1 Sustainability entrepreneurship competence framework

- *Foresighted thinking competence* (is the ability to collectively analyze, evaluate, and craft "pictures" of the future in which the impact of local and/or short-term decisions on environmental, social, and economic issues are viewed on a long-term global/cosmopolitan scale) (Wesselink et al., 2015).
- *Interpersonal competence* (includes motivating, enabling, and facilitating collaborative and participatory sustainability activities and research) (Schlange, 2009; Wesselink et al., 2015).

Halberstadt et al. (2019a) suggest a competence framework for social entrepreneurship. We adapted this to sustainability entrepreneurial competencies in Fig. 1.

These entrepreneurial competencies are receiving growing interest in EE research, even while most authors stress the urgent need for additional work on using and testing competence frameworks. Researchers and teachers should take these or selected competencies as a basis for developing their educational offerings. Returning to our initial question, it is important to not only develop higher education competence-oriented but also test and evaluate whether the approaches actually contribute to the development or improvement of these competencies. To do so, "more research about the 'how' question is necessary to further support teachers in their effort to design competence-based curricula, courses and authentic learning activities aimed at learning for sustainable entrepreneurship" (p. 45). Only a few studies analyze the influence of EE on skill development. While studies like those presented by Halberstadt et al. (2019a, 2019b) focus on a variety of competencies

and how service learning formats influence these as a specific form of EE (for detailed information on service learning, see the work by Schank and Halberstadt in this book), others deal with selected competencies. According to Bell (2015), for example, EE is shown to improve communication, problem-solving, and financial skills. Increasing business knowledge and skills connected to innovation is also stressed. Matsheke and Dhurup (2017) as well as Abaho et al. (2015) show a positive effect of EE on entrepreneurial self-efficacy. The latter underlines that self-efficacy increases with the number of methods being used.

However, inconsistent or a lack of effects, or even negative influences of EE on entrepreneurial skills are also found (Hattab, 2014; Kassean et al., 2015; Oosterbeek et al., 2010; Souitaris et al., 2007). One explanation for these adverse effects can be that students assess being an entrepreneur as more difficult than expected, which can negatively influence the attitude toward entrepreneurship, entrepreneurial self-efficacy, and/or the willingness to gain entrepreneurial skills. This could also be traced back to the quality of EE, the personality of trainers, and/or the overall picture of entrepreneurs that might emerge. In sum, there still is a vast need for further investigation. Empirical work in particular is missing on sustainable competence development as an indicator of EE's success. A prerequisite for this is the measurement of competence development; research here remains scarce. One recent exception, however, is seen in the study by Redman et al. (2021). Based on a systematic review of the growing body of research on the assessment of sustainability competencies, they introduce and analyze various self-perceiving-, observation-, and test-based assessment procedures. This could be the first step into more research in this field.

3 Some General Recommendations for Developing and Implementing Entrepreneurship Education

Against this background, some recommendations can be made with regard to the design of EE. According to Reich (2004), EE formats should be more constructivist based. This means that a subject-independent reality, about which there is objective, subject-independent knowledge that can be "implanted" into the "ignorant" learners through instruction is not assumed here. Instead, it is assumed that the world and its knowledge are constructed individually (Siebert, 1999; Reich, 2004). From this perspective, entrepreneurs are neither "born" nor can they be "made" mechanistically through clever teaching-learning arrangements. Instead, against the background of constructivist didactics, EE involves offering individuals a teaching-learning arrangement, and not imposing it on them, allowing them to make their own learning experiences in a self-determined manner. This is in line with current work on experience-based learning (Williams Middleton et al., 2014), such as service learning (Schank et al., 2020) or challenge-based learning (Hölzner and Halberstadt, 2022).

Within this kind of EE arrangement, diverse "learning stimuli" are offered in a method mix (theory-oriented lectures as well as action-oriented methods such as business simulations, projects, and competitions, and "real-life" experiences). At the same time, orientation including, e.g., mentors should be offered (Euler, 2014). This mix of methods should not be random or chaotic, but theoretically well-founded and structured (Fiet, 2000), since this is the only long-term way to create a corresponding coherent pattern, and thus an ability to act on the part of the learner. One possibility here is to orientate yourself using the experience-based learning cycle according to Kolb (1984) while building up EE formats in the order of theoretical input, illustration, exercise, and reflection. Overall, EE should follow a macro-didactic concept (Braukmann et al., 2009). Here, different EE learning impulses are repeatedly set in different contexts, e.g., in a wide variety of seminars with regard to content, and in an interdisciplinary manner in each semester. Over time, these additional content and learning impulses should come together like a mosaic to form a whole, guaranteeing the most comprehensive, sustainable development of entrepreneurial skills possible.

This effect could be increased when the structure of the course itself calls for more personal responsibility and self-organization. Here, the participants themselves and their personal progress, for example, in planning their career, become a kind of entrepreneurial project. At the Leuphana University of Lüneburg, for instance, this is implemented in the form of "Studium Individuale" (Leuphana Universität, 2021). The students can attend an orientation semester with a variety of introductory courses. Afterward, they decide what their idea is for their professional career and their studies, i.e., which field of activity they aim for, what they want to study, and why. Then, together with a mentor, they develop their individual study canvas or their study plan from the modules of all the study programs. They have the opportunity to become an "I-entrepreneur" and achieve their "business model you" (Clark et al., 2012).

4 The Importance of an Entrepreneurship Education Ecosystem

Developing successful EE that goes beyond the traditional formats and methods that only target the founding of start-ups in the business and management context requires a fundamental structural and cultural change in higher education. Universities have to commit to the concept of EE to allow for a holistic and interdisciplinary approach at various levels. How to change toward an entrepreneurship-friendly environment can be initiated and shaped has been examined in recent years within the framework of numerous projects (e.g., "EXIST Gründungskultur" of the German Federal Ministry for Economic Affairs and Climate Action), best practice studies (e.g., Fichter et al., 2016; Halbfas, 2006; Kulicke, 2018; OECD, 2012; Stifterverband der deutschen Wissenschaft, 2012), and action plans (e.g., European Economic and Social Committee, 2006, 2020).

One way to capture the organizational setting for education-friendly entrepreneurship is by investigating EE ecosystems. The concept of ecosystems has been established in natural sciences, and is increasingly being applied to regional development, or clusters, with a focus on interorganizational relationship structures (Brush, 2014). An ecosystem can be seen as an integrated entity that organisms and their surviving environment create together via interactions in a given setting (Jinyun & Tao, 2016). The ecosystem metaphor is used to create a more specific understanding of the milieu in which entrepreneurship and EE are embedded, with activities fostering entrepreneurial educational progress within it (Toutain et al., 2019). This can be applied to various contexts of EE such as in schools or universities. While universities have been in the spotlight for their contribution to entrepreneurial ecosystems and economic development (Delanoë-Gueguen & Theodoraki, 2021), they can also be the key player in building an entrepreneurial (education) ecosystem—developing and strengthening the entrepreneurial competencies of students, as well as researchers and teachers from other disciplines. Recent work has started focusing on EE ecosystems to better understand how an optimum support structure can be derived, and how different stakeholders can get involved to influence the success of deriving and integrating EE (Bischoff et al., 2018; Wraae & Thomsen, 2019).

Toutain et al., 2019, for example, suggest a multidimensional model to analyze EE ecosystems with the following dimensions:

- The *learning framework* (which refers to curriculum-related information).
- The *networks, connections, and relational proximity* encouraged by the education (which refers to the connections between internal and external stakeholders and the way they are perceived).
- The e*ntrepreneurial culture* of the ecosystem (which is based on key values that its actors perceive in the education).
- The *pedagogical solutions* (which stimulate the learning dimension, such as (a mix of) traditional teaching, experiential methods, and learning by doing).
- The *motivation of actors* to act or not act inside the ecosystem (which is an essential driving force for its development).

Liu et al. (2021) derive the following structure of an EE ecosystem (Fig. 2).

The constituent elements of an EE ecosystem are here divided into two categories: units and factors. While units refer to the institutions, organizations, or stakeholders in the ecosystem, including colleges and universities, learners, educators, government, industry, and community, factors are the intermediaries that link the units of the ecosystem together, or the conditions and environment associated with the units, including the entrepreneurship curriculum, entrepreneurial activities and practices, organizational structure, resources, leadership vision, core faculty, and operating mechanism. Three independent functional subsystems are constituted by the key elements: teaching and innovation, support, and operation. Here it is not the university itself functioning as the center of the EE ecosystem, but the universities interconnecting these subsystems.

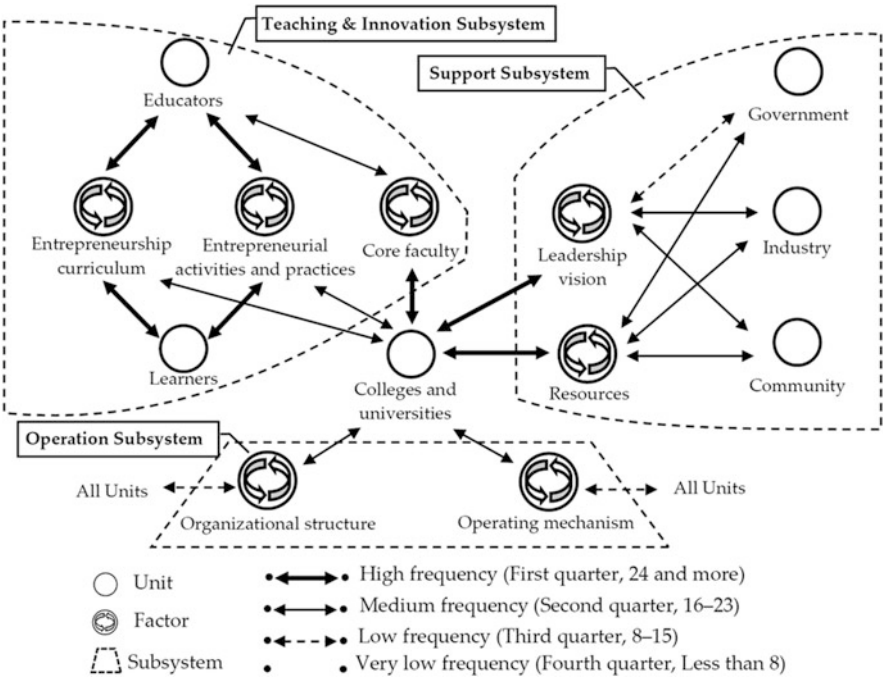

Fig. 2 Elements of an EE ecosystem. Source: Liu et al. (2021)

Some recommendations may be derived from research on EE ecosystems and related areas (Belitski & Heron, 2017; Boyer, 1990; Finkle and Deeds, 2001; Ghina, 2014; Gustomo & Ghina, 2017; Liu et al., 2021):

Creating the opportunity to teach (politics and management perspective)
Building an infrastructure that delivers possibilities for designing and implementing EE can be seen as the basis of all EE endeavors. This needs governmental support for EE that motivates university leaders to create an entrepreneurship-friendly atmosphere and build structures for designing and implementing innovative formats in this direction. It also needs support for the topic from university management, e.g., entrepreneurship should be included in all strategic considerations of research, teaching, and transfer (internal and public commitment). This should lead to an institutional anchoring of EE which clarifies the relevance of the topic for management, e.g., through a start-up center that reports directly to the university executive level, and at least one entrepreneurship professorship. Institutional implementation of the topic also needs long-term financial support for further developing EE, as well as motivation strategies and training structures. Finally, the university itself should also become more entrepreneurial on a meta-level, and at least consider the extent to which it adopts approaches from the "entrepreneurial university" concept.

Motivating and Enabling Teachers (Staff Perspective)
(Potential) EE teachers are often not trained to teach, as they often come from noneducational disciplines like management and business studies. Junior researchers will have to strike the right balance of research and teaching as they move toward professorship, even while the teaching of entrepreneurship classes will probably be left to nontenured track adjunct instructors (a trend that will be continually open to criticism). Whatever the case, the pedagogical expertise of university professors and staff will have to improve—especially with regard to entrepreneurship orientation. They will have to possess or acquire the competencies needed for educating future entrepreneurs, as well as the motivation to do so. Primarily busy with research, professors might not value teaching as much, and perhaps will not see any incentive for investing extra work into (further) developing EE. This will require an environment where EE is much more appreciated, with concrete incentive structures for teachers to invest in EE. This can include intrinsic motivation (e.g., by experiencing success and accompanying students' development) or extrinsic motivation (e.g., in monetary form). This can also lead to more practitioners becoming involved in EE, such as successful entrepreneurs or entrepreneurship consultants. We additionally observe that EE research and its results have yet to be systematically included in deriving EE formats.

Motivating and Enabling Learners (Student Perspective)
Finally, an environment is needed that motivates and enables students to learn. Students here, although of course the people studying at universities, can also be researchers and other staff interested in entrepreneurial vocational training. Creating a positive attitude toward entrepreneurship and the motivation to develop entrepreneurial competencies can be positively influenced by several factors. One can be connected to having fun, and enjoying some form of positive peer pressure. The entrepreneurial ecosystem can include infrastructural support for experiencing entrepreneurial activity in a professional, entertaining way, e.g., in the form of maker spaces, creativity rooms, or students' clubs. They can also be motivated by material or immaterial incentives to take part in transfer and entrepreneurship activities for students, employees, and academic staff. This could also include ECTS as well as free semesters or target agreements. In addition, interest in EE can be increased by showing its outcomes in the form of, e.g., successful entrepreneurs, stressing the possibility of founding a company as an alternative to being employed by someone. Participants in EE can also be motivated by the fact that it can have positive effects beyond founding a company, making clear the potential to innovate and operate in a solution-oriented manner. As repeatedly stated in this book, the contribution to social and environmental progress, in particular by developing entrepreneurial solutions (sustainability entrepreneurship) may play a significant role here. People who recognize the value of entrepreneurial thinking and acting within any private and job context may also show increased interest in entrepreneurial learning. If and how students learn, and what methods and formats work best, should be even more focused on by future EE researchers and practitioners.

5 Directions for Future Work

EE has the potential to change people's mindset toward an entrepreneurial solution and action orientation. It as a result can have an enormous influence on the sustainability-oriented transformation of societies by aiming at educating students to become problem solvers, and enabling them to generate positive societal impacts by acting entrepreneurially in their private and professional contexts. This makes research on EE now more important than ever. Studies so far have focused on EE on the curriculum, program, and course levels and their impact (Fellnhofer, 2019; Liu et al., 2021). This is a good start, keeping in mind that there is still a need for additional academic work—especially regarding the outcome of EE, or in other words, on the measurement of EE's success.

On the one hand, some authors criticize a focus on short-term, subjective impact measures such as entrepreneurial attitudes and intentions, rather than longer-term ones such as venture creation behavior and business performance, and call for future research to address this gap (e.g., Garavan & O'Cinneide, 1994; Henry et al., 2005; Pittaway & Cope, 2007). Long-term research with corresponding durations, or the empirical collection of specific figures with regard to economic and business aspects such as value creation, company growth, and innovative strength are scarce and should receive more attention (cf. Nabi et al., 2016). On the other hand, we argue that entrepreneurial activity can be far more than just founding businesses. As Gibb stated in 2002 (p. 258): "[P]erhaps the foremost [purpose of raising awareness about entrepreneurship] is to move the focus of entrepreneurship teaching and research away from the narrow business orientation toward the notion of the development of the enterprising person in a wide range of contexts and the design of organizations of all kinds to facilitate appropriate levels of 'effective' entrepreneurial behavior." Or as stated by Ratten (2017), EE is valued not just for its ability to develop practical skills and knowledge, but to also obtain competencies to help communities and promote an improved quality of life.

Therefore, research should also broaden perspectives when measuring long-term effects, and add other forms of entrepreneurial action to what is studied, e.g., intrapreneurial work (which may be even more difficult to capture), or focus more on skills and knowledge acquisition as the most important prerequisite for entrepreneurial mindsets and behavior. As underlined in this chapter, more work is needed regarding competence acquisition and learning processes via EE in general, and sustainability-oriented EE in particular.

The results of research on EE can deliver substantial implications for practitioners. On the curricular and format level, it will derive insights about how EE can be arranged, and how teachers can be successfully educated to develop and implement matching EE offerings. Since promoting and implementing entrepreneurship programs entails a substantial investment of time and resources, it is critically important to take stock of what we currently know about the range of EE outcomes and provide benchmarks—not only for future research, but for practice as well. Insights into the results of EE also help design reward and motivation systems, e.g.,

favoring governmental decisions in supporting EE, or university management decisions when developing degree programs. Research on EE success is especially relevant for innovative teaching. Here, it is crucial that formats or methods are not just hyped up because they are new and fancy, but because they genuinely contribute to competence acquisition.

In addition, we identified EE ecosystems as a topic of growing relevance, with the successful development and implementation of EE requiring a supportive environment. Even though recent academic work has shown that scholars have begun to re-examine EE in higher education institutions from a system theory perspective, and are analyzing EE from an ecosystems perspective (Ács et al., 2014; Liu et al., 2021; Wraae & Thomsen, 2019), there is still a need for additional work here—empirical studies in particular. The question remains what a supportive EE ecosystem should look like, and what it needs to build and establish these structures.

The corona pandemic also requires a brief mention. There are several ways how it has influenced EE and research on it. Research reacted quickly to the corona outbreak, and has presented studies connecting the coronavirus and EE (Liguori & Winkler, 2020; Ratten & Jones, 2021). The challenges and barriers connected to corona open windows of opportunity for entrepreneurial solutions. This not only increases the value of entrepreneurial behavior (and thus EE), it also goes along with specific competencies entrepreneurs may need in this field, and which should be integrated into EE formats. In addition, along with the challenges we have experienced caused by the virus, and their related fears and restrictions, we have also acclimated to and depended on digital technologies in education. This leads to an increasing need for technical skills from teachers, as well as revised didactical concepts. On the one hand, this will cause difficulties and barriers for teachers, while perhaps reducing the quality of EE. On the other hand, it makes space for improvement in the form of didactical concepts, perhaps integrating more (international) stakeholders such as successful entrepreneurs and coaches. More and different research is needed to address this field and these developments. Where do digital formats make sense, and where do they not? How does knowledge development work via digital and interactive formats? Do certain formats benefit from technical advances, while others that, e.g., focus on personal skill development work better in workshop settings with personal contact? This discussion may also be broadened to include what competencies are (additionally) relevant for entrepreneurship, and how EE can take this into account. Digital competencies in particular may receive more academic attention in this context.

Academia has plenty of interesting and relevant work ahead of it. With our chapter and this book, we hope to initiate a discussion on how EE can contribute to educating future entrepreneurs who found (sustainable) companies, while also educating future change agents who possess the relevant competencies for transforming societies via their entrepreneurial actions. We request that researchers and practitioners follow up on our work, targeting issues regarding EE and its impact—on both the personal and societal levels.

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