

Build-Measure-Learn in Education: Lessons Learned from the Iterative Development of a digital Project-based, International Entrepreneurship Format

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Abstract: How can we best possibly design an international and multidisciplinary entrepreneurship learning experience which combines elements of on- and offline learning? This paper will outline the iterative design development of such a project-based, international, and cross-functional entrepreneurship course on Greentech, Agriculture, and Food in a flipped classroom format.

Keywords: Entrepreneurship Education, Digital Education, Project-based Education, International Collaboration, COIL Collaborative Online International Learning

1. Introduction

Today, one of the most important priorities in teaching-learning is to encourage entrepreneurship among students in universities (Bergman et al., 2018; Ratten and Usmanij, 2021; Rauch and Hulsnik, 2015). Such activities that strengthen students' entrepreneurial mindsets can contribute to the local economy, opening new businesses and income without harming the environment (Severo et al., 2019). Students show a high demand for entrepreneurship courses. Grimm and Bock (2022) pointed to examples of good practices from Germany and the United States, where public, political, and social entrepreneurship have been integrated into curricula. As Olokundun et al. (2018) suggest, entrepreneurship teaching in higher education institutions, which includes practical activities and active student participation, can stimulate the development of students' entrepreneurial interests, and support their potential to start a business.

The COVID-19 pandemic was a huge challenge for education (Daniel, 2020). One of the most significant changes was the way in which classes were conducted, but on the other hand, it made it possible for students from other universities to take part in classes remotely. The major impacts of the COVID-19 pandemic are still affecting all social dimensions. Its specific impact on education is extensive and quite evident in the adaptation from face-to-face teaching to online methodologies throughout the first wave of the pandemic and the strict rules on lockdown (Baltà-Salvador et al., 2021). As lesson formats changed radically, the relevance of evaluating student online learning processes in university degrees throughout this period became clear (Revilla-Cuesta et al., 2021). What is more, students are continuously seeking specialised skills and seeking employment after graduation, so applied entrepreneurial activity is increasingly popular (Oliver & Oliver, 2022). Furthermore, innovation is one of the competencies needed in a workplace (Usher et al., 2021). This study aims to show a case of an international and multidisciplinary entrepreneurship learning experience that combines elements of on- and offline learning.

2. Methodological Approach: Case Study Research

The authors used the "research onion" by Saunders et al. (2023) to define the methodology for this research (Fig.1). Coming from a Critical realism philosophy and an abductive approach to theory development, the authors chose a mixed method research which includes qualitative as well as quantitative procedures. In order to figure out what is the best way to teach and combine on- and offline learning in an international and multidisciplinary setting to achieve the best learning experience for students, a case study approach was chosen. A case study is an in-depth inquiry into a topic of phenomenon within its real-life setting (Yin 2018). The entrepreneurship course which started in the winter term 2020 served as this real-life setting. As the data was collected from five differently executed online entrepreneurship courses between winter term 2020 and winter

term 2022, a longitudinal study was used. The five iterations of the course were all on the topic of Green Tech, Agriculture, and Food for students of their respective faculties (see Fig. 4). A sixth face-to-face course is planned for summer 2023 in Munich, Germany.

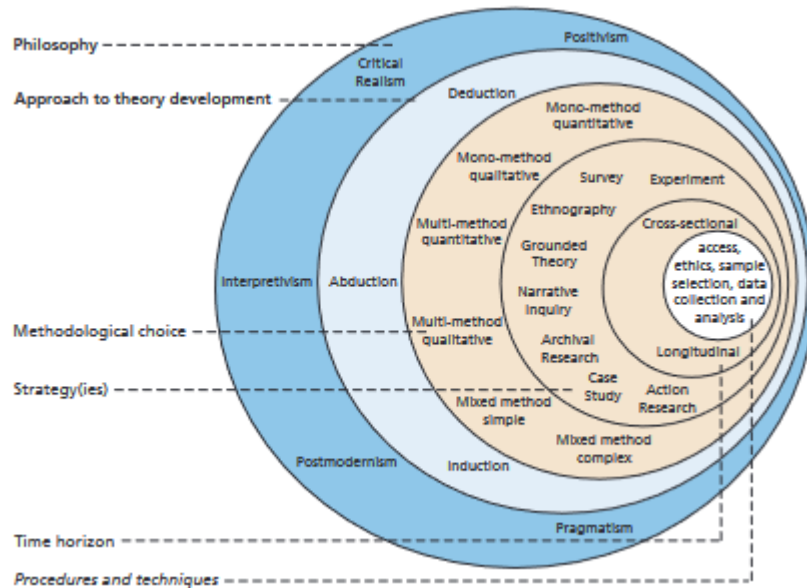


Figure 1: The research onion (Saunders et al., 2023, p. 131).

The scope of the case study is in total 6 courses with a total of 257 students (167 from Germany, 44 from Nepal, 24 from Poland, and 22 from South Africa).

The authors applied a Lean Startup (Ries, 2020) approach to continuously improve their course. The Lean Startup approach allows innovators (including innovative educators) to rapidly identify and refine promising ideas into models that work (Cook et al., 2022). It follows the logic to build something, measure its success, learn from the feedback, and integrate necessary changes into the design. In short, this is called a build-measure-learn methodology.

3. Results and Discussion

3.1 Initial setup

The course which is the basis of this case study started in the winter term of 2020 at Hochschule Munich University of Applied Sciences, when Verena Kaiser and Bettina Maisch held a joint online entrepreneurship course on the topic of Green Tech, Agriculture, and Nutrition for students of their respective faculties of business administration and mechatronics. The course went well given the fact that Vaiciukynaite et al. (2023) highlighted that COVID-19 infused challenges to entrepreneurial education that are more significant than in other business domains because entrepreneurial education is based on experiential education.

Therefore, the authors asked themselves: how might we enrich the learning experience of the next cohort of students in this online setting? Should we aim for not only a multidisciplinary course with students of Mechatronics and Business Administration, but also open the course for international students from other universities (apart from the incoming Erasmus students)? They wanted to turn the disadvantages of a digital-only course into an advantage by creating a richer student experience by adding a more international, as well as a broader functional experience. Therefore, they reached out to their network of international partner universities to find peer facilitators for their journey from a COL format (Collaborative Online Learning) to a COIL format (Collaborative Online International Learning).

3.2 Becoming international

Lecturers from Durban Technical University (South Africa) and King’s College in Kathmandu (Nepal) joined the team and brought in 10 students each for the class. This required a few changes to the course design. On the

organisational side, a switch from a weekly format to a one-week block due to different semester structures at the different universities, as well as additional communication tools apart from the Moodle online learning platform, which was only accessible with all functionalities for students from Munich. Time difference was not an issue, as South Africa is only one hour different from Munich, and Nepal is 3 hours 45 minutes ahead, however all facilitators and students were aware (and used to) the necessity of starting the day later in the morning and continuing to late evenings when working in international projects. Regarding coaching, warm-up exercises every morning and after lunch break facilitated by the lecturers were added, to freshen up participants during those long days. To sum up, including international students and lecturers as well as changing the format from weekly to block course were the main iterations in this semester.

3.3 Subject-matter expertise

The next iteration in the winter term 21/22 brought some significant changes. Małgorzata Krzywonos, a subject-matter expert in Food Technology joined the lecturer team and brought with her students' valuable knowledge for the course topic. Furthermore, the time of learning (when do students study/learn and when do they apply the learning) switched from in-classroom to a flipped classroom format. In a flipped classroom concept, the delivery of the learning content is flipped from input in the classroom and studying at home to studying the content at home, coming prepared to class and using the course time for exercises, discussion and application of the content. For the case study course, the authors recorded the theoretical content in small video bits which were provided to the students upfront. So, the content delivery and studying took place outside course hours. Students came prepared for the online sessions and the whole lecture time was used for coaching the team, i.e. applying the lessons learned from the theoretical input sessions on the real project challenges the students worked on. Course assessment was in addition to facilitator brainwriting also captured via a student feedback grid (Fig. 2).

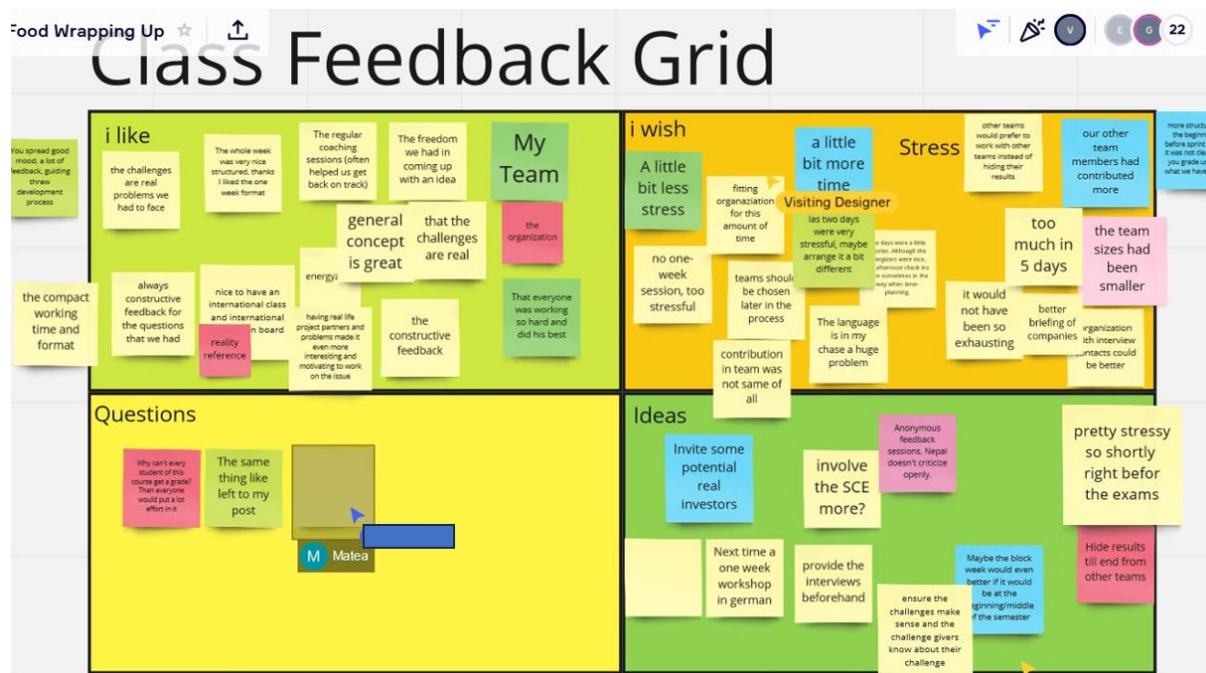


Figure 2: Class Feedback Grid on www.mural.com, winter term 21/22

Content-wise, presentations on intercultural teamwork were added, as well as student exercises like “introduce your favourite song in your local language to everyone” to enhance cross-cultural understanding and collaboration. We used problem-based learning approach (Kek and Huijser, 2015), in which a ‘real-life’ industry could be brought in, which helped to forge long-term, collaborative partnerships to facilitate learners’ acquisition of more meaningful knowledge and opportunities (Oliver & Oliver, 2022). The challenges were not created by the students themselves, but brought in by the lecturers and their network. It felt very valuable to have real and relevant problems by existing companies or individuals at hand, and the problem definition phase was easier for the students. To give one example, a team worked on the question of how to make the best use of apple pomace as a by-product in juice production, provided by a farmer in Poland (Fig. 3).

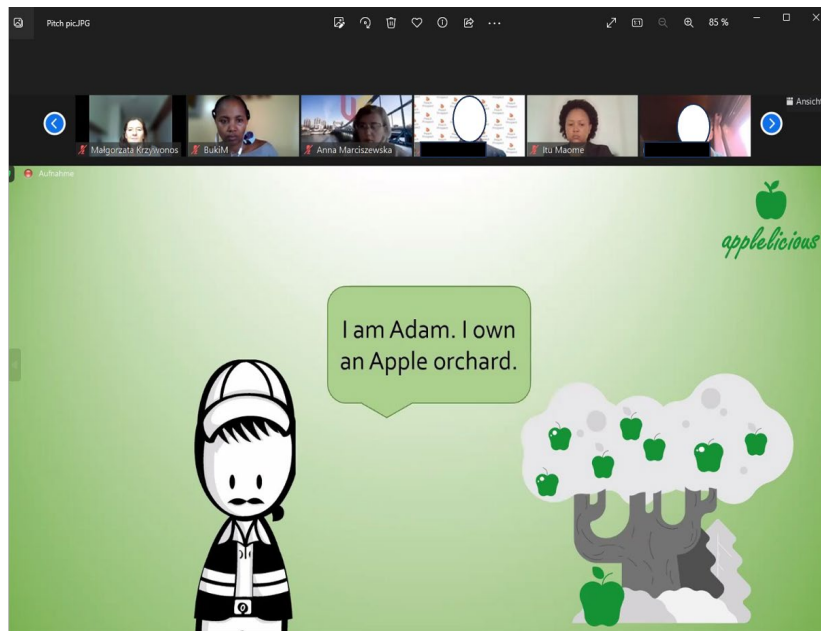


Figure 3: Pitch presentation team applelicious, winter term 21/22

To summarise, bringing in subject-matter expertise as well as introducing the flipped-classroom approach were the main changes during this semester, clearly enhancing the learning experience for students as they felt more comfortable with subject-matter experts in each team plus there was more coaching time available during course hours as the theoretical input was delivered outside course hours.

3.4 More coaching sessions

The South African students could no longer participate in the course due to lacking lecturer availability, and to enable student teams to participate in the START FOR FUTURE community (<https://startforfuture.eu>), the course was held in a weekly format again in the summer term of 2022. START FOR FUTURE is a community platform where teams interested in founding their startup can take part in various programs, present and find offers for collaboration, and exchange with like-minded innovators. It was mandatory for student teams to participate in the start of future programs. To foster the motivation for founding even more, startup founders in the space of Greentech, Agriculture, and Nutrition were invited for short presentations of their startups followed by Q&As. The flipped classroom content, which was until that time provided in a cloud working environment, moved to the MOOC (massive open online course) platform of Strascheg Center for Entrepreneurship (<https://www.sce.academy>). On the coaching side, it became mandatory for students to book coaching slots with lecturer tandems of their choice. So far, coaching was voluntary, and the lecturer teams realised that certain teams never booked coaching slots. Those were the teams that eventually did not fully meet expectations, so coaching was made a mandatory item of the course. In a nutshell, the summer term 2022 was adjusted in a way that even more coaching was given - through mandatory coaching sessions and via the START FOR FUTURE community. Both changes to the course design were based on lecturer feedback.

3.5 Enhanced team dynamics through consistent grading

In the following iteration of the course in the winter term 22/23, several more changes were introduced based on student and lecturer feedback. As the lecturers had got the feeling from previous classes that students did not always come prepared to class, meaning they had not watched the flipped classroom videos upfront, self-assessment quizzes after the three milestones were introduced. The aim was to give students a way to control their progress themselves, and the lecturers a way to identify which of the videos needed additional advertising or finetuning. As per another desire by the lecturers, the startup talks delivered by young founders were opened to the public and communicated via social media channels of the universities and lecturers.

To communicate among lecturers and students on one channel only, Slack was introduced (<https://slack.com>). This was based on the student feedback that too many different communication channels were at times confusing. On the coaching side, participation in the START FOR FUTURE program was made voluntary for teams

for two reasons which students responded back to the lecturer team: on the one hand, not all teams had the desire to find their own companies and therefore did not seek additional networks and peers. On the other hand, meeting times of the START FOR FUTURE program did not align with students' curricula sometimes, which generated additional pressure on the teams. Finally, and certainly the most important iteration of the case study course, the class was made part of the regular curriculum in all participating countries. Therefore, all participants received grades and could use the earned credits for their degrees, which was a hygiene effect for team dynamics. Until that time, there had been constant friction within teams where some team members felt others were not equally contributing to the team success, especially when there were only certificates of participation issued and no grades for the final degrees given.

Figure 4 shows an overview of all changes over time.

	Winter 20/21	Summer 21	Winter 21/22	Summer 22	Winter 22/23	Outlook: Summer 23
Organization						
Format	COL Collaborative Online Learning	COIL Collaborative Online International Learning	COIL Collaborative Online International Learning	COIL Collaborative Online International Learning	COIL Collaborative Online International Learning	COIL Collaborative Online and Offline International Learning
Setting	Weekly	Block course	Block course	Weekly	Weekly	Block course
Faculties involved	Mechatronics, Business Administration, Design	Mechatronics, Business Administration, Design	Mechatronics, Business Administration, Design, Engineering in Food Technology	Mechatronics, Business Administration, Design, Engineering in Food Technology	Mechatronics, Business Administration, Engineering in Food Technology, Print Technology	Mechatronics, Business Administration, Engineering in Food Technology, Print Technology
Countries involved	Germany	Germany, Nepal, South Africa	Germany, Nepal, South Africa, Poland	Germany, Nepal, Poland	Germany, Nepal, Poland	Germany, Nepal, Poland
Time of learning	In class	In class	Flipped classroom, videos provided on Google drive	Flipped classroom, videos provided via SCE Academy MOOC https://www.sce.academy/start	Flipped classroom, videos provided via SCE Academy MOOC https://www.sce.academy/start	Flipped classroom and Onsite in Munich
Assessment of learning	via heinnovate	via heinnovate	n/a	n/a	Self-assessment quizzes after milestones	Self-assessment quizzes after milestones
Course assessment	Reflection by facilitators via brainwriting	Reflection by facilitators via brainwriting	Reflection by facilitators via brainwriting, student feedback grid	Reflection by facilitators via brainwriting, student feedback grid	Reflection by facilitators via brainwriting, student feedback grid	Reflection by facilitators via brainwriting, student feedback grid
Grading	For all participants	For German students, certificate of completion for others	For all participants	For all participants	For all participants	For all participants
Faculty organization	Part of regular curriculum (elective)	Part of regular curriculum (elective) in Germany, voluntary course in Nepal and South Africa	Part of regular curriculum (elective) in Germany, voluntary course in Nepal, South Africa, and Poland	Part of regular curriculum (elective) in Germany, voluntary course in Nepal and Poland	Part of regular curriculum in all countries via Erasmus+ program	Part of regular curriculum in all countries via Erasmus+ program
Communication tools	Moodle	Google Drive, Moodle, Email	Google Drive, Moodle, Email	Google Drive, Moodle, Email	Slack	Slack
Content						
Addressing intercultural and team issues upfront	n/a	n/a	Presentations on intercultural management, country introductions (our favorite song) per team	Live by coaches at the start and throughout the course	Live by coaches at the start and throughout the course	Presentations on intercultural management online before course start, country introductions (our favorite song) per team live
Challenges	Designed by students	Designed by students	Brought in by coaches and their networks	Brought in by coaches and their networks	Brought in by coaches and their networks	Brought in by coaches and their networks
Foster motivation for founding	n/a	n/a	n/a	Selected founders of food startups invited for inspirational talks	Startup series with founders communicated via university channels and social media, open for everyone (not only participants)	1/2 day "Startup day" with inspirational pitches by founders in the food area
Coaching						
Management of coaching	Voluntary coaching slots	Voluntary coaching slots	Voluntary coaching slots	Mandatory coaching for all teams	Mandatory coaching for all teams	Mandatory coaching for all teams
Subject-matter expertise	Basic, one coach used to be a chef	Basic, one coach used to be a chef	Biotechnology & Food Engineer from Poland joined lecturer team	Biotechnology & Food Engineer from Poland	Biotechnology & Food Engineer from Poland	Biotechnology & Food Engineer from Poland
Warm-up sessions	n/a	By coaches	By teams	n/a due to weekly format	n/a due to weekly format	By teams
Additional coaching via International Programs	eBridge Alliance	n/a due to block week format	n/a due to block week format	Mandatory participation in Start for Future program https://startforfuture.eu	Voluntary participation in Start for Future program https://startforfuture.eu	n/a due to block week format

Figure 4: Iterative changes to the entrepreneurship course from winter 20/21 to summer 23

All the changes described above were rather incremental, small improvements that were introduced based on student and lecturer feedback and helped to improve the class in terms of a build-measure-learn Lean Startup procedure. One major topic however has been present in all iterations so far. After several semesters of online teaching, it is time to move the class to a hybrid format. Team interaction across continents remained a challenge given the fact that the students never saw each other face-to-face. This observation is in line with Usher et al. (2021) who pointed out that students in class and online reported similar levels of innovative behavioural tendencies. However, the face-to-face team students gained higher mean scores on innovation than the online team projects. Therefore, the biggest change lies ahead: bringing lecturers and students together in Munich, Germany in the summer term 23 for a first onsite block week. The plan is to invite have students from all four partner universities/countries participate. This onsite week will be enriched with two preparatory online meetings plus sessions on intercultural management upfront, as well as the flipped classroom elements. Vaiciukynaite et al. (2023) found that digital interaction and collaboration among participants and facilitators on various platforms promoted the development of an entrepreneurial mindset, therefore some online elements will be kept. Startup founders will be invited on each lecture day for short presentations of their companies and challenges. Summing up, the author team is looking forward to this new design of the course, to the new lessons learned, and to reporting back to the conference community on what is to improve next. This will be done during the mini track on Entrepreneurship Education and Learning, and will hopefully include lively discussions and feedback.

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References

- Baltà-Salvador, R., Olmedo-Torre, N., Peña, M. *et al.* (2021) Academic and emotional effects of online learning during the COVID-19 pandemic on engineering students. *Education and Information Technologies*, 26, 7407–7434 <https://doi.org/10.1007/s10639-021-10593-1>
- Bergmann, H., Geissler, M., Hundt, C., & Grave, B. (2018). The climate for entrepreneurship at higher education institutions. *Research Policy*, 47(4), 700-716 <https://doi.org/10.1016/j.respol.2018.01.018>
- Cook, D. A., Bikkani, A., & Poterucha Carter, M. J. (2022). Evaluating education innovations rapidly with build-measure-learn: Applying lean startup to health professions education. *Medical Teacher*. <https://doi.org/10.1080/0142159X.2022.2118038>
- Daniel, S.J. Education and the COVID-19 pandemic. *Prospects* 49, 91–96 (2020). <https://doi.org/10.1007/s11125-020-09464-3>
- Grimm, H. M., & Bock, C. L. (2022). Entrepreneurship in public administration and public policy programs in Germany and the United States. *Teaching Public Administration*, 40(3), 322–353. <https://doi.org/10.1177/01447394211021636>
- Kek, M. Y., & Huijser, H. (2015). 21st Century skills: Problem based learning and the university of the future. In *Third 21st century academic forum conference: Facilitating, fostering, and harnessing innovation to meet key challenges of the 21st century* (Vol. 6, No. 1, pp. 406-416)
- Oliver, P. G., & Oliver, S. (2022). Innovative online learning in entrepreneurship education: The impact of embedding real-life industry practice in the virtual learning environment. *Industry and Higher Education*, 36(6), 756–767. <https://doi.org/10.1177/09504222221121283>
- Olokundun, M., Moses, C. L., Iyiola, O., Ibidunni, S., Ogbari, M., Peter, F., & Borishade, T. (2018). The effect of non traditional teaching methods in entrepreneurship education on students entrepreneurial interest and business startups: A data article. *Data in Brief*, 19, 16-20. <https://doi.org/10.1016/j.dib.2018.04.142>
- Ratten, V., & Usmanij, P. (2021). Entrepreneurship education: Time for a change in research direction?. *The International Journal of Management Education*, 19(1), 100367. <https://doi.org/10.1016/j.ijme.2020.100367>
- Rauch A. Hulsink, W. (2015) Putting Entrepreneurship Education Where the Intention to Act Lies: An Investigation Into the Impact of Entrepreneurship Education on Entrepreneurial Behavior. *Academy of Management Learning & Education*, 14, 187–204, <https://doi.org/10.5465/amle.2012.0293>
- Reis, D. A. D., Fleury, A. L., Bento, T., Fabbri, K., Ortega, L. M., & Bagnato, V. (2019). Application of new agile approaches at University of São Paulo innovation agency's entrepreneurship and innovation course. *Gestão & Produção*, 26(4). <https://doi.org/10.1590/0104-530X4122-19>
- Revilla-Cuesta, V., Skaf, M., Varona, J. M., & Ortega-López, V. (2021). The outbreak of the covid-19 pandemic and its social impact on education: Were engineering teachers ready to teach online? *International Journal of Environmental Research and Public Health*, 18(4), 1–24. <https://doi.org/10.3390/ijerph18042127>
- Ries, E. (2020). *Lean Startup. Schnell, risikolos und erfolgreich Unternehmen gründen*. 7th edition. Redline, Munich.
- Saunders, E., Lewis, P., Thornhill, A. (2023). *Research methods for business students*. 9th edition. Pearson, Harlow.

- Severo, E. A., Becker, A., Rotta, C., & de Guimarães, J. C. F. (2019). The teaching of innovation and environmental sustainability and its relationship with entrepreneurship in Southern Brazil. *International Journal of Innovation and Learning*, 25(1), 78–105. <https://doi.org/10.1504/IJIL.2019.096553>
- Usher, M., Barak, M., & Haick, H. (2021). Online vs. on-campus higher education: Exploring innovation in students' self-reports and students' learning products. *Thinking Skills and Creativity*, 42. <https://doi.org/10.1016/j.tsc.2021.100965>
- Vaiciukynaitė, E., Ihasz, O., Portyanko, S., & Vyakarnam, S. (2023). Transforming a Highly Tactile Entrepreneurship Course “Ideas to Innovation” to an Entirely Online Delivery Model: Lessons for Theory and Practice. In *FGF Studies in Small Business and Entrepreneurship*. https://doi.org/10.1007/978-3-031-11371-0_7
- Yin, R.K. (2018). *Case Study Research and Applications: Design and Methods*. 6th edition. Sage, London.