



Empowering Engineering & Technology and Practice Teachers: Joining Virtual Exchanges for Enriched Learning

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Purpose: The purpose of the research was to explore how virtual exchanges can empower teachers of engineering and technology and practical subjects. The aim was to determine whether and how these teachers see virtual exchanges as an opportunity for personal and professional development, improvement of teaching, and exchange of good practices.

Findings: The research was conducted at the beginning of the 2023/2024 school year with interviews conducted via online video calls. The sample included 16 teachers and 2 students (future teachers of engineering and technology). Before the interviews, participants received an introductory presentation of the concept of virtual exchanges and then answered four pre-prepared questions that focused on the perception and meaning of these exchanges for teachers.

Originality/value: The paper is important because it focuses on a less researched area - the use of virtual exchanges in the context of technical education that includes practical work. The research fills a gap in the literature and offers valuable insights for the development of international collaboration among teachers of technical subjects and for the design of supporting platforms, tools and policies that would enable and promote this collaboration.

Keywords: Virtual exchanges, Education, Teacher professional development, Intercultural collaboration, Practice-based pedagogy

Introduction

Virtual exchanges create opportunities for different people, especially teachers, to meet. Meetings take place in a virtual world, in the form of communication through different platforms that allow live interaction via video call (O'Dowd & O'Rourke, 2019). In essence, then, virtual exchanges represent collaboration at a distance. This term is used to refer to the sustained engagement of groups of teachers (or students or other individuals) in online encounters where cross-cultural interaction and collaboration with other participants in virtual exchanges is encouraged. Interaction takes place with participants from different cultural backgrounds and locations (O'Dowd, Sauro, & Spector-Cohen, 2020).

Virtual exchanges have only begun to take shape with the opportunity to use technology to connect on a global scale, independent of the location of individual participants. One of the first to use the term 'virtual exchanges' to refer to such meetings was Warschauer (1995). Among the names, we can also trace the introduction of the term "telecollaboration" by Belz (2003), who used the term to refer to 'remote collaboration' as a form of meeting in which international participants meet in parallel groups using Internet-based communication tools. He pointed out that these tools can be of various kinds, e.g. e-mail, synchronous chat, discussion in forums, etc. This way of communication supports social interaction and discussion, which also brings about intercultural integration and exchange (Belz, 2003). As the use of the practice of connecting via the Internet, via the computer, and later also via other devices (mobile phones, smart tablets, etc.) has spread and established itself over time, other terms have also come to be used.

One of the major influences on the use of the term "virtual exchanges" has been politicians, who have used the term in most of their communications. In 2015, EU ministers announced that they would fund future virtual exchange initiatives in education, with the aim of promoting citizenship and the values of freedom, tolerance and non-discrimination. Virtual exchanges have thus become a movement through which many countries have sought to empower their citizens and nurture their professional development. This has established the term virtual exchange as a fundamental expression of such encounters (Dooly & O'Dowd, 2018).

Virtual exchanges allow participants to access high quality international and intercultural education (formal and non-formal) without physical mobility. In this context, digital platforms are a valuable tool to respond in part to the global mobility constraints caused by the Covid-19 pandemic. Virtual exchanges also help in some cases to prepare, deepen and extend physical exchanges. Virtual exchanges take place in small groups led by a trained facilitator and may include participants from different professional fields, disciplines, cultural backgrounds, etc. They take the form of online discussions over a period of time between experienced teachers, young teachers and students of pedagogical disciplines. They involve collaboration or training for all those who want to develop virtual exchanges with colleagues from other countries, share their views on education, exchange examples of good practice, consult with peers from the same or similar fields of expertise and gain experience in an international field. Virtual exchanges take the form of interactive open online courses, including course materials (such as recorded lectures, readings and problem sets, Massive Open Online Courses (MOOCs), with an emphasis on interactive user forums in small groups that support contact between participants).

Key features of virtual exchanges include:

1. Virtual exchanges represent a flexible practice that can be integrated into teaching and professional development in a variety of ways, both in the classroom and in blended learning environments.
2. Virtual exchanges provide an excellent opportunity to involve everyone, but especially teachers, in social interaction with other exchange participants. Virtual exchanges are also an excellent opportunity to foster cooperation with other participants who would not normally meet in a home (school) environment or who are extremely unlikely to meet in a home (school) environment.
3. Virtual exchanges are an excellent alternative to physical mobility. This is particularly useful for people who have special needs or for whom physical mobility would be a financial burden. Virtual exchanges thus make it possible for everyone to integrate and internationalise, regardless of health or economic means.
4. Virtual exchanges can involve the use of different online platforms, as they are not limited to one platform or application. This also means that this type of exchange is different from traditional self-directed learning, which is somewhat more focused (Dooly & Vinagre, 2022).

5. The intercultural networking between participants in virtual exchanges is one of the benefits of virtual exchanges, not only for teachers but also for students (Schenker, 2013).

It is also important to stress that online teaching (in whatever form), as it took shape during the Covid-19 pandemic, is not the same as virtual exchanges, since the latter involve a peer-supported process where the roles of the participants are mostly equivalent, whereas in the case of online teaching, the roles are more divided, with someone usually playing the role of facilitator. Virtual exchanges thus tend to connect all participants, independent of cultural differences and location, while also enhancing the participation of all those involved in the exchange (Dooly & Vinagre, 2022).

The literature review revealed that most studies on virtual exchanges focus on learning and improving communication in a specific language. Among the numerous studies (Flogie, 2025, Vičič, 2024), we found very few that specifically examine virtual exchanges in fields such as engineering and technology. This gap highlights the need for further investigation of virtual exchanges in this particular area.

The Purpose of the Study

The aim of the research was to find out how virtual exchanges could empower teachers of engineering & technology and practice. It should be noted that the subject of engineering and technology is a rather specific subject in the Slovenian school curriculum, as it involves more practical work with materials and machines, and theory does not usually play a central role in the subject content. Due to this specificity of the subject, it is important to explore how virtual exchanges could benefit both teachers of engineering and technology and teachers of practical lessons. For the purpose of the research, the following research question was formulated: *How do teachers of technology and engineering perceive virtual exchanges in terms of their empowerment in teaching?* This question guided the exploration of whether and how teachers see virtual exchanges as opportunities to explore new ideas, develop new approaches to their work, acquire new materials, and learn from examples of good practice.

Methodology

Research Design and Participants

The study was carried out at the beginning of the 2023/2024 school year through interviews. The study employed convenience sampling (voluntary response sampling). Invitations were sent via e-mail to teachers of engineering and technology (in-service teachers) and to students (pre-service teachers), and participation was voluntary. In total, 16 teachers and 2 students agreed to take part in the interviews.

Before the interviews, the concept of virtual exchanges was introduced to the participants. The presentation was based on definitions and characteristics discussed in the literature review (e.g., emphasis on intercultural dialogue, the development of soft skills, and the role of digital platforms in facilitating international collaboration).

After the presentation of the virtual exchanges, participants were asked to imagine being invited to participate in a virtual exchange. In this context, we asked them to answer 4 questions that we designed for the purpose of the study. The first question asked the participants to briefly describe how they see the possibility of participating in virtual exchanges with teachers of engineering and technology. This was followed by a question asking whether they thought that participating in a virtual exchange at international level would contribute to their personal growth and would have an impact on their professional identity. For this question, we asked for further clarification of answers where necessary. The third question asked what international

cooperation such as virtual exchanges mean to teachers personally and why they would consider it important for teachers of engineering and technology. The fourth and final question was about the learning objectives of the subject of engineering and technology. We wanted to know which learning content or objectives from the engineering and technology curriculum teachers would like to discuss with their colleagues from abroad if they had the opportunity to participate in a virtual exchange. In addition to the interview questions, we collected basic demographic information about the participants, including the type of school in which they work and their teaching experience. These characteristics are summarised in Table 1.

Table 1: Sample Characteristics

Variable	Category	Frequency	Percentage
	Student (pedagogy)	2	11
	Primary school – lower grades	8	44
	Primary school – subject teaching	6	33
	Secondary vocational school	0	0
	Secondary technical school	2	11
Teaching experience	0–10 years	10	56
	10–20 years	6	33
	20–30 years	0	0
	30–40 years	2	11
	>40 years	0	0

Limitations of the Sample

This study has several limitations related to the sample. First, the number of participants was relatively small ($n = 18$), which restricts the generalisability of the findings. The sample was obtained through convenience sampling, as participation was voluntary and based on responses to an e-mail invitation. Consequently, it is possible that mainly teachers with a stronger interest in international collaboration or innovation in teaching chose to participate, which may have introduced self-selection bias. In addition, the sample represented a limited range of school types, with most participants working in primary schools and only one from a secondary technical school. No participants from vocational schools were included. Finally, demographic variables such as gender or regional distribution were not collected, which limits the possibility of further analysis of differences between subgroups.

Data Analysis

The responses were analysed using qualitative content analysis. As no specialised software was employed, the answers were read several times and grouped manually according to recurring themes. Similar statements were clustered together, and from these clusters the main findings were derived. The analysis was conducted separately for each interview question.

Results

The analysis of the answers to the first interview question, asking participants to briefly describe how they see the possibility of participating in virtual exchanges for teachers of engineering and technology, shows that teachers mostly see participation as an opportunity to find ideas,

new ways of working, to learn about new materials, examples of good practice, especially for practical work with students. The responses also suggest that teachers would be likely to exchange different ideas about what products could be made in STEM lessons and how they could be made. In addition, teachers see participation in virtual exchanges as an opportunity to learn about new and different pedagogical approaches, including teaching methods from other cultures that could be partly transferred to their own teaching. There were also negative views on participation in virtual exchanges, as some participants reported that teachers were already overloaded and that such participation would only be extra work for them. Therefore, they do not see virtual exchanges as an opportunity.

When analysing the responses on how teachers' participation in virtual exchanges could contribute to their personal growth and how it would affect their professional identity, most teachers felt that they would welcome participation as a new experience that would certainly help their professional development. They also point out that it would help their professional development in terms of learning about and understanding new trends in education and being able to implement them more easily in their teaching. They also see an opportunity in professional development, as they would be able to influence their colleagues by learning about different teaching methods and approaches, which they would presumably learn about by participating in a virtual exchange. For some teachers, participation in a virtual exchange is not only about developing their own professional identity and personal growth, but also about contributing to the development of the whole team, as they would be happy to share their own experiences with their colleagues. Other responses include the view that for some teachers this would also help them to overcome personal barriers, such as improving communication, training in a foreign language and meeting new people. However, a minority of participants expressed a negative view, noting that they had already built their professional identity and did not see the need for such exchanges.

When analysing the third question, which asked what international cooperation such as virtual exchanges mean to teachers personally and why they would consider it important for teachers of engineering and technology, the analysis indicates a predominantly positive attitude. Teachers stressed that they see the opportunity to learn about other cultures and how education is delivered in those cultures, and in particular the teaching of subjects similar to engineering and technology. Some participants felt that international cooperation would mean that they would also get to know international experts, which would be an added value for them in a virtual exchange. They felt that this would give them the opportunity to work with competent professionals with a lot of experience. However, during the analysis of the responses, it was also found that in this question too, someone pointed out that they did not see the point of international cooperation, as they felt that teachers already had enough challenges in Slovenia and there was no need to look for challenges elsewhere.

An analysis of the answers to the last question, which asked which content and learning objectives from the engineering and technology curriculum would you like to discuss with colleagues from abroad who would also be taking part in a virtual exchange, shows that some teachers would be more interested in discussing content than objectives. Some teachers point out that they would like to learn, through virtual exchanges, how a subject such as engineering and technology is taught in other parts of the world. We also noted that teachers would be interested to know how the content of engineering and technology is introduced in lower age groups elsewhere. Teachers would also be interested to know how practical work is carried out elsewhere and what kind of products pupils make in lessons elsewhere in the world. Someone pointed out that they would also be interested to know how teachers design a more practically oriented course. They would also be interested in how they prepare course materials, documentation and how they evaluate products. Among the responses, we would also like to point out that teachers might also be interested in how and how much theory to put into practice

and how to implement modern technologies in teaching. Teachers would also like to know how they could build on teaching to make it more experiential. Teachers would be interested in examples and good practices of this from abroad.

The analysis of participants' responses revealed several recurring themes for each interview question. While most teachers highlighted opportunities for new ideas, good practice, and professional development, some also expressed concerns about additional workload or questioned the value of international cooperation. To illustrate these findings, Table 2 summarises the main themes together with selected quotes from participants.

Table 2: Themes identified in participants' responses to interview questions

Theme Area	Themes identified	Example quote
Perceptions of participation in virtual exchanges	New ideas, materials, good practice. Exchange of teaching practices and products. Learning about methods from other cultures. Negative perception (extra workload).	"I see the opportunity mainly in finding new ideas, new ways of working, new materials, and examples of good practice." "Hmm, it just sounds like another thing teachers have to add to our already overloaded to-do list."
Contribution to personal growth and professional identity	Professional growth and new perspectives. Learning about trends and other systems. Overcoming personal barriers (language, communication). Negative perception (identity already formed).	"Every experience of cooperating and learning from other cultures and systems contributes to personal and professional growth." "Honestly, I think I am already experienced enough in my field. My professional identity is already built, so I don't see the need for this."
Meaning and importance of international cooperation	Personal and professional growth. Learning about different systems and goals. Meeting international experts. Sharing experiences. Negative perception (no added value).	"International cooperation is desirable, because each country has different approaches and goals." "To be honest, I think this is more for those who are really interested in international cooperation. We already have enough challenges here in Slovenia."
Content and objectives for discussion abroad	Teaching strategies. Introduction of technology in lower grades. Practical work and product creation. Curriculum design, documentation, evaluation. Balance between theory and practice. Experiential learning.	"Practical work – making products. I would mainly be interested in what kind of products pupils make elsewhere and how they make them." "Theory as the basis for project work: how much theory for each level of education, how much practice, and how applicable it is to real life."

Discussion

Based on the analysis of the answers to the first interview question, most teachers perceive participation in virtual exchanges as an opportunity to exchange ideas, new and/or different ways of working, and as an opportunity to learn about new material that they do not use or have not come across in their work. Most teachers emphasise practical work with students and finding examples of good practice, which is understandable as teachers repeatedly pointed out during the interviews that engineering and technology is a specific subject where more practical work is possible, and which teachers want to improve. Some also emphasise the opportunity to learn about different pedagogical approaches, with a particular focus on teaching methods from other cultures and the implementation of these methods in the Slovenian education system. However, there were also negative responses, with teachers expressing concern about the additional burden and workload that participation in virtual exchanges would entail. Taken together, these findings suggest that teachers see virtual exchanges above all as a platform for sharing good practice and enhancing the practical dimension of their teaching.

Further analysis showed that teachers see participation in virtual exchanges as a new experience that would contribute to their professional development. Here again, they stressed that they would be interested in learning about new cultures, especially in terms of learning about new or different trends in education and learning in other cultures. Some also highlight the possibility of sharing experiences with colleagues in a team and the professional development of several employees, not just individuals. Teachers also see international cooperation as an opportunity to network with international experts and gain new perspectives and skills. They also highlight an interest in learning about teaching engineering and technology in different countries, especially in terms of practical work and the products that students create. During the interviews, teachers also expressed an interest in how engineering and technology content is being introduced in lower age groups elsewhere in the world. It is also important to us that teachers stressed that they would like to learn about the different pedagogical approaches used by other participants in virtual exchanges and how to put theory into practice using modern technologies. This reflects wider findings in the literature that virtual exchanges enhance intercultural networking and encourage the transfer of pedagogical approaches across contexts (Schenker, 2013). Some also felt that they would feel more motivated to work and make changes in their work after the exchange. This is supported by a study by Luo & Yang (2022), who found that participants in virtual exchanges were more motivated to learn. We believe that this would certainly have an impact on the teachers participating in such exchanges. Teachers also expect that their communication skills would improve if they participated in virtual exchanges, which is also supported by some studies (Hussain Al-Qahtani, 2019; EVOLVE Project Team, 2020; Machwate et. al., 2021). Communication is one of the essential areas that can be developed by participating in virtual exchanges, regardless of the content of the virtual exchanges, as participants need to be able to communicate in a foreign language such as the one used in the meetings.

Overall, the results suggest that teachers not only see virtual exchanges as a means of improving classroom practice but also as a tool for professional growth, motivation, and communication development. At the same time, the minority of critical voices—who emphasised workload and questioned the added value of international cooperation—point to the importance of institutional support if such initiatives are to be sustainable.

Given the generally views on the possibility of engaging technology and engineering teachers in virtual exchanges, our findings indicate that technology and engineering teachers perceive virtual exchanges as opportunities for their own professional development, as well as opportunities to explore new ideas, develop new approaches to their work, acquire new

materials, and learn from examples of good practice. Teachers expressed positive attitudes and would like to participate in virtual exchanges related to the teaching of subjects such as engineering and technology. In fact, teachers see more benefits than drawbacks in participating in virtual exchanges, as they feel that participation could empower them in several areas.

Conclusion

Based on the research carried out, several opportunities were identified to promote virtual exchanges between teachers of engineering and technology. This would be a worthwhile exercise to undertake in a thoughtful way. The findings indicate a need to develop platforms and online tools to facilitate and encourage communication and collaboration between teachers from different countries, as this is what most teachers want. At the same time, it is important to provide adequate support for teachers to engage in virtual exchanges, both from a technical and organisational point of view. It could also be useful to establish international networks and partnerships between schools and educational institutions to enable teachers to have more sustained and structured virtual exchanges. The financial aspect should not be neglected, as financial support from educational institutions and governments could also encourage teachers to participate more actively in such exchanges. The field still holds considerable potential for exploration. It would also be relevant to examine the effects of virtual exchanges on teachers' professional development and personal growth, to analyse the impact of virtual exchanges on students, and to explore optimal approaches to integrating virtual exchanges into teachers' professional careers and, ultimately, into the curriculum. Efforts should therefore be made to promote virtual exchanges and research their effects, as they make an important contribution to improving the quality of teaching and enriching teachers' experiences.

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References

- Belz, J. A. (2003). From the special issue editor. *Language Learning & Technology*, 7(2), 2–5. <http://dx.doi.org/10.125/25193>
- Dooly, M., & O'Dowd, R. (2018). Telecollaboration in the foreign language classroom: A review of its origins and its application to language teaching practices. In Dooly, M. & O'Dowd, R. (Eds.), *Teachers' experiences with transnational, telecollaborative language learning projects* (pp. 11–34). Peter Lang.
- Dooly, M., & Vinagre, M. (2022). Research into practice: Virtual exchange in language teaching and learning. *Language Teaching*, 55(3), 392–406. <https://doi.org/10.1017/S0261444821000069>
- EVOLVE Project Team. (2020). *The impact of virtual exchange on student learning in higher education: EVOLVE project report*.
- Flogie, Andrej, Vičič Krabonja, Maja (2025). Vloga učech se skupnosti v sodobnem izobraževanju. *Revija inovativna pedagogika*, letnik 1, številka 2, str. 203-220. URN:NBN:SI:doc-A8SSLVIB from <http://www.dlib.si>
- Hussain Al-Qahtani, M. (2019). Teachers' and students' perceptions of virtual classes and the effectiveness of virtual classes in enhancing communication skills. *Arab World English Journal (AWEJ) Special Issue: The Dynamics of EFL in Saudi Arabia*, 223-240. <https://dx.doi.org/10.24093/awej/efl1.16>
- Luo, H., & Yang, C. (2022). Pedagogical benefits of Chinese-American virtual exchange: A study of student perceptions. *ReCALL*, 34(1), 37-50. <https://doi.org/10.1017/S0958344021000203>
- Machwate, S., Bendaoud, R., Henze, J., Berrada, K., & Burgos, D. (2021). Virtual exchange to develop cultural, language, and digital competencies. *Sustainability*, 13(11), 5926. <https://doi.org/10.3390/su13115926>
- O'Dowd, R., & O'Rourke, B. (2019). New developments in virtual exchange in foreign language education. *Language Learning & Technology*, 23(3), 1-7. <http://hdl.handle.net/10125/44690>

- O'Dowd, R., Sauro, S., & Spector-Cohen, E. (2020). The role of pedagogical mentoring in virtual exchange. *Tesol Quarterly*, 54(1), 146-172. <https://doi.org/10.1002/tesq.543>
- Schenker, T. (2013). The effects of a virtual exchange on students' interest in learning about culture. *Foreign Language Annals*, 46(3), 491-507. <https://doi.org/10.1111/flan.12041>
- Vičič Krabonja, M., Kustec, S., Skrbinjek, V., Aberšek, B., & Flogie, A. (2024). Innovative Professional Learning Communities and Sustainable Education Practices through Digital Transformation. *Sustainability*, 16(14), 6250. <https://doi.org/10.3390/su16146250>
- Warschauer, M. (1995). *Virtual connections: Online activities and projects for networking language learners*. University of Hawaii Second Language Teaching and Curriculum Center.