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The impact of virtual exchange on East–West social relations: lessons from a China–Portugal foreign language exchange

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Abstract: Student collaboration has always been integral to the learner journey. The current limited opportunities for face-to-face discussions and student mobility due to the pandemic have heightened the need for such online intercultural collaboration initiatives like Virtual Exchange (VE). At the same time, few studies have looked at collaboration patterns between Asian and Western students, while using robust mixed methods research design (i.e., pre-post TPACK, foreign language competence, diaries) and social network analysis. To that end, this study explored an East-West VE of 10 weeks between 16 university students from China and 18 students from Portugal working together online on shared tasks. The study compared the perceived development of technological and foreign language skills between the two groups of students, the extent to which their reported lived experiences in VE were positive for all students, as well as looked at the kind of relations the students developed with each other over the length of the exchange. The study provides important pedagogical implications for educators willing to design VE for the benefit of all students, as well as methodological implications for the use of social network analysis with VE data.

Keywords: East–West; eTandem; China; mixed methods; Portugal; social network analysis; telecollaboration; virtual exchange

1 Introduction

There is a wealth of research emerging about the opportunities and affordances of virtual exchange (VE), sometimes also called telecollaboration or etandem learning (Barbosa & Ferreira-Lopes, 2021; O'Dowd & Dooly, 2022; Tang, Kan, Wang, & Hu, 2021). According to Baroni et al. (2019, pp. 8–9), VE “is based on

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student-centred, international, and collaborative approaches to learning where knowledge and understanding are constructed through interaction and negotiation with students from other cultures”.

As evidenced by a range of recent systematic literature reviews (Barbosa & Ferreira-Lopes, 2021; Luo & Yang, 2018) these VEs give learners opportunities to engage with other learners across the globe to build friendships, learn to communicate in a foreign language, and to gain cultural insights all from the comforts of one's home (Dooly & Sadler, 2013; Kukulska-Hulme et al., 2021; Rienties, Lewis, O'Dowd, Rets, & Rogaten, 2020). In a recent conceptualisation of internationalisation, Mittelmeier, Rienties, Gunter, and Raghuram (2021, p. 269) call this internationalisation at a distance (IaD), which is defined as “[a]ll forms of education across borders where students, their respective staff, and institutional provisions are separated by geographical distance and supported by technology.”

While there is emerging evidence that VE can lead to positive social interactions and development of foreign language competence, most of these studies are conducted in Western contexts (Barbosa & Ferreira-Lopes, 2021; Luo & Yang, 2018). Indeed, Tang et al. (2021, p. 110) argued that “there is a lack of research investigating the telecollaboration regarding language development between learners in the East and the West”. Whether these potential benefits of VE will also be apparent for Asian learners (or not) has received limited consideration (Tang et al., 2021; Tseng, Sun, & Lan, 2020). In particular as there are substantial (perceived and/or reported) cultural and linguistic differences between Western and Eastern learners (Cho, Levesque-Bristol, & Yough, 2021; Rienties, Johan, & Jindal-Snape, 2015), there is a wide body of literature that has highlighted that both groups of learners need to develop and nurture appropriate coping mechanisms (Hendrickson, 2018; Mittelmeier et al., 2021; Tang et al., 2021). Given the often short durations of VEs and a lack of opportunities to fully engage in a foreign culture, this research builds on the work by Tang et al. (2021) and aims to explore whether VE learners nested within a Western and Eastern context can develop intercultural learning relations.

In this study we will explore a VE between 16 learners from China and 18 learners from Portugal that was part of one of the largest evidence-based VE projects called EVALUATE (Baroni et al., 2019; Hauck, Müller-Hartmann, Rienties, & Rogaten, 2020; Rets, Rienties, & Lewis, 2020; Rienties et al., 2020). While there are several examples of VE focussed on English language learning for Asian students (Tang et al., 2021; Tian & Wang, 2010; Tseng et al., 2020), this context is unique as it focusses on how 16 Chinese learners were able to develop and strengthen their Portuguese language skills by collaborating with 18 Portuguese learners, and how social network relations were established and maintained.

1.1 Virtual exchange and technological and foreign language competence

VE offers a dialogic space where learners can use digital technologies to (co-) design and evaluate learning resources while reflecting on the affordances and constraints of such tools, as well as on the kind of communication that takes place (Barbosa & Ferreira-Lopes, 2021; Hauck et al., 2020; Kukulska-Hulme et al., 2021). An emerging body of literature points to the potential of VE to contribute to the development of technological and foreign language (FL) competence among learners (Hauck et al., 2020; Rets et al., 2020; Rienties et al., 2020).

The development of the technological competence is often analysed through the lens of technological pedagogical content knowledge (TPACK) model (Mishra & Koehler, 2006). In line with that model, many argue that teaching with technology should go beyond developing abstract technology skills among learners and instead provide them with practical experience of applying technology to specific learning contexts and pedagogical approaches (Bueno-Alastuey, Villarreal, & García Esteban, 2018; Rets et al., 2020; Yeh, Chan, & Hsu, 2021). Several VE studies that used TPACK found a positive effect of VE practices on the development of learners' TPACK skills (e.g., Antoniadou, 2011; Dooly & Sadler, 2013; Rienties et al., 2020). Such highlighted positive outcomes include learners' realisation of the educational value of technology, confidence building, and the advancement of critical thinking when working with technological tools.

Some studies found significant relationship between TPACK knowledge and other competences. For example, Hao and Lee (2017) investigated pre-service teachers' perceptions of the use of Web 2.0 tools. Their study showed that students who had more knowledge of technology, and higher awareness of Web 2.0 tools, also had more concerns about how to use these tools to maximise the benefits for learners. A large-scale review of 23 VEs by Rienties et al. (2020) found significant relations between (pre- and post-test) TPACK scores and (perceived) FL competence. Their analysis showed that, while most participants indicated that their technological and FL competence improved during the VE, learners with stronger initial TPACK skills benefited more from VE. Both of these studies (Hao & Lee, 2017; Rienties et al., 2020) highlighted the importance of accounting for the initial levels of TPACK knowledge, rather than making conclusions only using post-test results, as well as the importance of unpacking the relations between TPACK and other competencies and/or learning experiences.

Some studies focused exclusively on the FL competence and found a facilitative effect of VE on some aspects of its development, particularly in the domains of oral fluency, pragmatic knowledge (e.g., code switching, understanding of politeness,

register, turn taking), and speaker confidence (e.g. Cunningham, 2016; Luo & Yang, 2018; O'Dowd & Dooly, 2022). The reason why the growth in FL proficiency is concentrated in these domains in VE might be rooted in the importance of negotiation of meaning. Negotiation of meaning is central to a VE as the VE participants need to adjust their linguistic output to build rapport and/or overcome lack of understanding when communicating with their virtual partners (Dooly, 2017).

One study that tried to unpack of the lived experiences of how students develop meaning using a robust pre–post design of TPACK in two VEs and clustered learners into those reporting high-medium-low perceived TPACK development (Rets et al., 2020). Their analysis of learner diaries by cluster revealed several factors critical for this outcome: learners' reported ability to overcome anxieties during VE and to see the faced challenges in the positive light, expectations they had of VE and their prior knowledge of technology. Rets et al. (2020) suggested that those responsible for setting up VE projects (a) need to provide students with a clear expectation management plan in respect of what the VE aims to achieve, and perhaps more importantly, what it does not, as well as (b) strengthen collaboration between virtual teams by encouraging more communication between them; providing appropriate tools for synchronous communication; having explicit discussions of home group organization and the implications of task work.

Nonetheless, as mentioned earlier most of these studies have been conducted in a Western context. Indeed, there is a relative paucity of research on VE in an Asian context. For example, Tian and Wang (2010) in their study of a Chinese–Australian VE showed that the aspects of proficiency improvement with the highest reported means were fluency, pronunciation, and the ability to give spontaneous replies. The researchers noted that VE participants gave low ratings of their gains in grammar knowledge, which they attributed to a short duration of the VE which might not have allowed the students to see the transfer of new grammatical knowledge into visible results. In an Asian collaboration on 37 students on an online Chinese teaching practice Tseng et al. (2020) showed that synchronous language approaches in Chinese could effectively enhance students' language learning.

In a more recent study on Chinese–UK VE, Tang et al. (2021) concluded that VE offered a secure space where learners from two participating universities could trust each other when pointing out each others' language errors. This offered the advantage of personalised learning, whereby feedback became part of the lesson and was particularly helpful for Chinese participants who are usually withdrawn and reluctant to speak English in public for fear of making mistakes.

As mentioned above, VE participants find themselves working in multimodal environments, where they need not only to negotiate meaning but also need to learn how to effectively use online tools and technologies when working towards a

shared goal with their virtual partners. Again as indicated before, while this might be difficult for students who work at a distance in a VE but share some cultural similarities (as in most reported Western VEs studies), when working across Eastern and Western cultures there could be additional challenges (e.g., Cho et al., 2021; Mittelmeier et al., 2021; Rienties et al., 2015; Tang et al., 2021).

1.2 Social Network Analysis as a promising method to explore learning experiences in VE

While VE has been recognised as a potent tool that facilitates learning, it is also associated with a number of difficulties. O'Dowd and Ritter (2013) identified four levels of challenges that might be experienced by participants in a VE, most of which are social and cultural in nature rather than technology-related. The first identified level is the individual (e.g., learners' knowledge, their motivations, expectations from the VE, stereotypes). The second level is the classroom (e.g., the task design, the matching of learners, and the local group dynamics). The third level, which has received most attention in VE research (Luo & Yang, 2018) is socio-institutional (e.g., choice of specific mediating technologies, the general organization of the VE such as differences in learners' timetables, or recognition of student participation in VE activity). The final level concerns the interaction itself (e.g., cultural differences in communication styles or the cultures-of-use of particular tools).

One promising method to capture the interactions between VE participants, their learning characteristics, and their socio-institutional context is social network analysis (SNA). In the broader learning sciences there is an emerging recognition that students' social networks substantially impact upon their attitudes, actions, and behaviours (e.g., Froehlich, Rehm, & Rienties, 2020; Hendrickson, 2018; Hommes et al., 2012; Rienties & Tempelaar, 2018). In social network theory, the focus of analysis is on theorising, understanding, and measuring the social interactions between entities (e.g., individuals, sub-groups, schools, VEs), rather than focussing solely on individual or within-group behaviour (Froehlich et al., 2020; Rienties & Tempelaar, 2018). A general assumption of social network theory is that people's behaviours are best predicted by their web of relationships (Borgatti, Mehra, Brass, & Labianca, 2009; Rienties & Tempelaar, 2018). As such, a social network consists of a set of nodes (i.e., students or groups in a course) and the relations (or ties) between these nodes (Froehlich et al., 2020).

Recent advances in SNA (Borgatti et al., 2009; Froehlich et al., 2020) could provide VE researchers a much-needed holistic perspective on how students in their VE develop social relations over time, in particular when SNA is combined

with other (qualitative) methods (Froehlich et al., 2020). By using SNA VE researchers could potentially unpack explicit and often hidden relations between participants that may not be apparent from individual surveys, diaries, interviews, or discourse analysis. For example, in a range of studies amongst local and international students (Hendrickson, 2018; Rienties et al., 2015; Rienties & Tempelaar, 2018) students often interacted with peers from similar social and cultural backgrounds, while active learning design strategies (e.g., task design, group allocation) could encourage more intercultural network relations. However, to the best of our knowledge no study exists within telecollaboration of VE that has used SNA to explore how VE participants build relations over time.

1.3 Research questions

As highlighted in the literature review, while there is an emerging body of literature showing that VE can provide powerful learning experiences to both native and FL learners, relatively few studies have specifically focussed on whether (or not) similar positive effects are noticed when Asian and Western learners work together. In line with Tang et al. (2021) and Froehlich et al. (2020) we used a mixed methods approach in this study. First of all, we aim to explore whether (or not) the reported TPACK and FL competence developments amongst this “Asian” VE were similar or different to other VEs in EVALUATE. As this VE was the only exchange in EVALUATE that included Asian students, we will refer to this VE as the Asian VE for the remainder of this study.

RQ1: To what extent are the reported learning experiences in terms of TPACK and foreign language competence for the Asian VE similar or different to other Western VEs in the EVALUATE project?

Second, we would be keen to explore whether from a quantitative and qualitative perspective the lived experiences of students from China and Portugal were similar (or not). In most etandem language learning projects learners would typically spend half of their communication in one language and then switch to the other language (Tang et al., 2021). By being supported by native language speakers half of the time and then switching to the other language which is spoken by their etandem partners, there are substantial opportunities for reciprocity between the two groups of language learners. However, in our Asian VE 16 students from China primarily benefited from interactions with 18 native Portuguese speakers. The Portuguese students could learn substantial skills in terms of working online and be engaged with authentic discussions with learners from an Eastern culture, but

one could expect that the lived experiences between the two groups might be slightly different.

RQ2: To what extent does the Asian VE lead to positive learning experiences for learners from Portugal and China? Are these learning experiences common amongst both groups, or just in one group?

Finally, to the best of our knowledge there is no study within VE that has used SNA to explore how Asian and Western learners develop learning relations in VE. As highlighted previously, the way that learners build intercultural relations in online settings may be important for discourse, TPACK and foreign language competence.

RQ3: How many learning relations are developed between the two groups of learners, and what is the (perceived) quality of these relations?

2 Method

2.1 Setting and participants

This mixed methods study took place in an EU-funded project called EVALUATE (Baroni et al., 2019; Rienties et al., 2020). In total 23 VEs were run including 34 institutions of initial teacher education from 16 countries. Most institutions were from European countries (Baroni et al., 2019), but also included other countries (e.g., Brazil, Canada, China, USA). Altogether, 1,018 students were invited to these 23 VEs (Baroni et al., 2019), mostly pre-service teachers and FL students (42%), and mostly women (64%). On average participants were 21.54 years old ($SD = 3.31$, range 16–44) and most students were studying English as a FL (Rienties et al., 2020). In contrast, the Asian VE used as main language Portuguese, whereby 16 participants from Instituto Politécnico de Macau (China) and 18 participants from Instituto Politécnico de Castelo Branco (Portugal) worked together for around 65 days on three sets of tasks in smaller groups of 5–6 people. There was a mixture of reasons why participants joined this respective VE. Several participants indicated at the pre-test to join the VE to learn about other cultures (Eastern/Western cultures), others wanted to strengthen their Portuguese language, while others wanted to learn how to effectively use technology for learning as future educators. Participants were left free to decide which language to communicate in (e.g., Portuguese, English). For more details in terms of the pedagogical approach, timings, group allocations and task design used, we refer to our previous publications (Baroni et al., 2019; Hauck et al., 2020; Rets et al., 2020; Rienties et al., 2020).

2.2 Instruments

In order to measure the development of the technological competence we used an adjusted version of TPACK by Schmidt, Baran, Thompson, Koehler, and Mishra (2009). Given that participants had to fill in the TPACK at the beginning and end of the VE as well as contributing to several diaries (Baroni et al., 2019; Rets et al., 2020), the questionnaire was shortened to 17 items. A Likert response scale of 1 (=totally disagree) to 5 (=totally agree) was used. In this study we only report the overall TPACK constructs for the pre- and post-test and previous research has identified appropriate fit and reliability (Rienties et al., 2020). In total 593 VE participants completed both tests across of the 23 VEs, of which 29 out of 34 Asian VE participants (85%) completed the pre-test, while 17 (50%) completed the post-test. Unfortunately, while 15 out of 18 Portuguese (88%) students completed the post-test, only two Chinese (12%) students participated at the post-test.

2.3 Foreign language competence

(Perceived) FL competence was measured at the end of the VE using a newly developed instrument consisting of seven items, whereby participants could rate whether their FL got worse (1), no improvement (2), improved a little (3), and much improved (4). As previously reported the construct had appropriate fit and reliability (Rienties et al., 2020).

2.4 Diaries

Participants completed an online diary at the start of the VE in line with the pre-test of TPACK, exploring their previous experiences with online learning and working with people from a different culture, as well as their expectations of the VE (Rets et al., 2020). Mid-way through the course participants completed another diary about their experiences thus far. Finally, at the end of the VE in total 13 questions were asked in their online diary, including their overall learning experience, working in intercultural teams, FL acquisition, and use of TPACK for future teaching (Rets et al., 2020).

2.5 Learning relations

As a final question of the third diary, participants were asked at the end how many participants were there in their virtual collaboration group in order to gauge their social network development (Froehlich et al., 2020). Subsequently they were asked in an open text box exercise to recall a maximum of five names of whom they have worked together in group (i.e., a form of open social network recall (Froehlich et al., 2020)). While there are several ways to collect data in SNA, by not providing a list of participants and asking participants to recall the names of the people they have worked with we expected that participants would only mention names of learners within whom they maintained a substantial learning relation. While there are more detailed approaches and more sophisticated SNA approaches available (Froehlich et al., 2020), we chose for this option because it was relatively unintrusive and easy to administer across the VEs and across different cultures. In this Asian VE study 17 students completed the SNA questionnaire (50%). While this is well below common benchmarks of 80% response rate, given that most Portuguese students (89%) responded and reflected on their relations and primarily the Chinese student responses were missing, we argue that nonetheless the reflections of the Portuguese might provide useful insights into the social dynamics in the Asian VE.

2.6 Data analysis

For a detailed description of the data analysis and techniques, we refer to previous published work (Hauck et al., 2020; Rets et al., 2020; Rienties et al., 2020). All quantitative data were analysed using SPSS 27 using ANOVAs. For the diaries the two authors independently coded and analysed the data of the Asian VE. Subsequent social network analysis were constructed in UCINET 6.69, where we ran social network visualisations, calculated network relations and density metrics. Ethics approval for these two studies was provided by Human Research Ethics Community by the Open University, HREC-2655/Rogaten.

3 Results

3.1 TPACK and foreign language competence of Asian VE

In terms of RQ1, we first compared the TPACK score of the 22 VEs with the Asian VE as indicated in Table 1. At the start of the VE, using ANOVA the Asian VE

participants indicated to be significantly more confident about their (self-reported) TPACK skills relative to the 564 Western VE participants, with a small effect size ($\eta^2 = 0.007$). At the end of the VE Western participants reported substantially improved TPACK skills (see also Rienties et al. 2020), and on average reported a gain in TPACK of 0.30 (SD = 0.51). In contrast, Asian VE participants TPACK skills decreased over time, and their (negative) gain was significantly different from Western VE participants, with a small effect size ($\eta^2 = 0.013$). In terms of FL competence, no significant differences were observed between Western VE participants and our Asian VE participants in Table 1.

Table 1: TPACK and foreign language competence.

	Pre-test TPACK		Post-test TPACK		Gain TPACK		Foreign language competence	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Western VE	3.61	0.51	3.91	0.51	0.30	0.51	2.73	0.55
Asian VE	3.88 ^a	0.38	3.81	0.60	−0.07 ^b	0.56	2.91	0.66
Portugal	4.02 ^b	0.46	3.81	0.60	−0.09	0.58	2.84	0.61
China	3.42	0.49	3.57	0.24	0.15		3.43	0.61

Western VE ($n = 564$), Asian VE ($n = 15$), Portugal (n pre = 17, post = 15), China (n pre = 12, post = 2). ANOVA ^a $p < 0.05$, ^b $p < 0.01$.

In line with previous findings (Hauck et al., 2020; Rets et al., 2020) the qualitative experiences expressed by Asian VE participants were in general positive about the VE. Note that we have used pseudonyms to protect their identity, and where data was available also indicated their respective age, gender, TPACK post-test score and FL competence. In particular the use of technology was seen as an affordance for intercultural communication:

Technology offers new modes of communication through online discussions, chats and teaching materials based on the internet. Technology not only functions as a tool for the production or information. Technology constitutes itself in everything that enables us to do things in a more efficient and effective way. (Magdalena_P, 21 years, female, Portuguese, TPACK = 4.54, FLC = 4 (improved substantially)).

I loved it. The share of cultural experiences, the exchange, the availability of sharing opinions and knowledge were extremely profitable and positive. They lay the basis for the creation of threads of friendship and the spirit of cooperation/ assistance. (Victoria_P, 34 years, female, Portuguese, TPACK = 4.94, FLC = 3 (improved a bit)).

Several participants also indicated that by working together in the Asian VE they developed a better cultural understanding of each other. For example,

I feel interesting and rewarded. I have learned a lot about different culture, climate and so on. (Camila_C, female, Macanese, TPACK = 3.39, FLC = 3 (improved a bit))

To work with a multi-intercultural team is superb, as I acquired new knowledge on the Chinese language and the habits associated with the Asian culture and, most importantly, I started do understand the strategies and mechanisms that are used in China in the classroom context in the most varied tasks. (George_P, 19 years, male, Portuguese, TPACK = 4.56, FLC = 2.86 (improved a bit)).

3.2 Lived experiences of VE learners from China and Portugal

In order to address RQ2, we compared and contrasted the quantitative and qualitative data from the Portuguese and Chinese participants. As indicated in Table 1 Portuguese participants were significantly more confident about their TPACK skills at the start of the Asian VE relative to their Chinese peers using ANOVA, with a large effect size ($\eta^2 = 0.301$). At the post-test Portuguese students were slightly less confident about their TPACK skills, while Chinese participants became slightly more confident, although these differences were not significant. The lived qualitative experiences in general indicate a positive perception of the technology of the VE for both groups. For example,

In my professional career as a teacher in the future, I will try to use tools and online environment to enhance knowledge because we learn a lot from them, as we did by doing this task. (Catherina_P, 20 years, female, Portuguese, TPACK = 3.34, FLC = 2.23 (no improvement)).

In terms of FL competence, in Table 1 Chinese participants indicated that their FL competence improved substantially, while Portuguese participants mostly indicated that this improved a little. This seems intuitively obviously as Portuguese participants were native speakers of Portuguese, and probably learned only a bit in terms of teaching non-native speakers their language. In contrast, Chinese participants might have benefited substantially from interacting with and speaking to native Portuguese speakers. One reason why this difference is nonetheless not significant might be due to the low post-response of Chinese participants. Therefore, these quantitative results need to be treated with caution.

For example, Jack_C indicated that one of the primary reasons for joining the Asian VE was to give him a competitive advantage when eventually visiting Portugal:

I hope to learn enough to be accepted as a local, I hope to learn enough to be able to establish a network and prepare myself so I can come back to Portugal in the future and have an advantage over newcomers. I hope my class and I can offer what others cannot to locals and students in the exchange program, and make this is an unforgettable experience. (Jack_C, 24 years, male, Chinese, no TPACK score and FLC score available)

While participants in general were positive about the Asian VE experience, there was some imbalance in terms of the benefits of FL learning and teaching, and the direction in language learning (i.e., from the Portuguese to China, but not necessarily the other way around).

I think it is a unique experience. It has been fun to share experiences and get to know new people. It's easy as we speak Portuguese, and I find interesting the idea of improving the Portuguese of our colleagues within the perspective that we're going to become teachers in the future. I find difficult to find time for interaction due to different time zones ... By talking on WhatsApp with the colleagues, we approached some subjects and corrected any errors in real time. It was fun and very interesting. (Victoria_P).

Indeed Catherina_P indicated an asymmetry in the VE experience due to the imbalance in language abilities, and in contrast to Victoria_P she also reported substantially lower TPACK and FLC scores.

Within my working group, the challenge was the language because sometimes they didn't understand well what we're trying to say. So we used simpler words as an attempt to explain it in a way in which it could be understood. I didn't learn nor use any new element of language to complete this task. This exchange hasn't improved the foreign language because I used my mother tongue. (Catherina_P)

In contrast, Camila_C indicated that

Online tools make it possible communicating between two students in different countries and different time zones. It makes me more courageous and outgoing. Once you show your kindness and patience, they will show the same to you. I think I have improved my foreign language ... I made friends with them. (Camila_C)

In other words, while both groups of learners indicated substantial benefits in terms of the affordances of the technology, the ability to work and learn together, there were substantial differences in terms of the imbalance in FL ability, and the opportunities to improve their language competence, which in part also influenced participants' (self-reported) technological and FL competence.

3.3 Social network development

Finally, in terms of RQ3 based upon the 17 respondents on average participants indicated to have 4.22 group relations in the Asian VE. In total on average 3.00 (SD = 1.43) named relations were recalled by the 17 participants, whereby most reported recalled relations were with their peers from the paired country. The overall density of the network was only 1.70%, meaning that most participants

were only connected to a few peers. This in part could be a result of the relatively low response rate amongst the Chinese students, and in part could be a result of the way in which VE participants were allocated to smaller intercultural sub-groups.

As indicated in Figure 1, several clear group clusters of intercultural relations are visible. Two (sub)groups of VE participants are clearly visible on the left of Figure 1, whereby the Portuguese female student Mila_P was a connector and bridge between the two groups as well the group in the middle of Figure 1. Another bigger group is visible on the right of Figure 1 and a smaller group is visible on the bottom of Figure 1. At the same time, in contrast to other intercultural research (Hendrickson, 2018; Rienties et al., 2015; Rienties & Tempelaar, 2018) there is a substantial mix of participants from the two countries, whereby in each (sub) group there are connections between white (Chinese) and grey (Portuguese) participants.

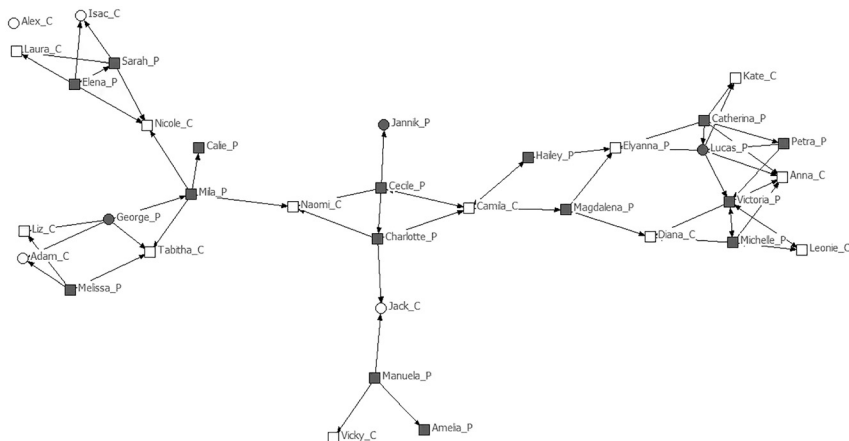


Figure 1: (Self-reported) Social network relations in Asian VE.

The qualitative data provided some more detailed insights into some of the social network relations and their underlying patterns. For example, Mila_P indicated that she enjoyed the opportunities for intercultural learning, but also indicated some tensions in terms of getting her Asian peers engaged:

I find very interesting to participate in a project like this one, because as I don't have the opportunity to go to China I had the chance to communicate with the locals and get to know their habits. The most difficult thing in this interaction is the lack of availability of both parts, which makes our communication more difficult. I think the share of videos and online chats could improve the interaction... One of the main challenges I faced was the fact that students

from China from my group didn't intervene a lot; they didn't pose a lot of questions, so our communication was difficult. To resolve the issue, I asked them more questions and took advantage of having a Timorese colleague who shared information about her country. (Mila_P, 21 years, female, Portuguese, TPACK score = 2.88, FLC score = 2.67)

By taking part in this project, I could see another cultural reality completely different from my own by contacting the Chinese colleagues. The most important thing was that one, the fact of contacting people from the other side of the world and having learned some things about their culture. It was gratifying. I Realise that the Asian culture is completely different from the European one; the food is completely different, and they are very respectful. (Melissa_P, 20 years, female, Portuguese, TPACK = 4.09, FLC = 3.89 (improved substantially)).

In a range of studies it has been found that some Asian students tend to have different learning and communication strategies than Western students (Holmes, 2005), and are sometimes less active in group discussions, and even silent (Zhou, Knoke, & Sakamoto, 2005). However, teachers can encourage active engagement when designing authentic group and respectful tasks that allow East and West learners to build on each other's knowledge and expertise (Mittelmeier, 2022).

4 Discussion

This mixed methods study was inspired by Tang et al. (2021) who indicated that there are very few virtual exchange (VE) studies that looked at online collaboration between Western and Asian students. While there is a wide body of evidence available that VE encourage technological and foreign language competence in Western VEs (Barbosa & Ferreira-Lopes, 2021; Luo & Yang, 2018; Rienties et al., 2020), there is limited evidence whether these effects are indeed similar when Eastern and Western students work together in a VE. A second gap in VE research includes a lack of studies that looked at the development of multiple competences and connected objectively measured gains to students' lived qualitative experiences in VE (Rets et al., 2020; Rienties et al., 2020). Finally, a unique new contribution of this study is the use of SNA in VE in order to capture and unpack the relations between VE participants.

To that end, the first research question of the study aimed to compare the perceived development of TPACK and foreign language (FL) skills between 16 students from China and 18 students from Portugal in one of the largest evidence-based VE projects (Baroni et al., 2019). Results showed that there was a significant difference in TPACK growth between the two groups of students, with Chinese students overall reporting positive gains in TPACK, and Portuguese – negative gains. Most previous studies report an overall positive effect of VE on students'

technological skills (e.g., Antoniadou, 2011; Dooly & Sadler, 2013; Rienties et al., 2020). However, the finding in this study on negative gains might be due to the fact that Portuguese students initially had higher pre-test TPACK skills, compared to Chinese students, and a potential ceiling effect of having a relatively high TPACK score at the outset of the VE might not have allowed them to make further significant gains.

An alternative explanation might be that while Chinese students were able to benefit from the native Portuguese speakers' language abilities, this was not necessarily reciprocated for Portuguese participants as the conversations were already in their mother tongue. This might be a limitation of this study as in contrast to some other etandem studies (Tang et al., 2021) there were limited opportunities for Portuguese students to practice a foreign language. While the qualitative experiences did indicate positive technological learning effects and lessons about culture for several Portuguese participants, perhaps this was not sufficient for all Portuguese learners to further improve their TPACK skills.

Overall, our findings to the first research question corroborated those in Rienties et al. (2020), who stressed the importance of adopting robust VE research designs with pre- and post-test scores, while tracking the development of multiple competences, as there is strong emerging evidence that pre-test TPACK can significantly predict FL competence, and, more generally, that students with stronger technological skills might benefit more from participating in online learning activities, such as VE.

The second research question was concerned with understanding the extent to which a VE between Asian and Western students leads to positive learning experiences for all students involved. Our findings showed that both groups reported mostly positive experiences, particularly around intercultural learning, communication, and diversity cognizance. Portuguese students often talked about their willingness to help their VE partners to improve their Portuguese FL skills, and find ways to correct any language inaccuracies. This finding is in line with Tang et al. (2021), who also found a VE to be a safe space where learners from two participating universities could trust each other when pointing out language errors, with such corrective feedback taking the form of personalised learning. However, a major difference was that the etandem experience in a way was not necessarily reciprocated. Indeed, there might have been an inherent power-imbalance due to the asymmetry of Portuguese language expertise.

Naturally, the 'real-life' experience of online communication and collaboration meant that participants had to face some challenges. The challenges reported in this study corroborate those reported in earlier VE studies and concentrate around the difficulties associated with asynchronous communication, differences in students' timetables, and differences in the levels of engagement with VE among

participating students (O'Dowd & Ritter, 2013; Rets et al., 2020). At the same time, the longitudinal nature of the diary method used in this study allowed us to track changes in students' attitudes to VE and to the faced challenges over time (Rets et al., 2020).

The analysis of Diary 3, which our study participants completed at the end of the VE after 65 days, showed that both Portuguese and Macanese students were more positive about their VE experiences than at the beginning. Most students commented on the novelty of this experience of working collaboratively online with peers from another continent, which perhaps is surprising given our global world connected through technology. This finding further highlighted that making intercultural connections does not occur naturally, and Higher Education can play an important role in building such intercultural, "internationalised at a distance" networks, through such tools as VE (Hauck et al., 2020; Mittelmeier et al., 2021; O'Dowd & Dooly, 2022).

The third research question tapped into our understanding of the quantity and quality of the relations that our participating students built through VE. Using the method of SNA we found that participants tended to build relations interculturally, rather than only connecting to peers from their home culture. Furthermore, our finding on Portuguese students acting as bridge-builders between the two groups of students is in line with our findings to the second research question above, where Portuguese students acted altruistically and were eager to help their Chinese peers learn Portuguese. This emerging evidence on the potential of VE to help students 'mix' and build relations with international peers, rather than superficially comment on cultural differences is an important finding, particularly in light of the literature that shows that international students tend to remain in their cultural silos even when studying abroad (Hendrickson, 2018; Rienties et al., 2015; Rienties & Tempelaar, 2018).

To the best of our knowledge, no previous study has used SNA before to explore VE data, while this method can provide useful insights on how students interact interculturally, and whether VE 'works' in achieving its claims. Overall, our mixed methods study shows that when exploring whether VEs work (or not), and for whom in particular, understanding the context in which learners work and using robust (longitudinal, internationally validated, mixed) methods are crucial.

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