

The Effectiveness of Virtual Team Learning and Its Potential Factors in Entrepreneurship Education Courses

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Abstract: Entrepreneurial instructors and learners are pioneers in adopting virtual team learning processes, despite its novelty and the lack of empirical results showing its effectiveness. In this study, we present an online survey method that was designed to collect data from both students and educators from higher education institutes, in order to analyse the perception of virtual team learning from competence, technologies, and possible factors influencing entrepreneurial education. Findings show that virtual team learning and technologies are effective for entrepreneurship education. Gender, family entrepreneurial history, and prior entrepreneurial experience do not significantly affect respondents' attitudes. The role, education degree, and field have impactation in certain aspects. This research will help educators and entrepreneurial scholars to adopt virtual team learning in practice and theoretical studies.

1 INTRODUCTION

Team learning method applied in business schools at higher education institutes (HEIs) is mainstream (Betta, 2016). For example, the “lean start-up” methodology is based on group and experiment and has been shown as an effective learning strategy for entrepreneurship education (EE) (Harms, 2015; Leatherbee and Katila, 2020). Entrepreneurial instructors and learners are familiar with the team learning method because of the benefits of the application, namely, learners acquire *working with others* and *learning through experience*, being two of fifteen entrepreneurship competencies Bacigalupo et al. (2016) by the means of team-based activities (Warhuus et al., 2017). Educators and policymakers adopt technological tools and devices for EE activities. Thus, technologies of virtual team learning are currently desirable and necessary. Therefore, virtual team learning is on the top list of EE activities.

The effectiveness of the virtual team in the workplace or organizations has been proved, similar to the face-to-face team (Berry, 2011; Dulebohn and Hoch, 2017; Newman and Ford, 2021). In the learning environment, online teams, distributed teams,

and others instead of virtual teams and combined with other technologies, are discussed (Jumat et al., 2020; Wang et al., 2021). The effectiveness of virtual team learning is discussed in an online learning environment (Ismailov and Laurier, 2021). EE is put into online with collaboration and cooperation amongst learners to ensure online learning success. Additionally, EE belongs to social discipline and requires “learning from experience”. The competence of collaboration is quite important for EE learners. Learners need to build a social network with other remote participants. Surveys revealed students favored the online collaboration (Ku et al., 2013; Lino-Neto et al., 2021). Virtual team adds the component of technology, the basis of online or distance learning. In line with informational and digital education, except the learning management system, teachers in Chinese Higher Education sectors apply social media to their daily teaching and administration. Learners send emails and messages in the WeChat group, sharing information and discussing within groups. The virtual team immerses daily life and work. Virtual team is utilized in medicine, engineering, and social disciplines. The area of EE requires more social presence and

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collaboration amongst learners. On one side, entrepreneurs learn through experience from themselves and other fields (Erikson, 2003; Bell and Bell, 2020). The other is learning from the social network (Man, 2007) from family and employees to suppliers. Accompanying with the digital of education, EE courses are put into the internet and are learned by remoted attendees. The researchers and educators from the realm of EE, however, lack enough first-hand data concerning students' and educators' attitudes or feedback towards virtual team learning. What's more, educators and learners might have different opinions on virtual team learning.

To further study virtual teams in EE and improve its effectiveness, in this research, we collected data from both teachers and students through an online survey research method to understand and obtain feedback relating to the effectiveness of virtual team learning applied in EE courses in Chinese HEIs. The specific objectives are:

- To explore the perception that learners and educators on virtual team learning applied in EE;
- To obtain entrepreneurial participants' ideas about the effectiveness of technology in terms of virtual team learning;
- To identify critical factors that affect participants' attitudes towards virtual team learning.

The following section shows the related theoretical background, the third section mentions methodology, the fourth shows the critical results and discussion, and the last makes a conclusion.

2 THEORETICAL BACKGROUND

This section presents theoretical underpinning, namely virtual team learning and the effectiveness of virtual team learning, and promotes the research questions to be solved.

2.1 Virtual Team Learning

Virtual team learning means teammates collaborate and cooperate with remote peers through the adoption of email, e-conference, and intranet (or internet) to transfer documents and exchange opinions. Information and communication technologies (ICT) extend activities and social software networking penetrates daily and school life for digital natives, especially for Generation Z (Janicke-Bowles et al.,

2018). This learning method has been widely applied to various disciplines, especially in EE courses during the COVID-19 pandemic, when instructors emphasized the remoted students' relationship with one another to facilitate learning effectiveness within groups. For example, educators utilized sub-groups via break-out rooms on Zoom (an online conference software) to allow team tasks to be completed and supervised successfully. Although scholars know little about the effectiveness and impact of EE being undertaken completely online (Liguori and Winkler, 2020), instructors and learners widely utilize educational technologies as a supplement to face-to-face and blend learning. Under the circumstances of a virtual team, teammates uploaded and shared documents with other participants in online learning environments. Additionally, they discussed via the technologies and noted down their opinions and brainstorming results with remote teammates. Furthermore, learners can log onto the software and check the results. Hence, this learning strategy makes learners have more connections and social presence whilst maintaining flexibility (Rogers et al., 2009).

2.2 Effectiveness of Virtual Team Learning

The virtual team provides opportunities for teammates to communicate and collaborate without the restriction of time and location, 24/7 learning with teammates. Virtual team has various kinds of communication. The textual communication, email, and message of the virtual team lack verbal cues, e.g., facial expression. Face-to-face communication happens randomly, such as informal workplaces, hallways, as well as the parking pot (Berry, 2011). Besides exchanging information, a virtual team can solve problems and puzzles during the learning process. In addition, a virtual team can attract international talents to join one learning group with lower costs compared to face-to-face team learning.

The effectiveness of virtual team learning is analyzed from entrepreneurship competence. The three main areas of virtual team learning: identifying entrepreneurial opportunities, mobilizing resources, and taking action are core sections of the framework of entrepreneurship competence.

Although the range of virtuality is from slight to an extreme degree, technology is a necessary element of a virtual team (Cohen and Gibson, 2003). Technology can electrically store communication data for further learning analysis. The participants can review the messages and deepen their understanding of the content. The function of technology is critical

in a virtual team, but the effectiveness of virtual team learning is not only because of technology. Scholars proved other factors impact the effectiveness of a virtual team, such as team diversity, trust, and so on. From the aspects of education and psychology, the participants' demographical information might influence the effectiveness. Additionally, learners' entrepreneurial background (both themselves and families) (Georgescu and Herman, 2020) is possible to affect their perception. Teachers and learners might have different attitudes. The teachers aim to achieve the objectives of courses and the perception of learners is the real result of courses. The various disciplines might affect participants' perceptions. The learning requirements of Science and Engineering are different from Humanities and Social Sciences. But the former needs social presence as well (Mackey and Freyberg, 2010).

2.3 Research Questions

In order to remedy the lack of face-to-face communication, virtual team organizers provide activities (e.g., ice-breaking and self-introduction) and technological tools to learners for knowing their classmates better since the team-building activities usually lead to more effective collaboration efforts. Therefore, when a virtual team is applied in EE, course organizers need to provide a manual, not automatic, "social presence" (Rogers and Lea, 2005). The sub-competencies of Entrepreneurial competence include mobilizing resources, identifying entrepreneurial ideas/opportunities, and taking appropriate actions (Bacigalupo et al., 2016). Our first question is, therefore:

- How are entrepreneurial attitudes of participants (educators and learners) towards virtual team learning in EE courses?

Virtual learning and virtual team learning were mediated by technology (Huda et al., 2018): Video explanation is for team business ideas presentation (Wu et al., 2018); Social networking sites are for communication and collaboration; Digital learning tools aims to publish and create content together, like Murual; Serious games motivate learners and increase interest (Swaramarinda, 2018). Hence, our second question is:

- What is the effectiveness of technologies applied in virtual team learning for EE courses?

Except for technology, many factors impact the effectiveness of the virtual team learning (Bhat et al., 2017). Family entrepreneurial history (Wadhwa and Aggarwal, 2009), gender (Nowiński et al., 2019), degree (Paray and Kumar, 2020), and prior

entrepreneurial experience (Ngoc Khuong and Huu An, 2016) influence entrepreneurial intention and EE effectiveness. Similarly, students and teachers have significantly different views on virtual team learning in EE. Deriving from this, our third question is:

- Do five factors (gender, entrepreneurial family history, degree or working areas, prior entrepreneurial experience, and roles) affect attitudes towards virtual team learning applied in EE?

3 METHODOLOGY

Here we adopted an online questionnaire survey to collect data as broadly as possible from both teachers and students.

3.1 Instruments and Distributing

A questionnaire was conducted with 20 questions (seven demographic, 11 central, and two optional questions) from 1 March to 30 April 2021. A five-point Likert scale ranging from 1 = fully disagree to 5 = fully agree was used to obtain structured answers. The items measuring the effectiveness of virtual team learning on EE are from the general effectiveness that was adopted from the entrepreneurship competence framework promoted by Bacigalupo et al. (2016). During the design of the questionnaire, two experts with an education technology background and two EE teachers in HEIs gave feedback and specific suggestions. We distributed the same questionnaire to teachers and learners. We contacted teachers from social media groups (WeChat) to get the data from the teachers' side. Meanwhile, entrepreneurial teachers from Chinese HEIs distributed questionnaires through Wechat and learning management systems to their students seeking their completion.

3.2 Participants

382 respondents from both learners and instructors completed this survey and the total number of valid respondents is $N = 372$ (50.3% male, 49.7% female). With the exception that four respondents did not fill in their age correctly and were subsequently excluded, the mean age of $N = 62$ faculty members were 40.21 years old. 98.4% of faculty members were Bachelor and over. 87.1% were from Social Science, 4.8% were Natural Science, 3.2% were Applied Science. The educational field and degree of learners were shown in Figure 1.

Table 1: Description data of participants.

Role	Mean	SD	Max	Min
Instructor	40.21	8.616	57	25
Learner	19.62	1.197	24	16

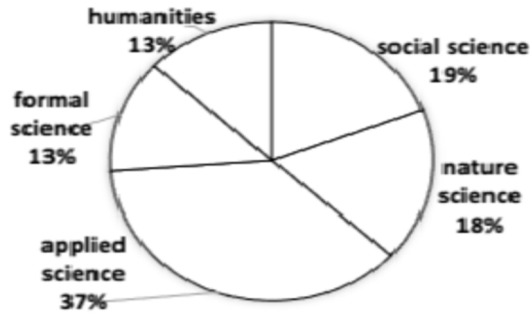


Figure 1: The education field of learners.

$N = 307$ learners were 19.62 years old. 60% of them studied for Bachelor and 38% studied for three years college or vocational and training education. Excluding five missing of gender, 51.8% of learners were male and 47.4% were female. 27.9% had an entrepreneurial family history and 10.8% had practical entrepreneurial experiences. In general, 45.2% of learners and educators had an entrepreneurial family background and 30.6% had entrepreneurial experience. Without six demographic questions, Kaiser–Meyer–Olkin (KMO) is $.934 > .9$, $p = .000$. Therefore, the factor analysis can be applied from F1_PRO to F2_OPP (central questions). The small coefficient absolute value is over .65. At the same time, in light of literature reviews and research objectives, researchers set two fixed factors. Because items 11, 13, and 14 are below .65, we deleted the three questions. Cumulative sums of squared loadings are $71.126\% > 70\%$. In the end, Factor 1 includes four items: the effectiveness of virtual team learning (Cronbach’s Alpha .910) and Factor 2 contains four items: virtual team technology (Cronbach’s Alpha .906).

Statistical analysis was completed using SPSS 28 using Analysis of Variance (ANOVA) to understand the cause and effect, and descriptive statistics of factors. ANOVA easily analysis and understand the effect of every factor with three or more groups.

4 RESULTS AND DISCUSSION

According to the completion of previous theoretical research and online survey, here we summarise key results from this survey study and discuss them from two sides.

4.1 Virtual Team Learning

The general effectiveness of virtual team learning is higher than 70% positive (fully agree and agree) in *identifying entrepreneurial opportunities* (F2_OPP, $M = 3.85$, $SD = .79$), *mobilizing resources* (F2_RES, $M = 3.94$, $SD = .71$), *taking actions* (F2_ACT, $M = 3.92$, $SD = .70$), and *efficiency item* (F2_EFF, $M = 3.95$, $SD = .66$). The negative response in F2_OPP is the highest (7.3%) and other items lower than 4.4%. It proved that the respondents agreed on the effectiveness of virtual teams, especially mobilizing resources, but less on identifying entrepreneurial opportunities, even though the trust amongst entrepreneurs facilitates exploiting entrepreneurial chances (Bergh et al., 2011). Participants easily shared text, video, and audio information related to entrepreneurial content through virtual team technologies. Every attendee was a learning content creator through digging resources from inside and outside of teams. In addition, virtual teammates or tutors join teams, which extends their social network. Therefore, they might find potential co-founders or suitable collaborators from worldwide. However, identifying opportunities is difficult for founders, especially learners and educators who are in the ivory tower. On the one hand, the “promising” business opportunities or ideas are not distinctive and might replicate the same format in other places. The nascent market is ambiguous, changeable, and short-lived. On the other hand, a promising entrepreneurial idea or opportunity is seldom uncovered as the right product features (Eisenhardt and Bingham, 2017). Therefore, fostering and acquiring this competence is not an accessible business and academic activity. Although EE increases intention and perceives behavior control (Rauch and Hulsink, 2015), potential enterprises seldom take action directly. Even when they know the difficulties and complications of starting a business, scholars found learners’ entrepreneurial intention decreased significantly after six months (Lorz and Volery, 2011).

Table 2: P value of One-way ANOVA (background for Factor 2).

	F2_OPP	F2_RES	F2_ACT	F2_EFF
Role	.597	.948	.026	.235
Gender	.778	.473	.702	.748
Education	.454	.056	.012	.031
Field	.008	.142	.018	.068
Family	.716	.455	.152	.227
Experience	.665	.978	.193	.191

Referring to demographic background, one-way ANOVA analysis showed that educational degree influences the two competencies of *taking appropriate actions* and *efficiency* (See Table 2). Senior school or under respondents are different from the other three education degrees on *mobilizing resources* ($p = .037$). Three years of college or vocational and technical education is different from over bachelor on *taking action* ($p = .014$). At least respondents from one field differ from the other three fields on identifying opportunities ($p = .008$) and taking actions ($p = .018$). About the role of participants, educators and learners have different ideas on taking entrepreneurial action ($p = .026$), namely learners marked virtual team learning higher than educators. In this study, a higher percentage of educators have entrepreneurial experience and they are more conservative than learners, which might explain the difference in the effectiveness of virtual team learning for taking entrepreneurial action. One-way ANOVA showed that gender, family background, and former experiences have no relationship with the perception of virtual team learning from both learners and teachers. This is different from previous studies.

4.2 Technologies in Virtual Team

83.4% agree (fully agree and agree) that “The chosen learning strategy affects virtual team learning” (F1_STR, $M = 3.97$, $SD = .61$). 79.4% agree that “Various technologies have different effectiveness for virtual team learning” (F1_VAR, $M = 3.99$, $SD = .62$). 79% of respondents agree that “The frequency of utilization of technology affects the learning or teaching effectiveness of EE” (F1_FRE, $M = 3.97$, $SD = .68$). 77.9% of respondents support “The degree of proficiency of technologies affects virtual team learning” (F1_PRO, $M = 3.95$, $SD = .67$). EE participants are active in introducing cutting-edge technologies, and 26.9% used artificial intelligence (AI). Educators introduce technologies to share documents, release notices, and distribute tasks anytime and anywhere. They provide different technologies, e.g., social media, serious games, visualization (Ifenthaler, 2014), and recognize their effectiveness. Technology is a tool for adapting to entrepreneurial learning objectives and contents. Serious games and learning simulation systems mimic real life, and learners collaborate in the virtual environment for readiness of entrepreneurship. The familiarity with technology applications makes learners use it efficiently.

Table 3: P value of One-way ANOVA (background for Factor 1).

	F1_STR	F1_VAR	F1_FRE	F1_PRO
Role	.168	.002	.220	.012
Gender	.611	.619	.765	.442
Education	.007	.023	.018	.012
Field	.265	.069	.097	.076
Family	.292	.912	.152	.935
Experience	.675	.948	.305	.429

The one-way ANOVA analysis showed that the role of participants didn't have a significant difference on F1_FRE and F1_PRO, except F1_VAR ($p = .002$) and F1_PRO ($p = .012$). The proficiency of technologies applied in virtual team learning facilitates the perception of learners, compared with educators. In other words, students gave higher scores than educators on F1_VAR and F1_PRO. Learners are born and live in the digital age, leading to a high acceptance degree of technologies. Educational degree affects the perception of participants: The higher the education degree of educators, the more agree on four sections of Factor 1. In general, the higher the education degree, the higher professionalism required in entrepreneurship activities and higher entrepreneurship intention (Paray and Kumar, 2020). Meanwhile, gender, educational field, entrepreneurial family background, and respondents' prior entrepreneurial experience did not affect their opinion on technology (See Table 3). Although the proportion of applied artificial intelligence is 26.9% in this research, based on the optional question “if it is possible, please write down artificial intelligent tools in EE”, chatbot, the interaction of thing (IoT), and AR/VR, which are three highest mentioned. Therefore, participants need familiarity with their deployed technologies.

5 CONCLUSIONS

Virtual team learning is a useful method for entrepreneurial participants, especially when adopting home studying and ubiquitous learning. Respondents are optimistic about the performance of virtual team learning in general. The effectiveness of EE through virtual teams, however, is not as good as educators' expectations as learners, and those educators prefer a face-to-face learning setting (Liguori and Winkler, 2020). Many opponents consider technology as a remedy for online learning. Recently, Chinese students have returned to physical schools and educators still provide technologies to learning environments for organizing and managing

entrepreneurial learning. The perception of virtual team learning for the effectiveness of EE is positive (all the means are close “agree”).

Education degree affects respondents’ attitudes towards taking action and the effectiveness of virtual team learning. Different educational fields affect identifying opportunities and taking action. Learners and educators have different opinions on taking action by use of virtual team learning. Furthermore, learners are more positive about the technology of virtual team learning, especially in the various and the proficiency of technology. The education degree of participants influences the attitudes towards EE technologies.

This research study helps educators and scholars to know the feedback from both learners and instructors about virtual team learning after the pandemic and returning to campus in China. Therefore, our contributions include knowing participants’ attitudes towards virtual team learning applied in EE courses and potential demographic factors, and encouraging educators and learners to utilize virtual team learning in EE courses.

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