Online Think–Pair–Share in a Third-Age ICT Course
Daniele Traversaro

Abstract—Problem: Senior citizens have been facing a challenging reality as a result of strict public health measures designed to protect people from the COVID-19 outbreak. These include the risk of social isolation due to the inability of the elderly to integrate with technology. Never before have Information and Communication Technology (ICT) skills become essential for their everyday life. Although third-age ICT education and lifelong learning are widely supported by universities and governments, there is a lack of literature on which teaching strategy/methodology to adopt in an entirely online ICT course aimed at third-age learners. This contribution aims to present an application of the Think-Pair-Share (TPS) learning method in an ICT third-age virtual classroom with an intergenerational approach to conducting online group labs and review activities. Research Question: Is collaborative learning suitable and effective, in terms of student engagement and learning outcomes, in an online ICT course for the elderly? Methods: In the TPS strategy a problem is posed by the teacher, students have time to think about it individually, and then they work in pairs (or small groups) to solve the problem and share their ideas with the entire class. We performed four experiments in the ICT course of the University of the Third Age of Genova (University of Genova, Italy) on the Microsoft Teams platform. The study cohort consisted of 26 students over the age of 45. Data were collected through online questionnaires. Two have been proposed, one at the end of the first activity and another at the end of the course. They consisted of five and three close-ended questions, respectively. The answers were on a Likert scale (from 1 to 4) except two questions (which asked the number of correct answers given individually and in groups) and the field for free comments/suggestions. Results: Groups achieve better results than individual students (with scores greater than one order of magnitude) and most students found TPS helpful to work in groups and interact with their peers. Insights: From these early results, it appears that TPS is suitable for an online third-age ICT classroom and useful for promoting discussion and active learning. Despite this, our work has several limitations. First of all, the results highlight the need for more data to be able to perform a statistical analysis in order to determine the effectiveness of this methodology in terms of student engagement and learning outcomes as future direction.

Keywords—Collaborative learning, information technology education, lifelong learning, older adult education, think-pair-share.

I. INTRODUCTION

The population of seniors is facing a difficult reality due to the COVID-19 pandemic. The risk of social isolation has increased especially among older people with no digital skills. Seniors with computer skills could be able to undertake their tasks at home, shopping, and bank transactions more easily, connect with loved ones and access lifelong learning opportunities on the web. In this context, ICT education during COVID-19 appears to play an even more important role in contributing to the social and digital inclusion of seniors.

In the literature it has been shown that ICT can improve the quality of life of older adults [1]. More generally, it has been shown that third-age education should enable social inclusion, recovery and raising self-esteem, dignity and citizenship [2]. Furthermore, it emerged that education and lifelong learning play an important role in active ageing [3]. In recognition of this, numerous programs around the world encourage learning in later life, such as the University of the Third Age (U3A) [4]. In general, U3A supports the idea of not formalizing the third-age education similar to traditional university courses but rather to try to get the group of students to engage in a discussion on any interested topic. Typically, the syllabus for the courses is not very well defined and a lot of emphasis is placed on research as candidates come from diverse backgrounds with experience [5]. But these indications are generic and transversal to each discipline which may require a more specific strategy.

The adoption of an intergenerational learning methodology emerges from the literature on third-age education [6]. It is defined as a learning partnership based on reciprocity and mutualty involving people of different ages, who work together to acquire skills, values and knowledge. In this approach, seniors work together with young tutors through observational and cooperative learning which results in intergenerational and intercultural solidarity. There are many examples of ICT courses for the third age with an intergenerational approach. At the University of Ostrava, ICT skills were promoted through intergenerational dialogue and active seniors’ approach [6]. The course was organized in two parts: one of the lectures held by the professor, and one in which seniors became teachers of their peers, collaborating with the young students to develop contents. In Italy, the Fondazione Mondo Digitale [7] has always promoted an intergenerational approach, where young students cover the role of digital facilitators to support the elderly in their learning process [6]. In the 2019-2020 academic year, this approach had to be adapted to meet the need for secure remote learning in the context of the COVID-19 threat.

In general, taking a third-age ICT course in a virtual classroom is not easy for either the teacher or the adult students. For the latter it is very challenging to attend an ICT lesson as they cannot count on the “physical” help of the teacher or on that of the tutors when they have practical problems, for example with the use of the mouse. Each student attends the course using their own personal computer which may differ from that of the teacher both in terms of hardware (e.g., keyboard, etc.) and operating system (e.g., Microsoft Windows 10, Microsoft Windows 7, Chrome-OS etc.). In addition, they must independently log into the learning platform, join the meeting call and interact with the teacher or colleagues through

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chat or other options offered by the platform. Generally, seniors are not familiar with these digital tools and this can generate an initial sense of discomfort and frustration. From the teacher's point of view, it is difficult to understand if students are acquiring digital skills correctly; furthermore, laboratory activities are difficult to manage due to the aforementioned problems linked to the barriers imposed by distance.

Our research has identified TPS as a possible teaching methodology for online group labs and review activities. TPS is a well-structured collaborative learning strategy where students work together to solve a problem. In particular, a question is posed, the students think about it individually, then discuss the solution in small groups and finally share their ideas in plenary. TPS is a very popular strategy (at least in secondary school and high education) and can easily be modified for distance learning. To our knowledge, no study has yet reported on the use of TPS in third-age ICT courses but there is evidence on the effectiveness of TPS in computer science courses aimed at undergraduate students [8]. Although the pedagogy for the elderly is very different from the one mentioned above, it has been shown that students of all age groups, including people enrolled in courses specifically designed for senior citizens, can benefit from collaborative learning or being reminded of how to cooperate with peers [9]. In general, regardless of age group, it has been demonstrated the positive relationship between collaborative learning and student achievement, effort and motivation [10]. Our general goal was to design an effective online learning environment, in order to increase student engagement, promote active learning and social interaction online, such as the discussion of contradictory information.

This paper thus aims at addressing the following research question: Is collaborative learning (with TPS methodology) effective, in terms of student engagement and learning outcomes, for an entirely online third-age ICT introductory course?

The remainder of the paper is organized as follows. Section II provides an overview of the participants and the setting. Section III is devoted to the methods and to the data collection. Section IV reports the achieved results. Section V is devoted to the discussion of the results and the conclusions.

II. POPULATION AND SETTING

Our University of Genoa of the Third Age (Italy) [11] offers courses for people aged 45 and over with a variety of cultural proposal. In particular, it offers three Information Technology courses: basic, intermediate and advanced. The basic course covers the following topics: historical notes on ICT hardware basics (what is a CPU, RAM, HDD/SSD, I/O peripherals etc.), computing (how to use simple computer tools such as internet, email, social networks, pdf documents, text editors, media players, printer, scanner etc.), hints of computer networks (notion of IP address, router, modem, network packet, firewall, client/server and peer to peer architecture), hints on security and privacy (fake news, spam, phishing, smishing, malwares and virus, etc.) and a brief introduction to mobile devices.

Our experimentation was aimed at older students enrolled in the basic ICT course. The course consisted of 40 hours of lessons (20 hours of theory and 20 hours of laboratory) with two hours of lessons per week. It did not include a final assessment test. Individual assignments were proposed which were then discussed in class. The lessons took place remotely on the Microsoft Teams platform. Each student had their own credentials to access it. All lectures were recorded and made available on the course channel. Before the course began, students were invited to attend a webinar on how to use the platform. Furthermore, in the first months of the course, a young undergraduate tutor was available by telephone to help participants access the platform and the lesson.

Our study sample consisted of 26 students over the age of 45. It was a very heterogeneous group as people had very different professional backgrounds and levels of qualifications. However, the class was gender balanced.

From a purely technical point of view, the TPS activities were developed using the breakout rooms. The latter are a specific feature of Microsoft Teams platform that allow to break students into small groups during class meetings. Students did not have to worry about opening or closing a meeting as they were automatically transferred from the general meeting to the breakout room and vice versa. In what follows, we will describe in detail the TPS methodology and how it was managed.

III. METHODS

A. Think-Pair-Share

TPS is a collaborative learning strategy which promotes the participation of all group members and where the teacher acts as a facilitator of learning. The strategy can be described in three stages:

1) Think: Teacher poses a question, issue or prompt to the class. Students have to think about it individually.
2) Pair: Students discuss their thoughts in pairs (or small groups, without the teacher).
3) Share: Student pairs (or groups) share their ideas with a larger group, such as the whole class.

The TPS allows students to express their reasoning, reflect on their understanding and obtain immediate feedback on their learning with a formative assessment value. Also, it can encourage peer education and high levels of participation and engagement, as students have the opportunity to work with peers to solve problems and gain clarity about a topic. We implemented the TPS as follows: (1) "Think" phase in the general meeting; (2) "Pair" phase in the breakout rooms of the general meeting (the text of the exercise was shared by the teacher in the channel of the course); (3) "Share" phase in the general meeting.

The professor in these activities played the role of facilitator of learning. He had to generate the groups randomly (despite the heterogeneity of the class, all students had the same level of digital skills), provide an amount of time for both individual and group activities and facilitate final discussion and sharing. Finally, the experiments -and the entire course- were conducted with an intergenerational learning approach as the teacher was a young PhD student in computer science.
B. Approach

Our experimentation consists of four activities in TPS. Firstly, we made a brief introduction to active and collaborative learning and to the TPS methodology. The first TPS unit was held in the seventh ICT lesson in the time slot devoted to the laboratory. These topics were covered: copy/move/paste, keyboard shortcuts on Microsoft Windows 10 and writing on text editors (Notepad and Microsoft Word). The TPS tasks were designed as multiple-choice quizzes (4 answer options, only one correct). The activity was organized as follows: 5 minutes of individual work (but the exercises were already available on the course channel a few days before the activity); 10 minutes of group work in breakout rooms; about 5 minutes (or more if necessary) for discussion with other groups and with the teacher in the plenary (general meeting). In particular, the experimentation consisted of two consecutive TPS sessions of four quizzes each. The quizzes are reported in the Appendix.

The second activity was carried out in the tenth lesson and consisted of two short TPS sections on topics just explained in class. Here the TPS sessions were proposed separate from each other and at the end of each sub-topic of the lesson with the aim of verifying whether the students had learned the new concepts necessary for the understanding of the next module. In particular, learners were able to immediately verify their knowledge and apply it in an active and collaborative way. The first task consisted in classifying some Italian sentences as "information measurement unit" or "data transfer speed". The translated sentences were: “Surf the internet up to 1 Giga with optical fiber!”, “You have 10 Giga per month in 4G”, “I bought a 500 Giga hard drive”. The phrases were deliberately ambiguous and similar to those of the Italian TV commercials. The second part of the TPS activity consisted of two multiple choice quizzes on the concepts of IP address, modem and router. The same time management previously described was adopted.

The last two TPS activities were carried out at the end of the course. The topic of both units was e-mail (notion of Cc, Ccn, spam, phishing etc.). We proposed several multiple-choice quizzes and true or false exercises. All the activities are reported in the Appendix.

C. Data Collection

At the end of the first TPS session (seventh lesson), we uploaded an online questionnaire in the form of a TPS satisfaction survey using Google Forms. We explained that it was anonymous and for research educational purposes. It consisted of five close-ended questions (from the third question onwards on a Likert response scale, from 1 (not at all) to 4 (a lot)): - How many correct answers did you give individually? - How many correct answers did your group give? - Do you think it was useful to compare yourself with your teammates? - Do you think TPS can help you understand the concepts better? - Do you think that TPS is useful for the ICT course in distance learning?

Finally, at the end of the course, another questionnaire was given where students could evaluate every aspect of the course including group activities. The questions related to TPS were: - I found teamwork a valid experience. - I found the time dedicated to teamwork well spent. - Participation in group activities helped me learn better. In addition, there was a field for free comments/suggestions. This questionnaire was also not mandatory to fill out.

IV. RESULTS

A. First Questionnaire

13 students (of the 18 who had participated in the activity) agreed to answer the first questionnaire. The results show that 69% of them found the interaction with their peers "very useful" while 23% found it "useful". In particular, the median value is 4. Roughly 54% thought it was very useful for understanding the concepts (median value: 4). Nearly 70% believed that the TPS is applicable in an online ICT classroom (median value: 3). Fig. 1 represents the distribution of responses using bar charts.

Finally, groups performed better than individual students. The average of correct answers is slightly higher in groups than in individuals (it increases from 7.08 to 8). Fig. 2 represents the bar charts of the score distribution.
Only 10 students completed the questionnaire. Of these, only one student considers group activity negative both in terms of experience and learning. The median of the three responses is respectively 3.5, 3 and 4. Fig. 3 represents the bar charts of the distribution of the responses. We received the following few comments from students on the TPS activity: “With online lessons, I don’t think we can do more”, “For me, teamwork was a bit difficult as I didn't have enough preparation to use the Teams platform. But in presence it would have been profitable”, “Due to the pandemic, there was no possibility of interacting directly with the teacher, and in a computer ICT course, I think the physical use of the computer is very important. Nevertheless, the course was very useful and teamwork was a good idea to get involved even from a distance”, “I found teamwork useful”, “The young teacher was very professional, engaging and patient”.

V. DISCUSSION AND CONCLUSIONS

The results appear to be quite positive. The qualitative and quantitative results appear to fit together. They suggest that older students seem to appreciate collaborative activities with TPS methodology. The latter seems to be applicable to an entirely online third-age ICT course. Before starting the experimentation, we were aware that applying such a strategy in an online third-age course could be a challenge, both for age and for the high heterogeneity. Despite the awareness of the greater risk and effort, we decided to perform the experiment anyway, as we believed that TPS could be a great strategy to make the (virtual) learning environment more suitable and accessible to learners, and a good tool for the teacher to have immediate feedback on the class. Our general impression was that the course and the TPS activities were appreciated by students. The "share" phases triggered healthy and formative discussions between the groups. In addition, the results of the first activity show that groups perform better than individuals.

Furthermore, from the free comments, it seems that the students appreciated the intergenerational approach.

Despite the positive results our experimentation has a number of limitations. First off, the data sample had low cardinality. There were few people enrolled in the course and not all attended the live lessons (usually there were about 18 participants). Not all students answered the questionnaires (for the second we think it is due to the fact that the teacher forgot to mention it in the last lesson). For this reason, it was not possible to perform more advanced statistical analysis. Furthermore, we did not have any data from previous years (for several reasons, such as different professor, no assessment test, face-to-face lessons etc.). In addition, there were technical and design problems. The latter is linked to time management (in some activities the students made it clear that more time would be needed for the “Pair” phase) while technical problems occurred at different times. For example, during the last activity there were problems with the breakout room function. This may have negatively impacted students’ perceptions of online teamwork, as partially emerged from the second questionnaire.

In general, we got the impression that the TPS and the learning platform themselves were something that the students had to learn and practice. For example, in the first activity, some of them found breakout rooms difficult because they were unable to share the screen with their peers (although it should...
be specified that it was not strictly necessary as the exercises were available on the course channel). One of the comments received in the second questionnaire highlights the fact that Microsoft Teams is something that requires practice. For a next edition of the course, it would be useful to spend more time on the collaborative use of the platform.

As for the “Pair” phase of the TPS, it would have been interesting to be able to observe the group dynamics during the activities in order to analyze how divergences or decision-making process within the group were managed. This would have made us more aware of the quality of the teamwork process. In the future, it might be interesting to design a peer evaluation phase. We would like to propose more activities in TPS (at least one for each course topic). Furthermore, as more data become available, we would like to perform a statistical analysis to verify the effectiveness of the methodology in terms of student learning and engagement. In this regard, it will be necessary to design more specific pre and post questionnaires. Another future direction is to analyze different online learning platforms in order to understand if TPS can be introduced to any other e-learning systems. Finally, we would also like to experience TPS in face-to-face lessons (when it will be possible) and to experiment with other collaborative teaching strategies. To conclude, if senior students want to, we would like to introduce computational thinking topic through group and unplugged coding activities.

APPENDIX

A. First TPS Activity

With what sequence of commands do you copy the text?

a. Copy and paste
b. Select and move
c. Copy and paste
d. Copy and cut
Which key combination allows you to copy a text?

a. CTRL V
b. CTRL C
c. CTRL A
d. CTRL X

What is copy and paste for?

a. It allows you to copy an element of a document (a character, a text, an image, etc.) and to paste it in another location or in another document.
b. It allows you to move an element of a document (a character, a text, an image, etc.) and to paste it in another location or in another document.
c. It allows you to delete an element of a document (a character, a text, an image, etc.)
d. It allows you to delete the document in the trash.

What is the difference between Notepad and Microsoft Word?

a. Notepad is a word processor for formatting documents (such as italics, bold, text color etc.) while Word is a basic word processor.
b. They are two different programs that save documents in different formats (.txt and .docx) but perform the same identical functions.
c. They are two programs that perform different functions but always save documents in the same format.
d. Notepad is a word processor designed for basic text, while Microsoft Word allows formatting of documents (italics, bold, text color, etc.).

How do I write the @ symbol with the keyboard?

a. I have to use the Shift key because it is a special symbol.
b. I have to use the Ctrl key as the @ key can have three different meanings.
c. I have to use the Alt Gr key (or Alt + Ctrl) as the @ key has three meanings assigned.
d. I have to use the Alt key because it is a special symbol.

How do you type the $ symbol?

a. By pressing only the 0 key.
b. By pressing the Ctrl and 0 keys.
c. By pressing the Alt Gr and 0 keys.
d. By pressing the Shift and 0 keys.

How do you select multiple lines of text?

a. With Shift and Arrow key
b. With Ctrl and Arrow key
c. With Windows and Arrow key
d. With Ctrl and Shift key

Which key on the keyboard allows you to always write in uppercase?

a. Shift key
b. Ctrl key
c. Caps Lock key
d. Tab key

B. Second TPS Activity

Information measurement unit or data transfer speed?

a. Surf the internet up to 1 Giga with optical fiber!
b. You have 10 Giga per month in 4G
c. I bought a 500 Giga hard drive

What is an IP address?

a. It is an address that uniquely identifies a Server connected to a computer network that uses the Internet Protocol as a network protocol.
b. It is an address that uniquely identifies a Host connected to a computer network that uses the Internet Protocol as a network protocol.
c. It is an address that uniquely identifies a Client connected to a computer network that uses the Internet Protocol as a network protocol.

What is the difference between a modem and a router?

a. A modem uses wireless technology to connect computers to the network; a router uses analog technology instead.
b. A modem is used if only one computer needs to be connected to the network; if you need to connect multiple devices to the Internet, a router is used, as it allows network access with multiple devices at the same time.
c. A modem is used if only one computer is to be connected to the network; if you need to connect multiple devices to the Internet, a router is also used, as it allows network access with multiple devices at the same time.
C. Third and Fourth TPS Activity

Students had to answer true or false. Fig. 4 shows the text of the exercise.

![New Message](image)

**To**: Pippo, Paperino, Gastone

**Cc**: Topolino, Minnie, Zio Paperone, Archimede, Amelia

**Bcc**: Paperina

**Subject**

Paperina is the primary recipient. **T / F**

Topolino sees that the message is only sent to Pippo, Paperino, Gastone. **T / F**

Minnie sees: Pippo, Paperino, Gastone, Topolino and Paperina. **T / F**

Zio Paperone does not see Archimede and Amelia. **T / F**

Amelia sees: Pippo, Paperino, Gastone and all the contacts in Cc. **T / F**

Paperina does not see the contacts on Bcc and does not see Topolino and Minnie. **T / F**

Pippo sees all contacts. **T / F**

The recipient in Bcc cannot view the other recipients that may have been entered in the Bcc. **T / F**

A Bcc recipient cannot open any attachments to the e-mail. **T / F**

The recipient in Bcc can view the sender's address of the message. **T / F**

The Bcc recipient cannot delete the message. **T / F**

The cost of sending an e-mail message depends on the distance of the recipient. **T / F**

If I receive a spam or phishing email, it is advisable to reply to the sender asking not to send more messages. **T / F**

If I receive a spam or phishing email it is advisable not to reply to the message but it is advisable to open any attachments (pdf documents, word files, etc.). **T / F**

In a spam/phishing email it is not recommended to click on any hyperlink (link). **T / F**

I need an internet connection to send or receive email. **T / F**

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**REFERENCES**


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Daniele Traversaro is a high school computer science teacher and a PhD student in computer science at the Department of Informatics, Bioengineering, Robotics and Systems Engineering of the University of Genova (Genoa, Italy). He received the B.Sc. Degree in mathematical statistics from University of Genova (2016), and the M.Sc Degree in computer science from University of Genova (2019). In 2020 he was a research fellow and a teaching assistant in computer science. In 2020-2021 he was teacher of the third-age ICT course at the University of the Third Age of the University of Genova. His current doctoral research focused on didactics of computer science and data education.