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# The Effect of Learning by Teaching on Soft-Skill Improvement Among Undergraduate Students

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**Abstract:** Learning by teaching is a technique where students teach an actual class to facilitate active learning. This paper reports ongoing research involving undergraduate students at an established university in Indonesia. The objective of this quantitative study was to find out the effect of this teaching technique in improving students' 21st century skills. The sample was selected using a cluster sampling technique, where 25 students who were English as a Foreign Language pre-service teachers were assigned to an experimental group, and the other 23 students were treated as a control group. The students in the experimental group were asked to conduct a workshop in groups to students from the same department at a different university. Each group selected one of the topics in their course syllabus. A pre-test measuring the students' soft skills was conducted before the course started and after it finished. The results show that soft skills, which include accountability, communication, innovation, problem-solving, teamwork, professional working, and networking skills, improved significantly among students in the experimental group, but the improvement was not evident in the control group. Therefore, learning by teaching should be embraced as an alternative teaching technique when soft-skill development becomes a target of instruction.

**Keywords:** *21st century skills, learning by teaching, pre-service teachers, soft skills.*

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## Introduction

Learning by teaching technique is a method in teaching to promote active learning by involving students in teaching either their peers or other students outside their class, even outside their learning institution. The technique was established on the belief that teaching is the best way to learn and retain the information that a student is studying (Kasim et al., 2020). This is also in line with the concept of the learning pyramid, although it is not backed up by adequate scientific evidence that teaching occupies a very high level of learning. Thus, learning by teaching technique was included in the innovative pedagogy project piloted in 2016 by The University of Turku, Finland, in five leading universities in Indonesia (Fibra, 2019). This pilot project was funded by Erasmus++ (Munawar & Zulfahrizal, 2019), and the Indonesian Ministry of Education will continue to support the implementation of this project in Indonesia. Therefore, comprehensive research on to what extent learning by teaching technique is effective is urgently required.

The advantages of learning by teaching have been extensively explored through research (Allison, 1976; Duran, 2017; Graves, 1972; Grzega & Schöner, 2008; McKelvy & Watson, 1969). Many of those studies show that students who were assigned to teach peers were more successful in understanding and retaining the materials compared to those who were taught the materials by their professors. This advantage is a result of the steps that students take in preparation for the teaching, i.e., reviewing materials, discussing the materials with peers, and preparing assessments based on the materials. However, recent research conducted by Kasim et al. (2020) revealed that learning by teaching technique and conventional instruction had a similar effect on students' understanding of the material when they were asked to teach an actual class outside their university. This result suggests disfavor of learning by teaching; however, learning by teaching technique does not only target academic achievement. Fibra (2019) claimed that this innovative teaching technique could develop students' soft skills such as problem-solving, critical thinking, teamwork, and communication. Although many studies suggest this unique advantage of learning by teaching technique (Aslan, 2015; Kasim et al., 2020; Stollhans, 2016), the claim is not backed by research in a controlled environment. Therefore, the current study was conducted to determine whether English as a foreign language (EFL) students taught using this technique obtained

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better improvement in soft skills than those taught using a conventional teaching method in a pre-service education course. The results of this study are significant in higher education instructions as it provides a better teaching practice that can improve both material mastery and soft skills required in 21st century workplaces.

## Literature Review

This section presents the theoretical framework, which is the basis for this research. It includes learning by teaching technique, soft-skills required in the 21st century, and how learning by teaching helps improve these skills to show the gap which the current study is addressing.

### *Learning by Teaching*

The emergence of learning by teaching may be traced back to John Comenius, who is often regarded as the father of modern education. This idea is reflected in his belief that teaching others is a part of the learning process (Bowermaster, 1978). This technique, however, has been used since the first century AD (Krouse et al., 1981), with many reports of its implementation and research in the 1990s (Trovato & Bucher, 1980). Publications based on those studies described how the teaching by learning technique was used. According to Topping (2005), this technique was initially used in a language class, but it has since been used in a wide range of disciplines.

Turku University of Applied Sciences has recently promoted the learning by teaching technique throughout Asia as part of the Indonesian Pedagogy (INDOPED) initiative, which is funded by Erasmus++ (Munawar & Zulfahrizal, 2019, p. 23). Its use is currently limited to university students to teach content knowledge. The focus of the program is on the improvement of both content knowledge and soft skills. This initiative was undertaken in five Indonesian educational institutions under the supervision of five European universities (Kairisto-mertanen & Budiono, 2019). In Indonesia, the Minister of Education has agreed to use this teaching technique and has pledged financial assistance for its implementation. As a result, scientific evidence of how effective this technique is in improving these two areas is essential.

Studies on the effectiveness of learning by teaching have been reported in some previous studies. First, Fiorella and Mayer (2014) experimented on the effect of teaching preparation of learning by teaching technique on students' material mastery and found that learning as a preparation of teaching was better than learning as a preparation for a test. A highly cited article by Leelawong and Biswas (2008) reveals that students who learned with learning by teaching technique outperformed those who were taught in completing a task. Finally, Kasim et al. (2020) found that both learning by teaching group and learning using teacher center technique group showed equal effectiveness. Previous studies were only focused on student material mastery, although with ununiform results. The effect of teaching by learning on student soft skill improvement is currently underresearched.

### *Learning by Teaching and 21st Century Skills*

The skills required in the 21st century have been changing, where innovation is the central requirement for success in workplaces. Most of these skills are not related to cognitive ability (Kasim, 2019), but soft-skills are dominant. In addition, based on the evidence from job postings, soft skills are more frequently found as a job requirement for applications (Lyu & Liu, 2021). However, a research study found that soft-skills that students acquire from educational institutions are too limited compared to those required by 21st century workplaces (Ngang et al., 2015). Gray (2016) proposed ten soft-skills that need to be developed for the 2020 workplaces.

(1) Complex problem solving

(2) Critical thinking

(3) Creativity

(4) People management (including teamwork)

(5) Coordinating with others

(6) Emotional intelligence

(7) Judgment and decision making

(8) Service orientation

(9) Negotiation

(10) Cognitive flexibility

According to Fibra (2019), students could learn eight of those skills, including teamwork, through the learning by teaching technique. In research conducted by Kasim et al. (2020), students practiced critical thinking when planning their workshops and preparing their teaching materials. Based on their observation, the students started the workshop

by presenting interesting ice breakers, which required creativity because each of the students in the class needed to come up with different ice breakers. In addition, because the students were asked to conduct the workshop off-campus, they needed to contact and work with a partner university, where they practiced coordinating with others and negotiation skills.

A comprehensive research study on how learning by teaching technique affects students' soft skills required in the 21st century workplaces was conducted by Aslan (2015). The study confirms that this teaching technique is effective for students to gain 21st century skills among pre-service teachers. Stollhans (2016) discovered that these skills were developed in the process of preparing their teaching activities. Previous research studies reviewed by Lachner et al. (2021) also show that the teaching activity is significant to make the teaching technique work, although its effect depends on the preparation of teaching. Although there have been many previous studies conducted in this area of research, the majority of them did not focus on transferrable skills, such as Suvannatsiri et al. (2015), who claimed that the skills "…may be highly individualized and dependent on the characters of the particular students" (p. 111). Therefore, this is a gap that future research is recommended to investigate further.

## Methodology

This research was a quantitative research study. The data were ordinal categorical data, and thus nonparametric statistic formula was used for analysis. An inferential statistic was used for primary analyses, but the descriptive statistic was also used to show the shape of the data.

### *Participants*

The study was conducted at an undergraduate program in one of the state universities in Aceh, Indonesia. The data were collected from the Department of English Language Teaching. The courses in the sixth semester were randomly selected, resulting in the selection of an English language testing course, which had been divided into two classes. The students in all language testing classes were selected as the research participants. There were 55 students enrolled in the course. Since this research was approached quantitatively, one of the classes was assigned to be the experimental group, and the other was the control group. There were 25 students in the experimental group, and the other 30 students belonged to the control group. The university set 75% as the minimum required attendance for students to be eligible to take the final exam, so students who did not meet this criterion were excluded from this study, resulting in 48 students between 18 and 22 years of age, consisting of 43 females and five males. Therefore, the number of participants in the experimental group was 25, and that in the control group was 23.

### *Data Collection*

Both classes of English language testing were taught by the same professor with an undergraduate degree in English Language Pedagogy and a master's degree qualification in Linguistics. The experimental group received conventional instruction for the first half of the semester (8 meetings), covering all topics in the course syllabus, followed by teaching preparation and the actual teaching activities in the second half of the semester. The conventional instruction in the experimental group consisted of the professor delivering a presentation in front of the class and students asking questions related to the materials. The instruction was not comprehensive because the 16-meeting materials were completed in eight meetings. Therefore, there was more than one topic covered in one meeting. The in-class conventional instruction was intentionally made shorter for the experimental group to allow adequate meetings for teaching preparation and teaching activities. In the third meeting, when the participants were still taught with conventional instruction, they were divided into small groups of four to five participants to prepare their teaching activities. The teaching preparation was not done in class, but it was a part of the assignment to be completed outside the regular meeting schedule. These meetings were monitored by their professor, and the professors often attended their group meetings. The preparation includes recruiting students from another university, scheduling the class, and preparing the material. During the student recruitment, the participants were required to seek a permit from their target institution and request participants from the student council of the target university. In preparing the materials, the participants regularly had group meetings where their professors sometimes helped. The participants helped one another in understanding the course material to be taught. They also planned what they would say in class, and they were assigned to do it in turn. Due to time limitations, each group was assigned to teach one of the topics in the course syllabus, which includes the concept of language testing, how to design a language test, standardized testing, assessing each language skill, and authentic assessment.

Before the teaching activities, the participants decorated the room with a banner, prepared certificates for students to motivate them to join the class, and prepared questionnaires for student feedback. The teaching was delivered in a workshop format, as experimented by Grzega and Schöner (2008), where the students started with icebreakers and continued with material delivery. Finally, the students were invited to answer some questions about the material. In addition, the participants also made competitions by asking students some questions about the material. Students who could answer the questions correctly received applause as a reward. The participants seemed to apply their knowledge of language pedagogy by offering rewards, attracting student focus, questioning, and staying engaged with the students.

The researchers and the professor teaching the course were present as mere observers when the participants were teaching.

In the control group, the students only received conventional instruction for a whole semester. They were taught mostly using a teacher-centered approach, but a student-centered approach was also implemented, although it was not frequent. The teacher-centered approach included the professor delivering the material in front of the class using a PowerPoint side presentation. Students were then invited to ask questions about the material presented by the professor. In another meeting, the professor used a student-centered approach, where the students were assigned to sit in small groups of four to five students to discuss the reading materials provided by the professors. Then, they were instructed to write a summary of the materials. Unlike the experimental group, the students in the control group learned each topic in the syllabus comprehensively in class because, unlike in the experimental group, the professor had 16 meetings to cover all the materials in the syllabus in the control group.

*Instruments*

The instruments were used to measure the participants' soft skills. The questionnaire was provided by the INDOPED (Indonesian Pedagogy) program (see Appendix) (Kairisto-mertanen & Budiono, 2019). It originally consists of 60 items, in a five-point Likert scale (5 = very good, 1 = very poor). The items were grouped into seven constructs and confirmed using confirmatory factor analysis (CFA), and the item with factor loading lower than 0.30 were removed, as suggested by Brown (2015), leaving only 25 items. The constructs include accountability, communication, innovation, networking, problem-solving, teamwork, and professional working skills. The internal consistency of the questionnaire was 0.91 for both pre-test and post-test, calculated using Cronbach's alpha. This internal consistency level shows that the questionnaire has a very high consistency coefficient.

*Data Analysis*

This research aimed to compare the students' soft skills before and after the implementation of teaching and learning technique. This research used ordinal numerical variables; therefore, nonparametric tests were used. There were two types of comparison employed in this study. First, to find out whether the soft skills improved after the treatment, the pre-test and post-test were compared using paired Wilcoxon signed-rank test. This hypothesis testing for the experimental group and control group was performed separately. The hypothesis to be tested was "*there is no difference in soft skills before and after the implementation of teaching and learning technique*." For the second comparison, the data were prepared to obtain the average improvement or "unimprovement" for each participant. The improvement in the experimental group was compared to that in the control group using Mann-Whitney U test, to test the hypothesis of "*there is no difference in soft skill improvement before and after the implementation of teaching and learning technique between experimental and control groups*." The hypotheses were set to be rejected at the significance level of 0.05. The tests were performed for each construct separately to understand which soft skills improved and which did not. Before any of the analyses above were performed, the equality of variance was checked using Fligner-Killeen test, a homogeneity test for categorical data (Dag et al., 2018).

## Results

This research was based on ordinal categorical data, and for simplicity in analyses, the results from both questionnaires were coded into rank, i.e., 1-5. Hypothesis testing was used to analyze the data, i.e., to compare the data from the pre-test and those from the post-test. A descriptive statistic was used to visualize the shape of the data. Figure 1 shows the results of CFA for each item in the questionnaire, grouped based on the constructs. The plot on the left is the CFA result for the pre-test, and that on the right is for the post test.

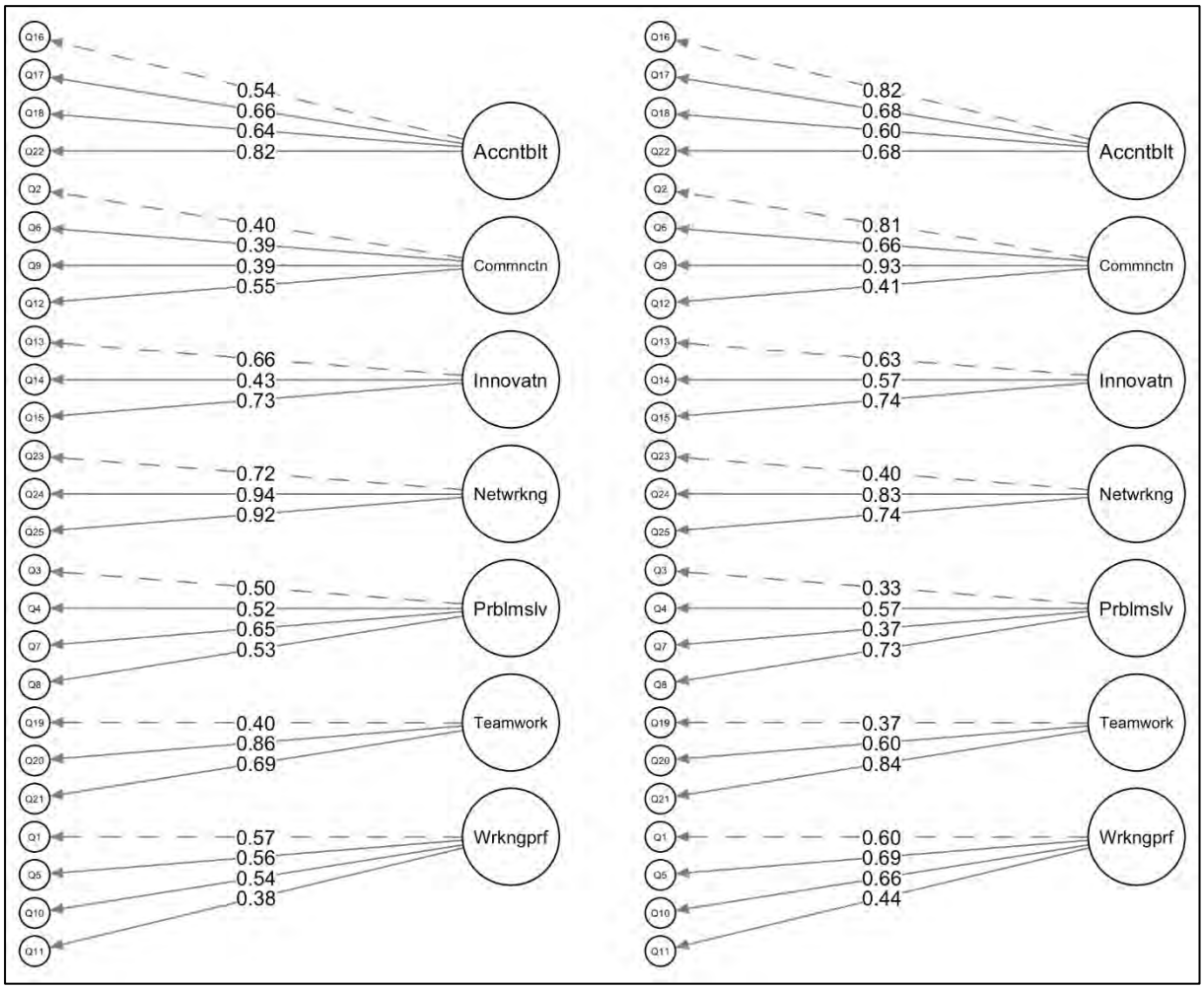


*Figure 1. Results of Confirmatory Factor Analysis for Questionnaire Constructs*

Figure 1 shows that all items loaded sufficiently to each factor after problematic items were dropped. The covariance between constructs ranges from 0.17 to 1.0, showing how a change in one construct affects the others. This result suggests that the items included in the questionnaire could be confidently used to serve the purpose of this research.

*Descriptive Statistics*

General analysis results show that the students' soft skills improved after the implementation of learning by teaching. Figure 2 shows the shape of the data in the pre-test and post-test of both groups.

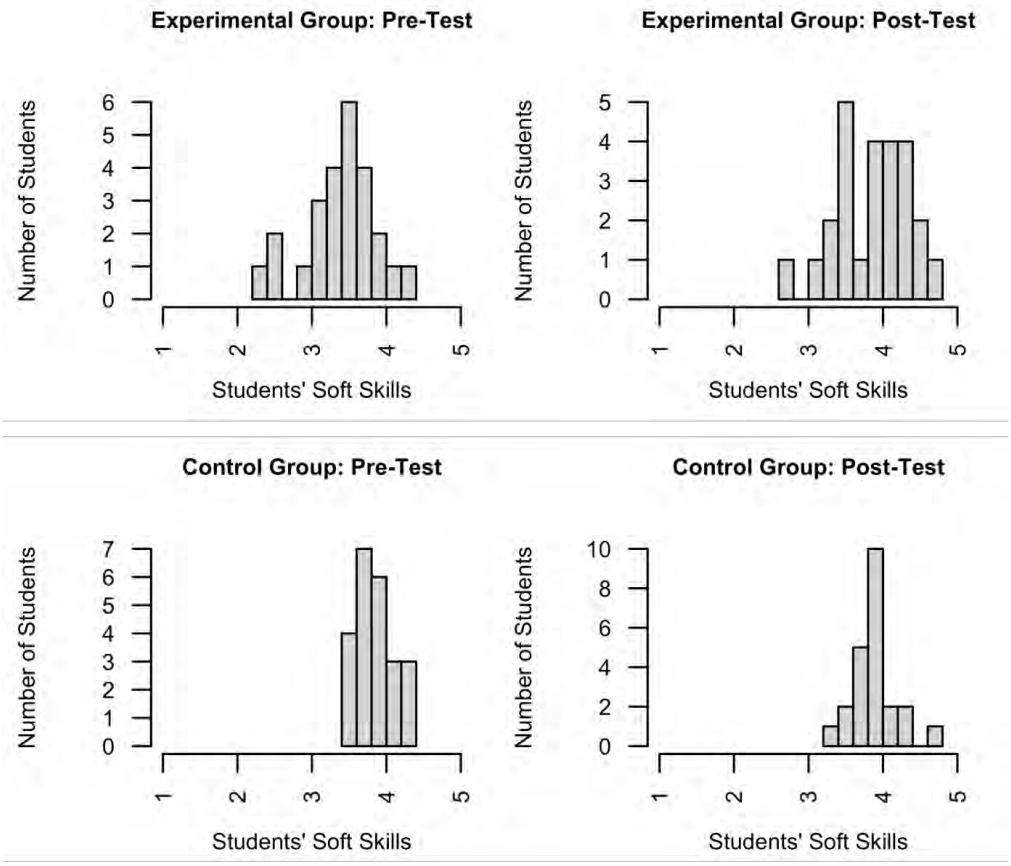


*Figure 2. Histogram of Soft Skills Before and After the Treatment*

Figure 2 shows a change in the shape of data between pre-test and post-test. The data distribution moved to the right in the experimental group, showing an improvement in the students' perceived soft skills. Meanwhile, such change was not evident in the control group. The details about the improvement of the soft skills are presented in Table 1 and Table 2.

*Table 1. Improvement in Perceived Soft-skills of Students in Experimental Groups*

| Constructs | Min | Q1 | Median | Q3 | Max | Mean | SD |
|---|---|---|---|---|---|---|---|
| Soft Skills | -0.72 | 0.20 | 0.60 | 0.72 | 1.48 | 0.49 | 0.50 |
| Accountability | -1.75 | 0.25 | 0.75 | 1.00 | 2.00 | 0.55 | 0.86 |
| Communication | -1.25 | 0.25 | 0.50 | 0.75 | 2.00 | 0.51 | 0.72 |
| Innovation | -2.33 | 0.00 | 0.33 | 1.00 | 2.00 | 0.37 | 0.94 |
| Problem Solving | -0.50 | 0.25 | 0.50 | 0.75 | 2.00 | 0.59 | 0.50 |
| Teamwork | -1.33 | 0.00 | 0.33 | 1.00 | 2.00 | 0.52 | 0.84 |
| Working Professionally | -0.25 | 0.00 | 0.25 | 0.75 | 1.50 | 0.31 | 0.49 |
| Networking | -0.67 | 0.00 | 0.33 | 1.33 | 2.67 | 0.61 | 0.91 |

*Table 2. Improvement in Perceived Soft Skills of Students in Control Groups*

| Constructs | Min | Q1 | Median | Q3 | Max | Mean | SD |
|---|---|---|---|---|---|---|---|
| Soft Skills | -0.52 | -0.08 | 0.04 | 0.16 | 0.52 | 0.02 | 0.27 |
| Accountability | -0.75 | -0.13 | 0.25 | 0.50 | 0.75 | 0.14 | 0.41 |
| Communication | -0.50 | -0.25 | 0.00 | 0.25 | 0.75 | 0.05 | 0.30 |
| Innovation | -1.00 | -0.33 | 0.00 | 0.33 | 0.67 | 0.00 | 0.45 |
| Problem Solving | -1.00 | -0.25 | -0.25 | 0.13 | 0.75 | -0.14 | 0.43 |
| Teamwork | -1.00 | -0.33 | 0.00 | 0.17 | 0.67 | -0.04 | 0.44 |
| Working Professionally | -0.75 | -0.38 | 0.00 | 0.25 | 0.75 | 0.01 | 0.46 |
| Networking | -1.00 | 0.00 | 0.00 | 0.33 | 1.67 | 0.10 | 0.54 |

Table 1 and Table 2 have shown the difference in the soft skill improvement between experimental and control groups. In general, all soft skills improved in the experimental group. However, most soft skills did not show noticeable

improvement in the control groups. Instead, two soft skills decreased. Based on the mean of perceived improvements in students' soft skills in Table 1 and Table 2, the students in the experimental groups seem to outperform those in the control group.

*Hypothesis Testing*

Prior to data analyses using Wilcoxon signed-rank test and Mann-Whitney U test, the homogeneity of the variance in each of the groups was to ensure that they were the same. The analysis was performed for the results of the pre-test using Fligner-Killeen test, and the result shows that there was homogeneity of variances for soft skills for experimental and control groups (p-value = 0.068).

*Table 3. Test of Equality of Variance (Fligner-Killeen)*

| | Med Chi-Squared | df | p-Value |
|---|---|---|---|
| Soft Skills | 3.338 | 1 | 0.068 |

Before comparing the improvement in both groups, Table 4 presents whether each group improved significantly in their soft skills before and after completing the Language Testing course. The improvement was calculated for each construct as well as for the combined soft skills.

*Table 4. Results of Mann-Whitney Test for Pre-test and Post-test*

| Constructs | Experimental Group | | | Control Group | | |
|---|---|---|---|---|---|---|
| | Difference | Statistic | p-Value | Difference | Statistic | p-Value |
| Soft Skills | 0.49 | 275 | 0.000 | 0.02 | 132 | 0.577 |
| Accountability | 0.55 | 268 | 0.005 | 0.14 | 134 | 0.120 |
| Communication | 0.51 | 257 | 0.002 | 0.05 | 83 | 0.430 |
| Innovation | 0.37 | 176 | 0.036 | 0.00 | 80 | 0.905 |
| Problem Solving | 0.59 | 246 | 0.000 | -0.14 | 84 | 0.161 |
| Teamwork | 0.52 | 161 | 0.009 | -0.04 | 41 | 0.752 |
| Working Professionally | 0.31 | 135 | 0.005 | 0.01 | 106 | 0.985 |
| Networking | 0.61 | 181 | 0.005 | 0.10 | 59 | 0.360 |

Based on p-value, soft skills and all the soft skill constructs improved significantly after the implementation of learning by teaching in the experimental class (p-value < 0.05). In the control group, none of the constructs showed a significant difference between pre-test and post-test.

To determine that the difference shown in Table 1 and Table 2 did not happen by chance, inferential statistical analyses were used to test the hypothesis. The results of hypothesis testing using the Mann-Whitney test. The results of the hypothesis testing are presented in Table 5.

*Table 5. Results of Mann-Whitney Test for Soft-skill Improvement Between Experimental and Control Groups*

| Constructs | Difference | Statistic | p-Value |
|---|---|---|---|
| Soft Skills | 0.48 | 465 | 0.000258 |
| Accountability | 0.41 | 406 | 0.014164 |
| Communication | 0.46 | 434 | 0.002257 |
| Innovation | 0.37 | 390 | 0.033756 |
| Problem Solving | 0.73 | 501 | 0.000009 |
| Teamwork | 0.56 | 419 | 0.005994 |
| Working Professionally | 0.30 | 370 | 0.086152 |
| Networking | 0.51 | 383 | 0.047277 |

The results of the hypothesis testing presented in Table 5 reveal that except for professional working skills, the improvements in other perceived soft skills are significantly different (p-value < 0.05) between the experimental group and the control group. The difference in mean score presented in Table 5, which is the mean of improvement in the control group subtracted from that in the experimental group, shows that the experimental group outperformed the control group. This conclusion can be made because the differences are all in positive numbers. The boxplot in Figure 3 illustrates how both groups differ in soft skill improvement.

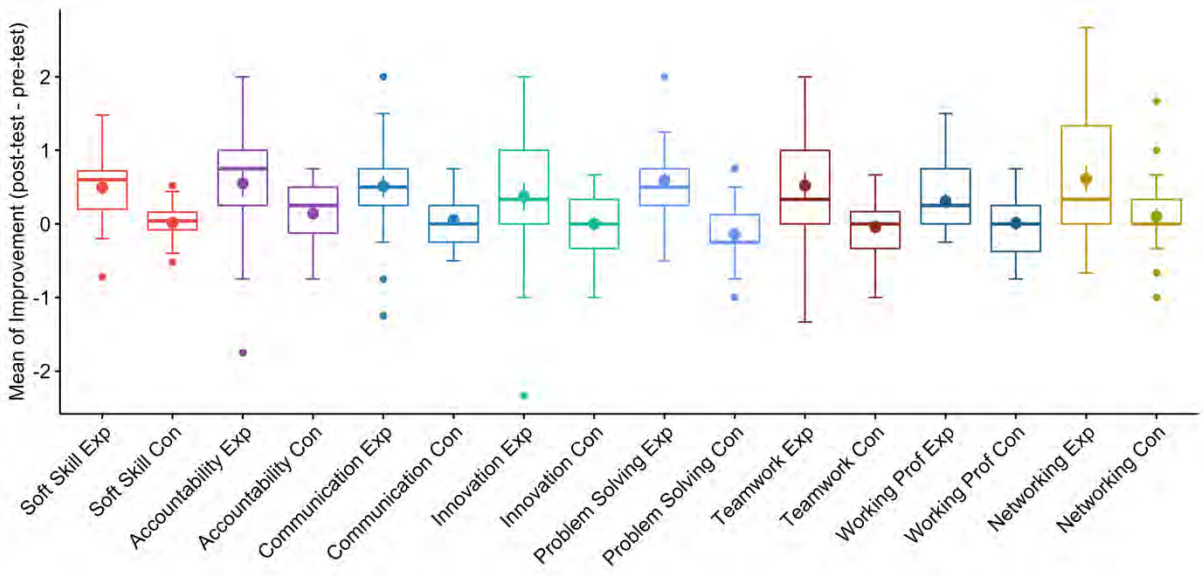


*Figure 3. Boxplots of Improvement in Each Soft-Skill in Both Groups*

A boxplot consists of a box where 50% of the data points are located and whiskers where the other 50% of the data are populated. The horizontal line in the box is the median, and the point is the mean. Some small points located outside the whisker range are the outliers. In Figure 3, the same constructs are represented by the same color, where the first boxplot (left) is the experimental group and the second one is the control group. The boxplots uniformly show that the experimental group outperformed the control group based on both mean and median. For the professional working skills, where the difference is not significant, detailed boxplots are presented in Figure 4.

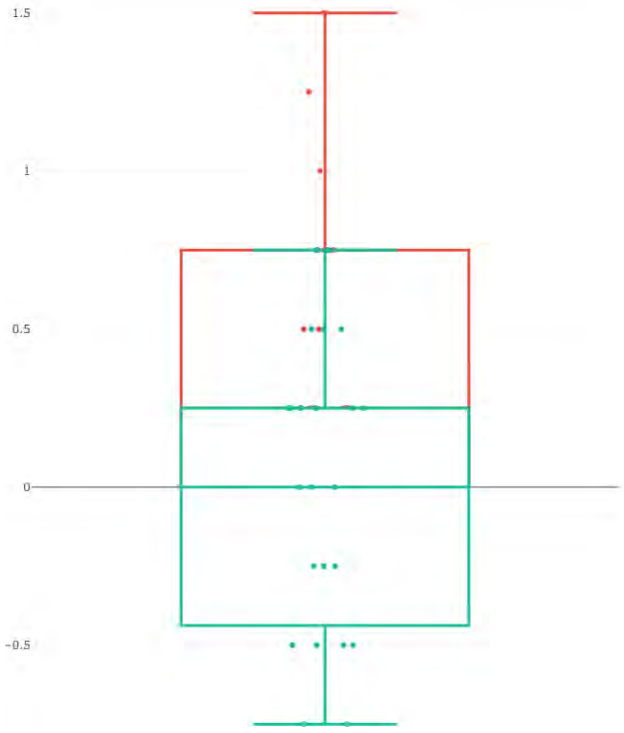


*Figure 4. Boxplots of Insignificant Difference in Professional Working Skill Improvement*

A detailed illustration in Figure 4 shows that the data points between the experimental and control groups mixed without any sign of discrepancy, and a considerable number of the data points were similar between both groups, suggesting that there is no difference in soft-skill improvement between the two groups.

## Discussion

The objective of this study was to find out whether learning by teaching technique could improve students' soft skills required in 21st century workplaces. The research results show that all soft skills improved after the students were taught using learning by teaching technique. The results contrast with the control group, where the class was taught using a conventional method, mainly relying on a teacher-centered approach. None of the soft skills improved among the students in the control group. The difference in pre-test and post-test scores of the experimental group was also compared to those of the control group. The results show that the difference in scores was significantly different between the two groups in almost all soft skills.

This research results have provided statistical evidence on the claims that learning by teaching technique is effective in improving students' soft skills required in 21st century workplaces. This claim could also be found in several previous publications (Fibra, 2019; Gray, 2016; Kasim et al., 2020). Our analyses, both based on descriptive and inferential statistics, have shown that the participants' soft skills improved approximately by half (0.5). The most significant improvements were shown in accountability, communication, problem-solving, teamwork and networking. These improvements are the results of the preparation process in learning by teaching technique (Stollhans, 2016). First, working in groups for a teaching workshop, each member of the group was assigned a job such as preparing the consumption or printing a slide presentation. Therefore, the participants were trained to be more responsible to complete their tasks. Communication and networking skills are required in the preparation process of learning by teaching technique. The participants were required to negotiate with target institution officials and student councils. They also needed to establish good communication with their prospective students. They utilized their network to build new contact with many parties, including the researchers, who financially supported their activities. Research by Aslan (2015) also shows that students improved their communication skills when preparing their teaching activities. Another soft skill gained in preparing the teaching activity was problem-solving. The skill was developed because the participants were often faced with many problems (Biswas et al., 2005), in this case, the problems related to students, materials, schedule, and group work.

Other soft skills improved after the implementation of learning by teaching technique include teamwork and innovation. Although these skills did not improve as much as the soft skills discussed above, the improvement was significant based on the hypothesis tests. Due to the implementation of learning by teaching technique, the participants bear more responsibility and are required to perform many tasks in order that the workshop they planned could work well on the schedule. Therefore, they needed to show teamwork skills, including good collaboration, respecting the ideas of other group members, and building a good relationship with the members. Based on the data in the current research, students perceived that these activities had improved their teamwork skills, which is a standard skill required in workplaces (Prihatiningsih, 2018). This result has provided empirical evidence to the claim made by Aslan (2015, p. 1443) that "… and learning by teaching can be an effective method for learning these competencies." The other soft skill, innovation skill, was developed because being a teacher is an entirely new experience for pre-service teachers, as found in a previous study (Cortese, 2005). They were required to prepare a business plan, comprising documents from syllabus to budgeting. Therefore, they needed to develop innovative ideas to complete all tasks under the learning by teaching technique.

Professional working skill was also included as one of the soft skills which improved significantly. This skill includes working systematically, independently, and under pressure, making strategies, and managing time efficiently. The participants will thrive in workplaces with these skills. In completing all tasks under the learning by teaching technique, the participants need to work professionally. They were required to make detailed plans because they had a deadline, and at the same time, they had many other coursework schedules. Therefore, time management needed to be as efficient as possible. Many of the participants were not accustomed to working independently because most of the courses in which they were enrolled were teacher-centered. In learning by teaching technique, their professor asked the product of their work, while they needed to decide the process of working by themselves. Only when they needed help did their professors step forward. Following the requirement of the learning by teaching technique has improved students' skills in working professionally, which is transferable to their future workplaces.

Finally, the research has shown that learning by teaching technique, although not superior in terms of improving students' material mastery (Kasim et al., 2020), could improve other significant skills required by future graduates of higher education levels. All soft skills included in this research improved significantly based on statistical analyses of each skill. One of the analyses was performed for the data where constructs were combined as one category, i.e., soft-skills. The results also show that the students' soft-skills, or known as 21st century skills, improved significantly after the implementation of learning by teaching technique. This research results have added a significant contribution in the form of a quantitative aspect to the results of a previous qualitative study by Aslan (2015).

## Conclusion

The objective of this research was to find out whether the implementation of learning by teaching technique could improve soft skills among students learning English as a foreign language better than the current teaching practice. To

achieve the purpose of this study, an academic reading comprehension course at one of the state universities in Aceh was randomly selected. One of the groups was assigned the experimental group, and the other was the control group. The learning by teaching technique was implemented with half of the semester instruction followed by a workshop hosted by the students with the students from another university as the workshop participants. The control group was taught using mostly a teacher-centered approach for the whole semester. The data were collected by administering a set of questionnaires at the beginning of the semester and at the end of the semester to measure the students' soft skills. The conclusion was drawn based on a comparison of the students' soft skills before and after the implementation of learning by teaching technique in both experimental and control groups. The analysis results show that the students improved all their soft-skills, including accountability, communication, innovation, problem-solving, teamwork, working professionally, and networking skills. Meanwhile, none of the soft skills improved among students in the control group.

## Recommendations

The results of the study have offered some pedagogical implications for higher education implementation. First, this study has revealed that a conventional teaching method could not facilitate the development of soft skills, which are required more in workplaces than academic achievement. Therefore, if the target of education is to produce graduates who are employable in enterprises, conventional teaching technique is no longer suitable. Therefore, teaching methods requiring students to practice their soft skills and achieve optimum material mastery are more appropriate. Learning by teaching is one of the techniques which can offer both based on the results of the current study for soft skill development and previous study for material mastery (Kasim et al., 2020). In addition, the technique was recommended to be included in the curriculum by Splett et al. (2011). There are some other techniques proposed by INDOPED project (See Kairisto-mertanen & Budiono, 2019), but their effectiveness is under investigation. Finally, the number of soft skills included in the data collection and analyses in this study was limited. Future research is recommended to use a questionnaire which covers more soft skills to obtain more comprehensive results of the research.

## Limitations

This study has revealed significant results related to the effectiveness of learning by teaching technique in improving students' soft skills. In addition, this study is a quantitative research study aimed at generalizing the results of the study beyond the context of this research. However, the generalizability of this study is subject to some limitations. First, the sample sizes are rather small for both groups. With larger sample sizes, the reliability of the results is higher, and generalization can be made with more confidence. Second, the students were only required to teach one topic in the course syllabus, making them only learn their own topic and ignore the rest of the topics in the course. Third, their learning process was not included in the assessment, creating a possibility for free riders and social loafers, which reduced the accuracy of the research results. Finally, this research used a ready-made questionnaire, which had not been statistically validated. As a result, some items needed to be removed from the analysis because they did not load adequately to the construct.

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### Conflict of interest

The authors declare that they have no conflict of interest.

### Authorship Contribution Statement

Usman: Conceptualization, design, supervision, final approval. Muslem: Editing/reviewing, data acquisition, securing funding. Mustafa: Data analysis / interpretation, statistical analysis, drafting manuscript, critical revision of manuscript.

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