Enhancing Student Comprehension of Audio Mixing and Mastering Through Jigsaw Activity: A Study of Pedagogical Impact

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ABSTRACT

Audio mixing and mastering are always being teach as a practice-based learning. The student-centered learning for this topic is related when student use their understanding and develop their skills in listening while adjusting knobs or audios technical which contributed to their final project. Jigsaw activity approaches is being selected to determine the student's understanding towards audio mixing and mastering in practice-based learning. A quantitative and content analysis method is being conducted for this study. The method of jigsaw activity had been practiced in the class session which the result varied in four activities that being prepared to analyze the student's understanding. The four activities are preparing slides, quiz, practical hands on, and questionnaire. The results shown the jigsaw contributed on enhancing student's understanding towards mixing and mastering activities. Although the students applied their understanding more on the practical activities, the jigsaw activity still influence towards the student's understanding in practice-based learning subject.

Keywords: Audio Mixing, Jigsaw Activity, Practice-Based Learning, Student-Centred Learning.

INTRODUCTION

Audio mixing and mastering are very essentials in the world of music production. This process integrated with the whole process of music production which contributed to the result of the artist's craft so it can be presented well to their avid listeners. Higher education schools in music education have been including audio production more and more in their curricula as they realize how important it is to preparing students for careers in the music industry. Vross (2016) asserts that the introduction of audio production courses into higher education has been crucial in helping students advance their technical and creative proficiencies, which in turn has improved their employability in a cutthroat market. There are many technical aspects that needed in this skill, which is important as their musicality and experiences. Musicality's like music theories, aural training, and instrument playing can enhance the quality production of

audio recorded, meanwhile the experiences can help in the quality of time production. Music education played a big role in impacting the developments the journey of music production implementation in higher education (Vross, 2016). The implementation of audio production into music education has gained prominence in academic discourse due to its ability to connect conventional music pedagogy with modern industry standards. The necessity for thorough education in audio production has grown as technology and the music industry develop together.

According to Ferreira (2007), higher education had brought the subject of music technology as their offer programmed. The technical aspects of sound creation received less attention in traditional music education, which was primarily concerned with performance, theory, and composition. However, a change in school curricula is required due to the quick improvement of recording technology and the democratization of music production equipment. Teachers started to realize how important it was to teach students not only how to compose music but also how to record and work with sound as early as the late 20th century (Moorefield, 2010). This change reflects the industry's growing reliance on top-notch audio production to satisfy the demands of creative and commercial projects. Audio production education has reframed auditory training, which was once a crucial part of traditional music instruction. Critical listening abilities are emphasized by educators as being vital for jobs like mixing and mastering (Bauer, 2014). With these abilities, students may produce recordings of a high caliber by identifying small changes in dynamics, balance, and sound quality.

All these elements are being taught formal and informal at universities in Malaysia that offer Music Programme. Usually, the instructor will provide insight and share their experiences as well as some tricks and tips to help the students achieve their vision for their projects. Although, the music education for music production is still improving from time to time in pedagogical context ((Boehm, 2007). In music education, audio production has been taught using a variety of pedagogical strategies, from conventional classroom settings to experiential, project-based learning. A blended method, which integrates theory learning with real-world experience, is something that many educators support. This approach enables students to get the technical proficiency required to handle digital audio workstations (DAWs) and other recording equipment in addition to understanding the fundamental concepts of sound engineering, such as acoustics and signal flow.

Some tools from student-centered learning experiences can be available to support the education system, and jigsaw activities is one of it. Many studies had been conducted on the effectiveness of the jigsaw techniques in teaching pedagogical. One of the studies that being conduct, Sahin (2011) stated that the jigsaw group performed well than the others. Elliot Aronson created the jigsaw exercise as a cooperative learning technique in the 1970s, and it has since been popular in a variety of educational settings due to its capacity to foster student involvement, teamwork, and a better comprehension of challenging material. This instructional approach presents special chances for students to learn cooperatively in the field of music education, especially in audio creation, by utilizing their individual skills to create a coherent product. This study of the literature investigates the use of jigsaw exercises in audio production education, looking at the advantages, difficulties, and general effects on student learning.

Jigsaw activity is one of the methods that being used in student-centered learning. This activity enhances the learning engagement among students where the students involve in teaching and discussing with their peers. The jigsaw method has its roots in cooperative learning, which assigns students to work in small groups, with each member in charge of mastering and instructing a specific topic area. Because each member's participation is essential to the group's success, this approach promotes interdependence. Because audio production jobs are multifaceted and frequently call for a combination of technical skills, creativity, and critical thinking, this technique can be especially useful in the context of audio production education

(Aronson, 2000).The jigsaw method broadens the range of learning opportunities and teaches students course material and cooperative social skills (Perkins & Tagle, 2011). According to Gonzalez (2015), the jigsaw activity help to enhance individual's knowledge, recover any important ideas, and clear up misunderstandings. Sanchez-Muñoz et al. (2020) research stated that the combination of flipped learning, project-based learning, and jigsaw method influences the motivation and enhancing the learning skills in real world context. This shown an influences of jigsaw activity that can be experiential in music production subject. Since in real world of music production, collaborative and applying social skills are essentials.

The jigsaw technique can be used in audio production by giving each group member a separate part of a production work. In a project-based learning setting, for instance, students could be split up into groups where each person oversees a particular step in the production process, including mixing, recording, mastering, or arranging (Johnson & Johnson, 1999). To guarantee that every member of the group has a thorough understanding of the whole production process, each student becomes a "expert" in the subject matter that has been allocated to them and then shares that expertise with the group. Controlling student assertively is the key to making Jigsaw Techniques work well in group learning. To ensure everyone participates and no student takes over, you can appoint the group leader and specify roles such as tracking time and recording notes (Johnson, D.W.; Johnson, R.T, 1999). In addition, using peer reviews, rotating roles, and teaching good communication and teamwork skills helps create a fair and inclusive learning environment (Perkins, D.W.; Saris, R. 2001). This structured method allows all students to become more self-aware and encourages active participation.

This method's ability to replicate real-world audio production situations, where teamwork and specialization are frequently required, is one of its many important advantages. Students that participate in jigsaw activities not only improve their technical abilities but also gain valuable time management, communication, and peer appreciation skills. According to Slavin (2015), these are all necessary abilities in the field of professional audio production. Nowadays, music production working towards collaborative process (Stickland, Athauda, & Scott, 2022) Hence, according to Huang et al. (2014) these methods inspire students to value and support other people's work. Also, their interaction among their peers can be increase in positive environment (Herrmann, 2017). This study examined the success of using jigsaw activity approach on student's understanding towards audio mixing and mastering in practice-based learning.

METHOD

The data that the researcher obtained for the jigsaw activity is from the 29 students at University of Malaysia Sarawak (UNIMAS) that enrolled in GKM 2313 – Studio Recording Techniques. This subject is a compulsory subject before they proceed to the next semester. This is a second-year subjects in Music Programme, UNIMAS that focus on the basic principle of studio recording techniques that being used and relevance to music industry. Topics include principles techniques in digital music production, studio recording practice (practical) and audio theory of music production. This subject is a continuous learning from the subject GKM 1343 – Musical Instrument Digital Interface (MIDI) which exposed the students with recording software or digital audio workstations (DAW).

As prior knowledge, the students had exposed with music recording software or Digital Audio Workstation (DAW) and a few plugins. This course introduces the principles of studio recording techniques specifically on digital audio workstations. The lesson and teaching plan for the class session was to expose them and enhance their understanding in building their own channel strip effect or decision to choose plugins during their mixing/mastering session later.

The data of this study are from the questionnaire that being given to the students after attending the class session. The questionnaire was given 1 week after the class session being conducted.

For the class session learning objectives, at the end of the lesson, the researcher targeted the students should be able to:

a) Analyze sound that being recorded and identify plugins to be use:
b) Apply plugins effects for their mixing & mastering session:

The researcher had provided 4 excerpts of notes that being adapted from two good resources in online website. The instructions of jigsaw activity are:

1. When each expertise from each group that has been selected, the student will read the excerpts of notes prepared accordingly (Gonzalez, 2015). The group was setup before the jigsaw activity.
2. After the expertise members read and discuss the given section, the expertise members will return to their respective original groups and explain and share the topic they understood to their respective group members.
3. After that, each group should prepare a simple slide for EQ and Compressor topics and answer a QUIZ in eLEAP as an activity. The QUIZ activity is a volunteer or self-grading assessment that help the students to test their understanding.

*eLEAP is one of the blended learning platforms in UNIMAS

The student's understanding reflected in the next session of the class. The topics that being implemented in the jigsaw activities are the spectrum of Equalizer (EQ), the basic principles of EQ, the important of Compressor, and the basic knob of Compressor. The data will be analyzed by the questionnaire that being given based on the topics above. The table shows how the data shall provide the results that answer the objective of the lessons.

Table 1 shows how the researcher analyzes the understanding of the student after the jigsaw activity.

Topics	Slide	Quiz	Practical	Questionnaire
Spectrum of EQ	Summarize of the contents	Student's participants	The use of plugins EQ	Student's participants
the basic principles of EQ,	Summarize of the contents	Student's participants	The use of plugins EQ	Student's participants
the important of Compressor	Summarize of the contents	Student's participants	The use of plugins Compressor	Student's participants
the basic knob of Compressor.	Summarize of the contents	Student's participants	The use of plugins Compressor	Student's participants

The questionnaire showed feedback from the students and conclude the influence of jigsaw activity in audio practices. Some questions stated to establish understanding with the objectives of this study (refer Table 2).

Areas of Concern	Questions
Introduction of the topic	How prepare are you for the lesson? Are expect the outcome for the topic? Which software do you prefer to use?

	Do you know about EQ before? Do you know about Compressor before?
Jigsaw Activity (Group Activity)	Do find this activity help your understanding on plugins? Do you think you can practice your understanding?
Likert Scales (Understanding the Topics – Group Activity)	I can explain the function of both EQ and Compressor I understand the spectrum frequency of the EQ My classmate explains well to help me understand I understand on boosting, cutting, and filtering in EQ I understand the important knob of compressor in the audio
Practical (Individual Activity)	Do you find using the plugins effect is much efficient in your mixing/mastering after the discussion? Are you able to use in your final projects?
Likert Scales (Understanding the Topics – Individual Activity)	I understand and can use the EQ band/Compressor I can use EQ and Compressor in my projects I prefer and easily to use 3rd party plugins (Fab Filter, etc.) I prefer and easily to use stocks plugins (Logic, Cubase.) Preset in Cubase/Logic help me to understand more in using these plugins.

RESULT AND DISCUSSION

As for the results, it's start with the outcome of the 'jigsaw' activity which the students need to come out with their understanding about the plugins through a simple slide. The slide content is about their understanding and using their own words. All students manage to prepare a simple slide in the period of class. However, there a hole in this activity that the students 'might' had copy and paste some information from the notes given.

The second activity is Quiz in the eLEAP which being prepared after the session. The quiz activity is to help them recall back what they read and discuss, also, self-check on their understanding. Half of the class participated in this activity. The instructor noticed that the students prefer to do 'hand-on' activity and forgot to participate in the quiz activity although they had been reminded in the group chat. 23 students from 29 students had participated the quiz. The result shown that the students score average 8.82 marks. 9 students get full marks, and only 5 students score 7 marks, which is the lowest. Figure 1 shown the overall number of students achieving grade ranges. The Quiz activity that being conducted showed that that the jigsaw activity helps their understanding on EQ and Compressor. The students were having problems in answering the EQ techniques, which they were preferred to do it practically rather than memorizing the range of EQ spectrum. However, understanding and visualize the EQ spectrum is very importance before handling it practically.
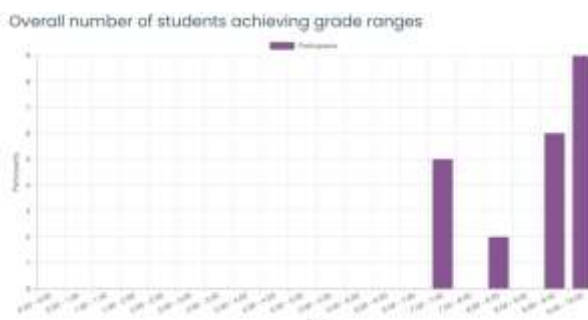

Figure 1: the overall number of students achieving grade ranges. (Sources: eLEAP page)

During the practical session, the students performed well on handling and applying the plugins

effect in the Digital Audio Workstation (DAW). The DAW that they been using is Cubase 8, which installed in the faculty studio, and equipped with stock plugins. Form the instructor observation, most student are comfortable to use a plugin called Studio EQ. The Studio EQ is a parametric EQ that consists of 4 knobs, and an EQ visualization. These features preferable among the students which become the commonly used for their project rather than other EQ in the stock plugins. For compressor plugins, the student also using the stock plugins in the DAW which called The Compressor in the Dynamics Section. This plugin features the same basic components that they learn through the jigsaw activity. However, most of the student prefer to use the setting that had been preset in the plugins, which the preset is being set in specific role like Lead Vocals in Your Head, Smooth Vocals, Backing Vocals, etc. The instructor noticed also that the students use the preset in the plugins and adjust around with knobs until they get their preferences sound that they might like. This observation shown that the students were practicably in using the plugins. Although they were depending on the preset which help their understanding, it still helpful rather than hindering themselves from the mixing and mastering process. After the class session ended, questionnaire had been given to the students. The questionnaire helps the instructor to understand and the study the influences of the jigsaw activity toward their understanding on the plugins. The questionnaire is being conducted via Google Form. According to the feedback from the questionnaire, Figure 2 shown that the jigsaw activity helps the students understanding on plugins which 96.6%.
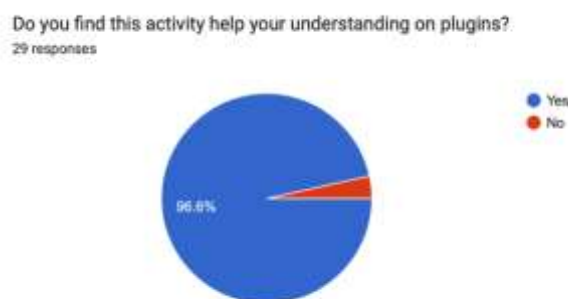

Figure 2: The result on whether the jigsaw activity help the students understanding.

Also, Figure 3 shown that most of the student confidently to practice their understanding practically which resulting 79.3%. Some of the student not sure if they were able to apply it until the hand-on activities.

Figure 3: The result on whether the students can apply their understanding practically.
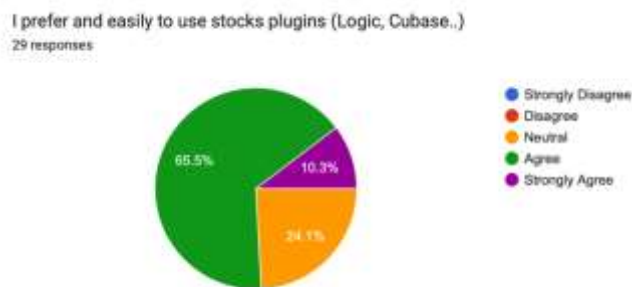
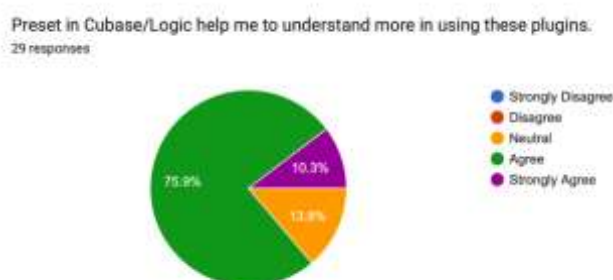Figure 4: The students' preferences on plugins.

Figure 5: The setting preset in the stock plugins helps the understanding of the students towards the plugins.

The questionnaire shows that the jigsaw activity influenced the understanding on the application of plugins in mixing and mastering. Figure 4 also showed that the students prefer to use stock plugins rather than the 3rd party plugins. The 3rd party plugins mean that the DAW using other plugins that not included in its stock plugins. In other hands, the preset from the plugins help the understanding for the student to achieve what sound or effect they needed for their projects as shown in Figure 5.

Most of the students find out that the jigsaw activity helps them to understand well on the plugins. However, a few of the student might not understand due to the communication difficulties with their group members, lack of the understanding on the terms, or their expert member couldn't explain well during the activity. The session also had been observed by the instructor colleague as a peer observation session. It being suggested that the jigsaw activity could be done much before the class session begins, as it might take a long period of time. The demonstration from the instructor could help the understanding of the students after the jigsaw activity ended.

CONCLUSIONS

The jigsaw activity indeed provides influences on the understanding of the plugins in mixing and mastering among the students. However, the jigsaw activity must be plan properly in materials and time aspects. Stanczak et al. (2022), suggested that the instructor also need to focus and control the situations and the involvement of the students during the jigsaw activity. Hence, the instructor must carefully plan and coordinate the jigsaw technique, especially to make sure that every facet of the audio production process is sufficiently covered. Although it can take some time, the advantages in terms of learning outcomes and student engagement frequently outweigh the difficulties (Leikin & Zaslavsky, 1997). For this class, the time consumed more than 3 hours, hence the students that being assigned as 'expert' need a longer time to study and refer to the notes, then explained to other students.

Using jigsaw activities in audio production instruction has advantages, but there are drawbacks as well. Ensuring that every student contributes equally to the group effort is one of the main challenges. Stronger pupils might occasionally take the lead in the action, while others would only participate passively.

The jigsaw activity might be useful to help the students in understanding the references and the terms theoretically, but still, the hands-on activity is still essential in practice-based or studio-based learning. The instructor had to plan properly on which materials and topics suit to jigsaw activity. It been suggested that the jigsaw activity can be applied in the discussion practically rather than doing a presentation in the case of practice-based or studio-based learning. The influences of this jigsaw techniques must include strong evidence. This is because lack of strong evidence might mislead to a wrong interpretation (Kraft, 2020). Strong evidence might need more control than a slide and quiz activity to justify the influences of the jigsaw activity towards practice-based learning. As from the instructor's observations during the jigsaw activity, the slide presentation content can be copied from the internet. Also, the students might use book or refer to online information to answer the quiz activity.

The students' understanding of the plugins can be shown through the hands-on activity and practical assessments. For this case, the jigsaw activity influenced the students' understanding towards plugins for mixing and mastering, however, it still needs to be in control. Hence, experimental and observations suggested to be conducted with jigsaw activity in practical way for further research and understanding in the future. Future research on the integration of jigsaw exercises with other instructional techniques in audio production education is possible. For further opportunity to increase student involvement and skill development, consider integrating jigsaw with project-based learning or flipped classroom methods (Kirschner, Paas, & Kirschner, 2009). Additionally, there is a chance to modify the jigsaw method for use in virtual classrooms, where students can work together remotely on audio production projects, given the growing number of online learning platforms available. Although the jigsaw exercise helps students grasp the theory, using it in a practice-based learning setting calls for careful preparation and management. To ensure efficacy, lecturer must choose relevant materials and keep an eye on student participation. To give conclusive proof of their influence on practical learning, future study ought to concentrate on incorporating hands-on activities with jigsaw methods. This strategy will enhance the use of technology in educational settings and validate its impact.

In audio production music education, the jigsaw exercise is a potent teaching technique that has several advantages for improving student engagement, teamwork, and comprehension of challenging material. Even if putting it into practice can be difficult, with careful planning and assistance, these problems can be minimized, and the learning outcomes can be enhanced. The future of music education seems very promising when the jigsaw technique is used in conjunction with other cutting-edge teaching techniques, since audio creation keeps evolving with technology breakthroughs.

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