The Impact of Podcasts on EFL Students’ Listening Comprehension

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Abstract
This research has objective to investigate students’ listening comprehension through the use of podcast in EFL classroom. 60 high school students in Indonesia were taken as sample for this research with distribution of 30 students in experiment class and 30 students in control class. The samples were taken by using cluster random sampling. Quasi-experimental method with the post-test only control group design was applied in this research. In addition, a survey questionnaire was administered to experimental group to explore their perception on the use of podcast instruction in teaching listening. Findings revealed that there is a significant difference of post-test score between two groups, favoring experimental group. Data analysis using one way ANOVA showed significance value (sig. 0.010) is lower than < 0.05 which interpreted that Podcast has significant impact on students’ listening comprehension. Additionally, the result of questionnaire indicated that students have positive attitude toward the use of podcast in listening classroom. Students perceived that podcasts provided authentic materials, interesting activities including listening exercises and meaningful tasks for them so they felt more motivated to learn English. This study recommended that teacher may utilize podcast in teaching listening considering its effectiveness as technology based learning tool.

Keywords: podcast, English, EFL, listening comprehension

1. Introduction

1.1 Background

In Indonesia, English is taught as a foreign language from elementary up to university level. Particularly for high school students, Indonesian national curriculum has set some objectives of English language teaching. One of the objectives is that students are able to master three types of communication such as interpersonal, transactional and functional both in written and spoken context. (Kebudayaan, 2017). Ideally, upon finishing the study at senior high school level, students are expected to be able to communicate in English both oral and written way. Yet, the above-mentioned objective has not been achieved satisfactorily as the students’ achievement or performance in the English subject is low. Recent data showed that high school students in Indonesia who failed in the National Examination (UN) reached 52.57% in 2017 compared to 44.97% in 2016. English is one of the subjects that contribute to low score of achievement in the National Examination (UN) especially for high school, vocational and boarding school (Kebudayaan, 2017). English subject examination covers only three skills including listening, reading and writing. As one of the skills that examined to students, this skill is a fundamental skill which needs to be mastered at first before students master other skills. In order to make students master English listening skill, teaching listening must be done by using English ideally so students are exposed to pronunciation and the meaning of vocabulary through listening. In reality, many schools in Indonesia use Bahasa Indonesia as language instruction in English subject. This shows that English language and even authentic resources for English language teaching are not utilized utmost yet by English teachers. This unfortunate condition has sure mostly contributed much to the poor achievement of Indonesian students’ in listening. In addition, Huang (2004) argues that limited understandings of classroom instruction or lesson and materials can be another problem faced by students in learning English. Likewise, in Indonesian context, students rarely in situation where they have opportunity to practice English and teachers are lack of commitment to apply an appropriate approach and use authentic resources in listening.

As one of authentic resources for teaching listening, Podcasting is an innovative mobile technology consists of
series video and digital audio broadcast that could be downloaded and played on mobile devices. The term “Podcast” was derived from two technologies, “iPod”, and “Broadcast”. Podcast provides convenience for listeners to choose and listen to their preferred program. Constantine (2007) defined that Podcasts is an internet audio publishing that is designed to be downloaded and listened to a portable device such as tabs, Smartphone and laptop. Moreover, Podcasts have unique feature and different than other audios in terms of its content. The audio content presents authentic listening source which allows every listeners benefit from it. Still in the same notion, Sloan (2005) claims that podcasts is an innovative way of broadcasting through the internet that can be used it for transferring digital audio content automatically to mobile phones. Regarding to its usage in classroom teaching contexts, several scholars have offered some point of views and reasons for including Podcasts in language learning classrooms (Aguilar, 2016; Al Qasim & Al Fadda, 2013; Abdous, & Facer, 2009; Ahmed, 2008; Blaisdell, 2006; Chinnery, 2006).

Regarding to the frequency of its usage, Constantine (2007) explained the use of Podcasts in the EFL classroom, even at the beginning levels, all foreign language learners can benefit from Podcast by only listen it six minutes a day. Furthermore, a research was conducted by Edirisingha, Rizzi, Nie and Rothwell (2007) reported that podcast is successful in supporting students’ preparation for assessed work, providing significant advice on portfolio and presentations. In line with this, Rizzi, Rothwell, Nie and Edirisingha (2007) and Beheler (2007) also have proven that Podcasts enhance students’ ability in listening.

Based on the above rationale, the use of podcasts in a language classroom is enable students to comprehend content, to enhance their proficiency and to improve their listening comprehension. Unfortunately, in Indonesian teaching context, scarce research existed prior to this study regarding best practices of podcasts and its effectiveness in the context of teaching high school students. Inspired by the usefulness and benefits of the Podcast as teaching resources discussed above and have been verified empirically by several experts, this study has been carried out as an effort to investigate whether Podcast can impact high school students’ listening comprehension in EFL setting in Indonesia as well as to explore students’ perception on the use of podcasts in listening classroom.

1.2 Review of Literature

The proliferation of technology has colored learning and teaching situations nowadays. The integration of technological devices in classroom settings brought portability and allows time shifting opportunities for both students and teachers. In addition, the integration of technology in EFL classroom assists students not only to acquire foreign language but also to increase their motivation and confidence (1). In the area of language teaching particularly listening, Podcasts for example, provide a unique feature of content choice and repository of real-life speaking materials which allow students to study at their own time and pace (Kavaliauskiene, 2008). This current study will review the literature that describes the benefits of Podcasts and highlight specific areas that relates to teaching listening and the use of podcasts in a pedagogical context.

1.2.1 The Teaching of Listening

Listening is an important aspect in communicating with others. Feyten stated that listening is used more than 45% in communication, which clearly shows how important this skill is in overall language ability (2010). Furthermore, Brown states that teaching means to help someone to learn how to do something, to guide someone in the study of something, and also to provide someone with knowledge (2000, p. 7). In recent years when listening is examined in relation not only to comprehension but also to language learning, listening has been considered from a further perspective. Teaching listening needs a bit more on the part of the teacher than that of the learners. One of the main principles of teaching listening is that language material should be intended to use for training listening comprehension and it should never be presented visually first. Therefore, audio listening is a great tool to achieve this objective.

1.2.2 The Use of Podcasts in Teaching English

Podcast is a series video and digital audio broadcast that could be downloaded and played on mobile devices. The term “Podcast” was derived from two technologies, “iPod”, and “Broadcast”. Podcast is same as radio but there is a thin line between radio and Podcast. Podcast give listeners full access to select their favorite program according to their convenience and listen to it. Podcast was first known in 2004, and it is defined as an internet audio blogging or internet audio publishing. The audio recording is designed to be downloaded and listened to on a portable mp3 player or on a computer. Podcasts are delivered online automatically via a website, so it is different from other audios. Podcasts utilize voice which is the most influential tool that relates to the audience very quickly. Thus, podcast is a series of sound files that consist of educational information in a comprehensive manner to make the user an advanced learner.
As defined by Sloan (2005) above, Podcasting as a media became an important portable audio which can be utilized for drilling students’ listening practice. Moreover, Gromik (2008, p. 47) claims that podcasting provide learners with “full access authentic resources” in non-English speaking contexts. In addition, Podcasts offer a ‘real-life listening’ source that all foreign language listeners are allowed to benefit from it. Constantine (2007) explained the importance of using Podcasts in the foreign language class from beginner level to advance level. Beginners can benefit from general listening and exposure to new language. For intermediate level, students are able to access authentic materials and exposed to a variety of voices while for advance level, they are able to choose podcasts materials based on their own need. Another benefit of podcasts has been proven by Lu (2007) through his four week study. The study investigate how podcasts in both UK and US English could boost the listening and speaking proficiency of language learners in an EFL context which involved a Taiwanese learner who had not previously been exposed to authentic English. The participant was asked to transcribe the podcasts, to identify vocabulary and grammar in context, and a discussion of the topics was conducted in English at the end of each week. The study discovered that using podcasts in listening instruction has a positive influence for his listening comprehension. He also gained confidence in his ability to comprehend English overall.

Specifically in teaching listening comprehension, Podcasts also used as primary sources and review tools in EFL classrooms. A study conducted by Ashraf, Naroozi and Salami (2011) demonstrated that podcast has significant impact on Iranian EFL sophomore students’ listening comprehension. Similarly, Hawke’s (2010) study reported significance improvement on science students’ scientific English listening skills through podcasts. As supplementary materials, podcasts assist students pay attention on its content and motivate them to learn listening both using bottom up and top down strategies. Moreover, Istanto (2011) also has proven that Podcasts improve students listening skills and grammar knowledge. Not only for Listening comprehension skills, several studies have also shown the significant effect of podcasts for students vocabulary, pronunciation, speaking, grammar and writing skills. Several researches have also proven that podcasts are very useful sources and easy to be downloaded which provide students with authentic materials so they can broaden their knowledge and allow them to practice their listening (Artyushina et al., 2011; Kan, 2011).

1.2.3 Perception Towards Podcasts

The application of Podcasts in English classroom has influenced students’ English skills as well as their perception toward it. Beside reports on students’ English skills above, several scholarly works revealed both students and teachers’ perception on the use of Podcasts in English language teaching. A group of studies concluded that students have positive response toward learning English through podcasts (Vaezi & Desmet, 2014; Chin & Lin, 2011; Kim & King, 2011; Heilesen, 2010; Kavaliuskine & Anusiene, 2009; Fernandez, Simo, & Sallan, 2009).

Moreover, Putman and Kingsley’s (2009) developed a study asking science students perception toward the use of podcast in English classroom. The findings revealed that podcasts help students to enrich their science vocabulary as well as motivated them to learn vocabulary. Similarly, Both Borgia (2010) and Putman & Kingsley (2012) reported that podcasts enable students to gain more vocabulary and reinforce them to learn vocabulary at their own pace. In addition, Cross (2014) found that podcasts can promote students’ autonomous learning. By giving students regular guidance and feedback on the use of podcasts, they are able to develop their listening ability.

Kavaliuskine & Anusiene (2009) indicated that students have positive feedback on podcasts, shown by their high appreciation to the utilization of podcasts in English classroom and their extensive use of podcasts in listening practice. Also, Students’ enthusiasm in using podcast as learning sources shown by their efforts to downloading podcasts frequently, listening to it regularly as for listening practice and entertainment. Some studies also concluded that podcasts enhance students’ motivation due to its various and interesting topics (Heilesen, 2010; Fernandez et al., 2009; Evans, 2008)

2. Method

2.1 Population and Sample

The population of this research are 270 high school students in Jakarta, Indonesia. The sample is 60 students of grade ten at SMA Angkasa 2 in the Academic Year of 2017/2018. They are split into two classes, consisting of 30 students as experimental class and 30 students as a control class.

2.2 Instrument

The instrument used in this research are objective test, lesson plan of listening which treated to students for sixteen meetings, and survey questionnaire.
2.3 Data Collecting Technique
Data were taken from experimental class and control class. The data was collected from instrument in form of 30 multiple choice of question items for post-test. Then, 10 items of survey questionnaire was used to gather students’ perception toward the use of podcasts in English teaching subject.

2.4 Data Analyzing Technique
The quantitative data is analyzed by using One Way ANOVA. For the sake of accuracy the data were calculated by SPSS 20 Version. To obtain better result, the objective test was analyzed by using validity, realiability, index of difficulty and discrimination power. In addition, the survey questionnaire is analyzed by likert scale.

3. Results
3.1 Result of Statistical Data
Below is descriptive statistics from the result of post-test which calculated by SPSS 20.

<table>
<thead>
<tr>
<th></th>
<th>Experiment</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Valid</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean</td>
<td>76.7000</td>
<td>67.7000</td>
</tr>
<tr>
<td>Std. Error of Mean</td>
<td>1.64502</td>
<td>1.76306</td>
</tr>
<tr>
<td>Median</td>
<td>78.0000</td>
<td>66.0000</td>
</tr>
<tr>
<td>Mode</td>
<td>80.00</td>
<td>60.00</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>9.01015</td>
<td>9.65669</td>
</tr>
<tr>
<td>Variance</td>
<td>81.183</td>
<td>93.252</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>.031</td>
<td>-.962</td>
</tr>
<tr>
<td>Std. Error of Kurtosis</td>
<td>.833</td>
<td>.833</td>
</tr>
<tr>
<td>Range</td>
<td>36.00</td>
<td>35.00</td>
</tr>
<tr>
<td>Minimum</td>
<td>60.00</td>
<td>50.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>96.00</td>
<td>85.00</td>
</tr>
<tr>
<td>Sum</td>
<td>2301.00</td>
<td>2031.00</td>
</tr>
</tbody>
</table>

It can be seen from the table above that experiment class obtained higher score in mean, median, mode and minimum and maximum score than control class. In addition, it is clearly shown that students who were taught by using Podcast has higher score in range, minimum and maximum 36, 60, and 96 respectively over control class. This indicates that experimental class gained better result in listening achievement.

To be more comprehensive, below is the result of One Way ANOVA using SPSS 20 applied to experimental and control class.

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>501.621</td>
<td>1</td>
<td>501.621</td>
<td>7.581</td>
<td>.010</td>
</tr>
<tr>
<td>Within Groups</td>
<td>1852.679</td>
<td>28</td>
<td>66.167</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2354.300</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the analysis by Anova test, sig. value 0.010 is lower than < 0.05. Therefore, $H_a$ was accepted and $H_o$ was rejected. Obviously, there is a significant impact of the usage of podcast on students’ listening comprehension. Furthermore, degree of freedom (df) (1:60), namely (4.00) used in this research and yielded the value of $F_{\text{observed}}$ 7.581 which is higher than $F_{\text{table}}$ 4.00. This score also supported the hypothesis that students’ listening comprehension of experimental class was influenced by podcast.
3.2 Results of Questionnaire

<table>
<thead>
<tr>
<th>No</th>
<th>Questions</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I feel that my listening skill improve after listening to Podcasts.</td>
<td>5%</td>
<td>80%</td>
<td>10%</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>Using podcast enhance my motivation in learning English</td>
<td>20%</td>
<td>60%</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>I find a difficulty to understand what the speaker says.</td>
<td>0%</td>
<td>5%</td>
<td>20%</td>
<td>45%</td>
<td>30%</td>
</tr>
<tr>
<td>4</td>
<td>Podcast offers authentic materials of English listening</td>
<td>60%</td>
<td>30%</td>
<td>10%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>5</td>
<td>The tasks and activities in podcasts are interesting</td>
<td>70%</td>
<td>25%</td>
<td>5%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>6</td>
<td>Podcasts is very portable and easy to use</td>
<td>25%</td>
<td>70%</td>
<td>3%</td>
<td>3%</td>
<td>0%</td>
</tr>
<tr>
<td>7</td>
<td>Podcasts is not effective in terms of time</td>
<td>0%</td>
<td>10%</td>
<td>10%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>8</td>
<td>Podcasts duration is appropriate for us to concentrate on listening</td>
<td>75%</td>
<td>10%</td>
<td>10%</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>9</td>
<td>My vocabulary is enriched after listening to podcasts</td>
<td>70%</td>
<td>20%</td>
<td>10%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>10</td>
<td>I recommend teacher to use podcasts in teaching listening</td>
<td>70%</td>
<td>10%</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

From the questionnaire above, majority of students felt their listening skill improves after listening to podcasts. Moreover, 80% students (60% agree and 20% strongly agree) in agreement that podcasts can enhance their motivation in learning English. Even though podcasts offer many benefits, few students found difficulties to understand the speech or conversation. This is shown by 5% of students chose agree and 20% neutral. In terms of its authenticity, most students thought that podcasts provide them with authentic materials of English listening. Then, vast majority of students (70% strongly agree and 25% agree) perceived that the tasks and activities presented in podcasts are interesting. Most students agreed that podcasts are portable and easy to use. Regarding the effectiveness of podcasts, 80% of students agree while there are still 10% says it is not effective and 10% of students stay neutral. Even though many students felt that the duration of podcasts is enough for them to concentrate on listening, there are 5% who did not agree and 10% chose neutral. Interestingly, 90% of students admit that their vocabulary is enriched after listening to podcast. Lastly, almost all students recommend teacher to use podcast in their listening classroom.

4. Discussion

The result above showed that podcast has significant effect on students’ listening comprehension. The higher score achieved by experimental class has proven the effectiveness of podcast as media to improve students’ listening achievement. This fact clearly proven that the use of English podcasts in teaching listening gives significant impact to students’ listening comprehension. This result confirms several studies in which students who were taught by podcast performed better in listening comprehension skill than those who did not taught by podcast (Al Qasim & Al Fadda, 2013; Kavaliauskienė 2008; Ahmed, 2016).

Moreover, this study found that students in experiment class has high motivation to study English by using podcast due to the features provided by podcast such as various ELT classroom activities. Specifically, podcast offers students opportunity to enthusiastically respond to teachers so the levels of their learning speed up desirably. Some exercises and assignments of podcasts motivates students to use their creativity as well as to sharpen their listening skill. This motivation can be seen directly from students’ enthusiasm during treatment period using podcast media in the classroom. This finding is in line with Morri’s (2010) study that podcast can be a way to help students in listening comprehension in which students use their imagination and build pictures of who and what they are listening to in their head. By incorporating podcasts into English teaching, students develop their proficiency in Listening and English as general. Therefore, podcasts can be used as main sources or supplementary tools as suggested by previous research (Istanto, 2011; Abdous, 2009; Lee & Chan, 2007).
Regarding to the result of questionnaire, it is obviously seen that podcasts impressed students with its meaningful and appropriate content for listening, portability and benefits for students. First, students are exposed to new vocabulary and content knowledge through activities and tasks of podcasts. Therefore, students felt that their listening comprehension is improved as well as vocabulary. Similar results found that students have chance to learn new vocabulary and content knowledge from listening materials (Putman & Kingsley, 2012). Another interesting activity done by the students during treatment period such as sharing, discussion, acting out and group competition to answer listening tasks. Students are excited to learn listening from different topics of podcasts. This was inferred that students’ vocabulary is improved due to their exposure to various topics of materials through podcasts (Chan, Chi, Chin, & Lin, 2011). This result supported the idea of teaching the language skills can be integrated not only listening but also vocabulary and speaking skill. Furthermore, students perceived that activities in podcasts are very engaging and connect tightly with real life situation so it enables them activate their critical thinking, creative thinking and problem solving skills. For this reason, students felt that working on podcasts assignments are very interesting and somewhat challenging. Through the fun and challenging situation, students felt motivated to complete listening activities and finish listening tasks.

Regarding to its portability and easiness, students felt the effectiveness of using podcasts both inside and outside of classroom for listening exercise during class activities and for their leisure time. Podcasts audio is easy to use. Students mentioned that it can now be downloaded through students’ Smartphones which makes them easy to access it anytime. Concerning with the use of podcast in EFL teaching, Szendefy (2005) stated that podcast provide students and teachers with great full access and integration of material than tape recorders or videocassettes. In this study, accessibility and easily of podcast can be perceived by both teacher and students. Download materials (audio podcasts) from some websites can be done and used easily in classroom as well as conducting activities. Students were asked to write the difficult vocabulary they heard from the audio, find the meaning then correct meaning and spelling after they got the audio script.

Furthermore, students perceived that podcasts offer effectiveness in time and duration. During treatment, audio listening material is presented in 3 to 5 minutes and students enjoy listen to any topics within this duration. This notion is supported by Constantine (2007) that students benefit from 3-5 minutes podcasts every day. Another important point found in this study is the benefits offered by podcast to boost students’ listening comprehension. Podcasts can stimulate students become more imaginative, enriches students’ vocabulary and help them to learn new things which is hard to find in traditional classroom (Lee, 2009).

In this study, students’ enthusiasm appeared when they pay full attention to answer teachers’ questions directly and through assignments as Salmon and Edrisingha (2008) point out that the sign of successful teaching is to holding students’ attention. Similarly, students’ enthusiasm was clearly shown by their request and activity since the first meeting. Students requested more audios for the next meeting and they initiate to write a personal journal about podcasts they have listened as an exit slip before they leave the classroom in first meeting. Most students preferred the audio listening materials with topics of cultures and academics.

Although this study yielded positive impact of podcast on students’ listening comprehension, few individual cases cannot be ignored in terms of the result of post test score. Scaffolding is needed for those students who have low scores even in experimental classroom. Even though students recommend teacher to use podcasts in teaching listening, it is essential for teachers to choose appropriate podcasts audio with the lesson topic, manage time and frequency of using podcasts and preparation. The findings also showed that it is important for teacher to use appropriate instruction in order to have maximum result. Podcasts will convincingly assist teacher and students in learning English particularly in listening process activity.

The findings revealed a positive result regarding the effect of podcast on students’ listening comprehension in EFL teaching and learning. More precisely, it is found that podcasts can improve students listening comprehension. The success of podcasts, however, depends on the teachers’ competence with the use of such e-tool and the appropriate selection of the materials in a way that guides the learners to meet the learning objectives. To put in a nutshell, podcasts play a significant role in both teaching and learning. The revealed results have served the primary hypothesis, which is podcasts in EFL classes will improve students’ listening comprehension skill. The result led to conclude that it is a reliable and relevant tool to for listening practice and for improving EFL learners’ vocabulary. For the sake of integrating podcasts in EFL teaching and learning at school, the following recommendations need to be regarded; time allocation, availability of electronic tools in schools, and teacher with technology competence.
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References


Al Qasim, N., & Al Fadda, H. (2013). From CALL to MALL: The effectiveness of podcast on EFL higher education students’ listening comprehension. English Language Teaching, 6(9), 30-41. https://doi.org/10.5539/elt.v6n9p30


Podcast Applications in Language... (PDF Download Available). Retrieved from https://www.researchgate.net/publication/287149938_Podcast_Applications_in_Language_Learning_A_Review_of_Recent_Studies

Science Vocabulary. *The Reading Teacher*, 63(2), 100-108. https://doi.org/10.1598/RT.63.2.1


**Glossary**

EFL: English Foreign Language

UIA: Universitas Islam As-Syafi’iyah

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