Interdisciplinary Research Review
Volume 17, Number 4, Pages 8 – 14

Enhancing vocabulary among grade 4 deaf and hard-of-hearing (DHH) learners through an online sign language intervention: A mixed method study

Jordan S. Madronio[1,*]

[1]**Department of Education (DepEd), Philippine School for the Deaf, Philippines**

Abstract

Filipino Deaf and Hard-of-Hearing (DHH) learners are generally considered bilingual who use Filipino Sign Language (FSL) as their primary mode of communication. Written language in Filipino or English form-part of their secondary mode of communication but the DHH learners' familiarity with the English written language is evident due to the influence of the American Sign Language (ASL). There is a challenge among grade 4 DHH pupils to remember Filipino-written *Araling Panlipunan* (Social Studies) vocabularies and their corresponding manual sign. The overall purpose of this study is to address the difficulties encountered through an intervention called *Araling Panlipunan* (AP) Filipino Sign Language (AP-FSL). The intervention is in the form of multimedia learning resource material that is made accessible for any Android or iOS device. The study used mixed method approach in collecting quantitative and qualitative data. Quantitative data were gathered through the conduct of pre and posttest to thirty (30) grade 4 learners while the qualitative data were collected through survey forms and semi-structured interviews. Results revealed a significant increase in the mean percentage score from 9.33 to 83.47. Post test result fell under the independent reading level. The overall impression or rating of the stakeholders to the AP-FSL intervention was "strongly agree" which implies that an intervention to increase the AP vocabularies among DHH learners is strongly recommended. Stakeholders' recommendation to further enhance the intervention were also taken into consideration highlighting the importance of close collaboration with the Filipino Deaf community in utilizing appropriate manual sign in AP lessons.

Keywords: deaf and hard-of-hearing education, Filipino Sign Language, multimedia, social studies

Article history: Received 27 January 2022, Revised 20 June 2022, Accepted 21 June 2022

1. Introduction

In 2015, UNESCO, in its call for functional literacy, initiated the Education for All (EFA). This initiative included provisions to ensure all Filipinos to achieve the ability to read, write and do calculations at a level that is sufficient for the country in which a particular person lives [1]. Through this endeavor, the deaf and hard-of-hearing (DHH) pupils who have unique learning characteristics are included. Considering that they are bilingual and visual learners, sign language serves as their primary language while written language, in Filipino or English, as their second language. Among the two written languages, they are more versed in English because of the American Sign Language (ASL) influence [2].

Numerous studies have indicated that DHH children have significantly delayed vocabulary and reading comprehension, literacy skills, and overall depressed academic achievement in general when compared to their hearing peers [3]. Since their primary acquisition of learning is through their sense of sight, appropriate learning materials should be utilized to suit their learning needs. It may include pictures, images and video clips with sign language interpretation.

Computer-based interventions are conducted to improve DHH learners' vocabulary, literacy and comprehension skills. Previous studies examined the applicable format via computerized programs containing combinations of picture, print and interactive content [4, 5]. Study conducted by Reitsma [6] focused on the utilization of video with sign language, printed words and drawings for 6 to 9 year-old deaf learners. Results indicated that drawings were most effective in increasing word identification, spelling, and reading comprehension. However, in a study conducted by Holmer, Heiman, and Rudner [7], they concluded that computerized interventions that utilize sign language, on either word reading or reading comprehension, have no significant effect. In the said study, regarding the three variables, namely, (a) sign language phonological awareness, (b) sign language comprehension, and (c) non-linguistic working memory, no significant effects were found.

In other reviews on the interventions using computer-based applications and captioning, they reveal that when lectures were presented to DHH students through the use of sign language, these students were found to comprehend more the content of the lectures. However, they tend to understand better and become more attentive when the lecture materials being provided to them are aided with captions and visual cues [8] [9]. These findings align with those studies focused on comprehension for reading and mathematics. Students with hearing loss seemed to benefit the most when a combination of print and visual representations such as pictures or photos were used [10] or when captions were paired with an American Sign Language

*Corresponding author; email: jordan.madronio@deped.gov.ph

(ASL) video [10, 11] to present instructional material. Student engagement and performance were greatly improved when instruction was paired with scaffolding software [12].

Multiple studies used computer-based multimedia applications in teaching learners with hearing loss [10, 13, 14]. Researchers Jackson, Gaudet, McDaniel and Brammer [15] stated that the use of multimedia technology, including synchronous text-talking media can enhance learning and promote the acquisition of information at all levels through multiple modalities and immediate feedback. This use of technology is seen as very crucial in accommodating the diverse styles of learning which would allow educators to structure educational activities creating positive learning environment, effective interaction, communication, critical and higher-level thinking among DHH learners. Multimedia computer programs, applications and digital media present a combination of both verbal and visual information, including pictures, video, and models such as concept maps to introduce new vocabulary and grammatical concepts. These types of programs have proven to increase recall, and retention of information over information presented in only one form [11]. Hamilton [16] conducted a study titled, "The Efficacy of Dictionary Use while Reading for Learning New Words," which suggested that DHH students may benefit from the use of electronic bilingual multimedia English-American Sign Language (ASL) dictionaries to build vocabulary during independent reading.

Mayer [17] refers multimedia learning as the learning from both words and pictures. Visual learners highly preferred a well-designed multimedia that contained pictures, words, and interactive features than the traditional "words model" alone. Mayer's theory assumed that successful multimedia learning was dependent on the ability of a person in selecting words and pictures, and integrating prior knowledge stored in long-term memory. Mayer's cognitive theory of multimedia learning was based on three assumptions. First, the human information processing system consists of two separate channels, verbal channel for processing verbal representations and a pictorial channel for processing visual representations. Second, the channel in the mind, limited in the amount of materials, can process at any one information at a time; and the third assumption stated that meaningful learning can occur when pupils were engaged in active processing within the channels. People learn thoroughly from words and pictures rather than from words or pictures alone [18]. By combining text, pictures and illustrative video, learners could make assumptions or explain the picture through their prior knowledge.

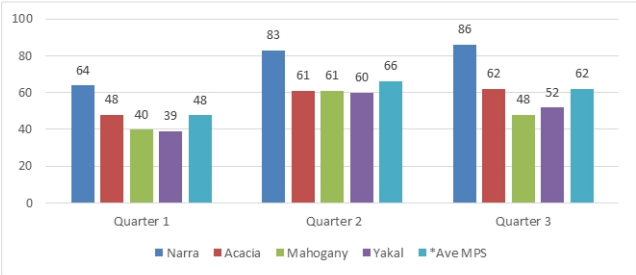
During the time of COVID-19 pandemic, where the traditional classroom set up is not possible, the use of multimedia and pre-recorded video lessons was widely practiced for knowledge acquisition of DHH learners. However, this intervention was not enough for them to fully understand the Filipino-written sentences. Blended Learning is the Department of Education's (DepEd) response to the COVID-19 pandemic. DepEd defined it as face-to-face with any or a mix of online distance learning, modular distance learning, and TV/Radio-based Instruction [19]. In the case of the Philippine School for the Deaf (PSD), the country's pioneer, semi-residential and sole government-owned institution for learners who are deaf and hard of hearing (DHH) [20], learning delivery was primarily through the combination of modular and online synchronous/asynchronous sessions. PSD is an integrated school located in the Schools Division of Pasay City along FB Harrison Street and offers K-12 curriculum of the Department of Education (DepEd). It uses total communication as a mode of teaching delivery [21].

Prior to the pandemic, lessons in *Araling Panlipunan* (AP) were adapted using sign language and written English as modes of teaching strategy. The school year 2020-2021 was the pilot year of using Filipino as the mode of instruction delivery in *Araling Panlipunan* (Social Studies) or AP in the elementary department. *Araling Panlipunan* is a field of study which focuses on human connections and how society functions. It is a portion of the basic education curriculum that includes lessons in history, government, economics, civics, sociology, geography, and anthropology and is focused on the study of social relationships and the functioning of society. Government schools in the Philippines use Filipino language in teaching this subject area. AP is commonly taken from the first year to the fourth year of high school in the old Basic Education Curriculum. In Grades I to III, this is referred to as *Sibika at Kultura* (Civics and Culture); and in Grade IV to VI, it is called HEKASI or *Heograpiya, Kasaysayan at Sibika* (Geography, History and Civics). With the implementation of the K to 12 Basic Education Program, *Araling Panlipunan* is already included in Grades I to VI curriculum. The study of AP in basic education is integral in the development of pupils, whom the government envisions to become socially aware, actively involved in public and civic affairs, and contribute to the development of a progressive, just, and humane society [22]. The shift from English to Filipino language created a challenge among grade 4 DHH pupils in remembering AP vocabularies and the corresponding manual sign.

Grade 4 pupils in PSD were grouped into sections that composed of 10 learners. Section names were derived from the trees found in the Philippines that have stunning features. Trees like Acacia, Narra, Mahogany and Yakal were the designated names for each section. The DHH learners were made aware that these trees are found in the country's forest, and prevalently being used in the process of furniture making [23].

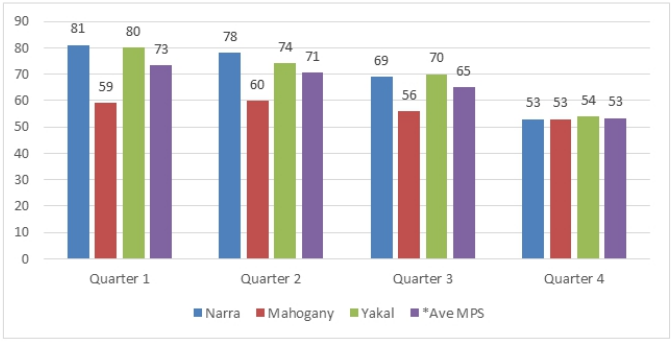
Figure 1 reveals the level of performance of grade 4 in AP from the previous school year 2019-2020 gathered from the results of the teacher-made quarterly examinations. A fourth quarter examination was not administered due to the Covid-19 outbreak in the last quarter of the aforementioned school year [24]. It can be implied from the graph that there was a low performance of grade 4 DHH learners in AP particularly during the first quarter. Section Narra showed an above 80% MPS for the 2nd and 3rd quarters. Three sections namely, Acacia, Mahogany and Yakal, garnered a below 50% MPS from the first quarter. For the succeeding quarters, a below 61% performance was recorded.

The grade 4 sections were reduced into 3, namely, Narra, Mahogany and Yakal. Figure 2 shows the level of performance of Grade 4 DHH pupils during the blended distance learning through the summative tests conducted during first, second, third and fourth quarters of the school year 2020-2021. The data presented were collected from the teacher-made summa-



*MPS- mean percentage score

Figure 1: Grade 4 Consolidated Test Results (SY 2019 – 2020)



*MPS-mean percentage score

Figure 2: Grade 4 Consolidated Summative Test Results (SY 2020 – 2021)

tive examinations. Despite the modifications made in the test questions, it still revealed a noticeable decrease in the grade 4 DHH learners' summative test results in AP. The highest MPS average was recorded during the first quarter at 73% while the lowest in the last quarter was at 53%.

One of the factors that might have affected their performance was the shift from English to Filipino written language in the delivery of instruction. Another factor could be due to the school calendar adjustments. It can be recalled that DepEd adjusted its school calendar of activities and added two weeks to compensate the adjustment made in the school year 2020 – 2021 [25]. Initially, the school year was scheduled to end on June 11, 2021. However, with the changes of the school calendar, DepEd moved it to July 10. This could have affected the teaching-learning process of the last quarter which had shorter number of school days. Although the number of school days was increased, it could have had a contributory impact with regard to the preparation of 4th quarter learning materials, summative tests and other activities such as graduation, accomplishment reports, among others.

The researcher was motivated to conduct this research endeavor as a response to the academic challenges being experienced by the grade 4 DHH learners as presented in tables 1 and 2. This intervention is called *Araling Panlipunan* Filipino Sign Language (AP-FSL) intended to contribute to the limited multimedia learning resources specifically designed for the DHH learners [26]. The general objective of this study is to come up with an intervention that is aimed at the increase of the vocabulary of DHH learners in Filipino-written AP subject.

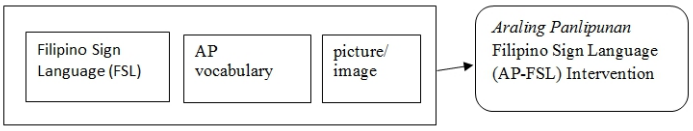


Figure 3: Components of the APFSL intervention

Table 1. Profile of the participants in the evaluation of AP-FSL.

Participants	Age	Gender	Profession	Hearing Ability/Loss
A	12	Male	Pupil	Profound
B	47	Female	Parent	Regular Hearing
C	25	Female	Deaf teacher	Profound
D	38	Female	Teacher	Regular Hearing

2. Research Questions

2.1 What is the level of AP vocabulary of the Grade 4 DHH learners before and after the AP-FSL intervention?

2.2 Is there a significant difference before and after the AP-FSL intervention in the sign language skills of Grade 4 DHH learners in AP vocabularies?

2.3 What are the challenges, perceptions, and opinions of the stakeholders in the implementation of the AP-FSL intervention?

HYPOTHESIS (HO)

There is no significant difference in the mean percentage scores of the grade 4 pupils before and after the utilization of the AP-FSL intervention in increasing the pupils' sign language skills in AP vocabularies.

3. Methodology

In this research endeavor, mixed method approach was utilized which involved quantitative and qualitative data collection [27]. Quantitative research was employed in the pre and post-test of the participants. The qualitative part, on the other hand, was utilized to gather perceptions, insights and opinions through survey and semi structured interview from selected stakeholders.

3.1 Population and samples

The participants in this study were 30 grade 4 DHH learners of PSD who were enrolled in the school year 2020-2021. Twenty-one or 70% were male and nine or 30% were female. The study presupposes the predominance of male more than female. Participation rate was at 100% which represents the entire grade 4 population of PSD during the said school year.

Purposive sampling method was used to select stakeholders to represent learners, parents, teachers and the deaf community. Table 1 summarizes their profile in terms of age, profession and hearing ability/loss.

3.2 Research instruments

For the quantitative part, the pre-test and post-test scores were collected to determine the level of their vocabulary skills in AP. The study adapted the "Reading Level Proficiency Rubric" of the Philippine Informal Reading Inventory (Phil-IRI) to measure and describe the level of vocabulary of the pupils [28]. The scores of each participant were recorded in the Level of Vocabulary Proficiency Form to determine their

Table 2. Mean percentage scores (MPS) of pre-test and post-test.

Grade Level	No. of Items	No. of Pupils	PRE-TEST MPS	POST-TEST MPS	Difference
4	50	30	9.33	83.47	74.14

MPS Mean Percentage Score

Table 3. Level of AP vocabulary.

Grade 4 Sections	AVERAGE PRETEST RESULTS	*Proficiency Scale	AVERAGE POSTTEST RESULTS	*Proficiency Scale
NARRA	5.82	Frustration Reading Level	42.64	Independent Reading Level
MAHOGANY	4.56	Frustration Reading Level	40.89	Independent Reading Level
YAKAL	3.50	Frustration Reading Level	41.10	Independent Reading Level

**Proficiency Scale was based from the Reading Level Proficiency Rubric of Philippine Informal Reading Inventory (Phil-IRI)*

level of language proficiency scaled as follows: 0-15, Frustration Reading Level, which means that the learners found the AP-FSL intervention so difficult that they cannot successfully respond [29]; 16-35, Instructional Reading Level, which means that the learner benefited the most from the teacher-directed instruction in AP vocabularies; and 36-50, Independent Reading Level, which means that the learners could function on their own and the results were almost perfect in terms of reading and comprehension through sign language.

The 50 item AP vocabularies were taken from the Most Essential learning Competency (MELC)-based Self Learning Modules (SLM). AP vocabularies included were the following: *mamamayan, komunidad, bansa, teritoryo, lupain, demokrasya, soberanya, saligang batas, konstitusyon, Pilipinas, arkipelago, kultura, republika, ehekutibo, lehislatibo, kongreso, hudikatura, Luzon, Visayas, Mindanao, La Union, Pangasinan, Nueva Vizcaya, Quirino, Pampanga, Tarlac, Zambales, Bulacan, Cavite, Laguna, Rizal, Quezon, Bicol, Iloilo, Cebu, Samar, Leyte, Zamboanga, globo, mapa, ekwador, Asya, pulo/isla, hayop, ibon, bundok, gulay, pagsasaka, lindol, pagbaha/baha*. Sign language was executed twice. The AP vocabulary appeared first, and followed by manual sign language, fingerspelling, image and another manual sign language. To verify the increase in the pupils' vocabulary in AP, the pre and post-test results were compared. The significant difference of the pre-test and post-test was computed using the dependent t-test. The data was gathered, recorded and interpreted using the Level of Vocabulary Proficiency Form.

Figure 3 depicts the component of the intervention in the form of multimedia learning resource material containing different AP words written in Filipino language, images and sign language. Vocabularies.

The qualitative data collection of this study was done using the AP-FSL Feedback Form was presented to evaluate the overall effectiveness and applicability of the intervention in terms of content, layout and accessibility aspects. It contained a five-point Likert Scale which may be answered by checking under the number that corresponded to the evaluators' responses. The criteria on the said scale were rated as follows: 5-Strongly Agree; 4- Agree; 3 Neutral; 2 Disagree; and 1 Strongly Disagree. The weighted means was interpreted with the same arbitrary scale, viz: 5 Strongly Agree, which means strong affirmation of the APFSL to be used as intervention; 4 Agree, which means affirmation of the APFSL to be used as intervention; 3 Neutral, which means that APFSL may or may not be suitable to be used as intervention and needs more revisions; 2 Disagree, which means negative affirmation of the AP-FSL to be used as intervention; and 1 Strongly Disagree, which means strong negative affirmation of the proposed intervention and the proposed intervention is not suitable for DHH learners. It also contained comments section for a specific feedback and suggestion from the stakeholders. To validate their responses, a 1015-minute, unstructured phone interviews were also applied.

3.3 Data analysis

The data gathered was also analyzed using the following statistical tools:

3.3.1 Mean was used to get the scores of the grade 4 DHH pupils when data are grouped into before and after the AP-FSL intervention.

3.3.2 Paired Sample T-Test was used to compare the results or mean scores from the pre and post-test.

3.3.3 Thematic analysis was applied to come up with specific themes generated from the unstructured interview.

4. Results and Discussion

The findings of a study on enhancing the vocabulary of grade 4 DHH learners through AP-FSL intervention is presented in accordance with the aforementioned research questions as follows:

4.1 In order to measure the level of AP vocabulary of the grade 4 learners before and after completing the intervention program, data gathered were carefully recorded, tabulated, and analyzed to see the difference using a paired sample t-test. The data is presented in tabular presentations for easy identification of the variances. Table 4 shows the results of the pre-test and post-test of the 30 participants in the 50-item test conducted by the researcher before and after the utilization of the AP-FSL intervention.

It revealed pre and post-test results of 9.33 and 83.47 MPS, respectively. It clearly reflects in Table 2 that there was a remarkable increase in the MPS of pre-test of the participants after the utilization of the APFSL intervention with 74.14 difference. This is a significant intimation that the utilization of AP-FSL is an effective and potent multimedia material intervention in increasing the AP vocabulary of the DHH learners.

4.1.1 Table 3 shows the overall level of AP vocabulary obtained by learners of grade 4 classified in three sections.

The pre-test results of the three grade 4 sections, namely, Narra (5.82), Mahogany (4.56) and Yakal (3.5), fell under the frustration reading level. This means that the learners find

Table 4. T-test result on finding the significant difference in the means of the Grade 4 pupils before and after the utilization of the AP-FSL intervention.

Variables Compared	DF	MPS	Computed t-value	Critical t -value	Decision	Impression @ 0.05 Level
Pre-Test (X1)	29	9.33	80.19	1.70	Reject H_o	Significant
Post-Test (X2)		83.47				

MPS Mean Percentage Score

Table 5. The overall perceptions and opinions of the stakeholders in the implementation of the AP-FSL intervention.

Positive Feedback and Things Appreciated from the AP-FSL Intervention	Challenges and Suggestions to Improve the AP-FSL Intervention
•The content of the AP-FSL is very applicable. It provides appropriate accommodation to It enjoyment through the use of multimedia	• *Some signs utilized need to be enhanced for proper FSL recognition (Mindanao, La Union, Cavite, Samar, Leyte, Asya, lindol)*
• Very accessible. Big help for them to recognize the words or what their teacher teaches through the use of multimedia.	• Accessibility to computer may vary depending of the current memory, features-some format may not be opened to some laptop models... you can save it in multiple formats like mp4, mov, wmv, etc
• Easy to understand layout. Easy to understand, convenient learning, students finding it interesting, time-saving, and effective	• AP vocabularies used maybe accompanied with short meaning to understand by the deaf
• The delivery and presentation is impressive	• Unstable internet connection affects the stakeholders access to the multimedia intervention

the AP vocabularies so difficult that they cannot successfully respond. The average post-test results revealed positive impact of the AP-FSL intervention which fall under the independent reading level. Narra obtained the highest post-test result at 42.64; followed by Yakal, 41.10; and Mahogany, 40.89. This means that the grade 4 learners can function on their own with excellent comprehension using sign language after the intervention [29].

4.2 Table 4 shows the result of the t-test in finding the significant difference in the pre-test and post-test results.

Based from the t-value of 80.19 and the critical t-value at 1.70, the researcher rejected the null hypothesis, which is significant at 0.05 level. This implies that there was a very significant improvement in the AP vocabulary of grade 4 pupils because of the remarkable increased of the mean after the implementation of the intervention.

4.3 Survey results or rating of the stakeholders to the AP-FSL intervention was at 4.61 with an interpretation of Strongly Agree which implies that AP-FSL is strongly recommended to be used as intervention to help the grade 4 pupils increase their AP vocabularies which are written in Filipino language. Table 5 summarizes the overall perceptions, challenges, opinions, and specific suggestions in relation to the implementation of the AP-FSL intervention. It contains the qualitative data gathered through interview and survey questionnaires.

Three themes emerged from this research on the overall perceptions, challenges, opinions, and specific suggestions in relation to the implementation of the AP-FSL intervention. The themes included Content Layout, Accessible Technology, and Perceived Challenges.

4.3.1 Content and Layout. Contents were derived from the Self Learning Modules (SLMs) written in Filipino. Words included are often encountered from first to fourth quarter. The interviewed learner, parent, teacher, and Deaf community representative described their experience of using AP-FSL in positive terms. AP-FSL was seen as effective, easy to understand and enjoyable learning resource material. The stakeholders also observed that the layout was simple and concise. Furthermore, it was evident that the pupils sign as they read the content of the AP-FSL just like reading the words aloud. This was a good indication of learning because as mentioned in the related studies, to be able to experience a good vocabulary and reading comprehension, the pupil must be able to identify words easily [30]. Clearly, the interventions' features fit the learning characteristics of the learners with hearing loss by allowing them to enhance their AP vocabulary in an enjoyable manner [31]. A Deaf community representative suggested sign language modifications to some AP vocabulary (e.g., *Mindanao, La Union, Cavite, Samar, Leyte, Asya, lindol*) in accord with the Deaf community's standards. A teacher suggested that short meaning of the word may be included in the slides. This is very crucial observation to deepen the DHH learners' understanding of the given AP vocabulary. However, mastering basic AP vocabulary is a requisite before/proceeding to the more complex phrases written in Filipino

4.3.2 Accessible Technology. The stakeholders believed that the AP-FSL intervention is very accessible, considering that it can be accessed using any iOS or Android device. DHH learners can access it during their free and convenient time. Hence, they can watch and navigate it several times, without any assistance, until they memorize the vocabularies presented. Considering that this is a multimedia with sign language interpretation, DHH learners find it interesting and engaging. They copy the signs they see from the video which also contains AP vocabulary and picture.

4.3.3 Perceived Challenges. The interviewed teacher shared her concern about the internet connection challenges. In the Philippines, 31% percent of Filipino families with members studying through online distance learning have weak internet connection [32]. The level of internet connectivity also affects the quality of the multimedia intervention. In addition, some gadgets have limited capacity to view multimedia depending on the format available. The AP-FSL is in an MP4 format which can be viewed in a typical telecommunication device like computer, cellular phone, tablet, among others.

5. Summary and Conclusions

The general purpose of this study is to develop an intervention called AP-FSL and address the challenges experienced by the grade 4 DHH learners in Filipino-written AP vocabularies. To summarize, the results of the study were discussed in accordance with the research questions as follows:

5.1 The level of AP vocabulary of the grade 4 DHH learners

before the intervention was at Frustration Reading Level with 9.33 mean percentage score (MPS). After the AP-FSL intervention, the learners got an MPS of 83.47%, which shows a remarkable increase with 74.14 difference. This is a significant intimation that the utilization of AP-FSL is an effective and potent multimedia material intervention in increasing the AP vocabulary of the DHH learners. The average posttest results revealed positive impact of the AP-FSL intervention which fall under the Independent Reading Level which means that the grade 4 learners function on their own with excellent comprehension after the intervention;

5.2 The result of the AP-FSL intervention implied that there was a very significant improvement in the AP vocabulary of grade 4 pupils because of the remarkable increased of the weighted mean. The overall impression or rating of the stakeholders to the AP-FSL intervention was 4.61 with an interpretation of Strongly Agree in favor of the said intervention. It is also strongly recommended to be used as additional learning resource materials in enhancing the literacy of DHH learners in written Filipino language.

5.3 Summary of suggestions, overall perceptions, challenges and opinions of the different stakeholders in relation to the implementation of the AP-FSL intervention were also recorded for its further enhancement. Among the suggestions were: (a) utilization of appropriate sign language for proper FSL recognition (Mindanao, La Union, Cavite, Samar, Leyte, Asya, lindol); (b) AP vocabularies maybe accompanied with short meaning to understand by the Deaf learners; (c) accessibility issue of the laptop features; and (d) issue on internet connection.

5.4 In conclusion, AP-FSL intervention has a very significant impact in improving the literacy skills of grade 4 DHH learners. Three themes emerged (content layout, accessible technology, and perceived challenges) from this research on the overall perceptions, challenges, opinions and specific suggestions in relation to the implementation of the AP-FSL intervention.

5.4.1The stakeholders' overall impression of the developed intervention, in terms of its effectiveness and applicability, was strongly agree, which showed a high level of acceptability for it to be used as an online learning resource material to improve their vocabularies in Araling Panlipunan which are written in Filipino. This study may also serve as a benchmark for future research related to the field of deaf and hard-of-hearing education in the Philippines. Moreover, considering that the stakeholders gave the rating of "strongly agree", this indicated that an intervention is necessary to achieve an increase to AP vocabularies of DHH learners. More related research studies may be undertaken to address the perceived limitations of this study.

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