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IGN and Development of an Interactive Learning Application Software to Enhance Alphabet Knowledge in Kindergarten Learners

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ABSTRACT
The study was conducted to design and develop an interactive alphabet learning application software and to find out its effectiveness in enhancing letter name and sound knowledge of kindergarten learners. To achieve this goal, this study utilized sequential developmental research design, adapting the ADDIE (Analysis, Design, Development, Implementation and Evaluation) instructional model to design and develop the interactive learning application. The development of the instructional material was anchored on Information Processing Theory, Bottom-up Theory, Constructivist Learning Theory and Cognitive Development Theory. Having five kindergarten learners as participants, this study also utilized quasi-experimental design to find out its effectiveness when used by kindergarten learners as a supplementary tool to develop and improve the alphabet knowledge. Based on the results, the least learned letters were Ii, Ee, Nn, Pp, Bb and Dd. These could be enhanced using technology tools such as the internet and smartphone which are both common among learners. Moreover, the Interactive Application Software was found out to be appropriate to address their needs. This study concluded that has significantly improved the alphabet knowledge of the kindergarten learners. Thus, it is recommended to be used as a supplementary and intervention tool in learning the letter names and sounds. Kindergarten teachers are also recommended to devise similar learning material which addresses least learned competencies brough about by distance learning. Finally, it is suggested that future studies be conducted to investigate the effectiveness of the same materials to another set of learners.

Keywords: Interactive Learning, Kindergarten Learners, Alphabet Knowledge, Educational Software

INTRODUCTION

Learning to read begins with alphabet knowledge or the knowledge of individual letter names, shapes, and sounds. This basic and fundamental skill to reading is taught in the early childhood education. Failure to master this at an early age can affect later literacy performance or even future academic achievement since alphabet knowledge is an early academic skill together with phonological awareness and rapid automatic naming of letters. Hence, children will likely commit reading miscues if they have weak foundation on early skills (Mohammed & Amponsah, 2018) and will likely succeed academically if otherwise (Hanover Research, 2016).

In the standards and competencies of a kindergarten learner in the K-12 curriculum, alphabet knowledge is a subdomain of language, literacy and communication. Accordingly, learners in kindergarten are expected to demonstrate understanding of letter representation of sounds – that letters as symbols have names and distinct sounds and when letters are grouped, they form words. Such learning competencies are proven to have direct and indirect relationships with reading performance up to the tenth grade (Stanley, C., Petscher, Y. & Catts, H., 2018).

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Jones, Clark, & Reutzel (2012) also underscored the same. Specifically, children's alphabet knowledge and phonological awareness which are taught and learned at an earlier age predict their later proficiency in reading and writing (Ramos, 2017). An earlier study of Mascle (2010) opined that learners who are struggling with reading in early grades continue to struggle through the secondary grades. Thus, children must acquire the foundational literacy skills that will set them on track for appropriate reading development.

In addressing this problem on alphabet knowledge, Throne (2020) came up with effective methods to alphabet instruction for preschool. However, the list of methods was all proven effective in a face-to-face learning environment. Distance learning especially when conducted online were said to be different. Accordingly, face-to-face classes create social pressures and rewards that can encourage them to participate while online classes make struggling learners struggle even more (Loeb, 2020). Although online learning is not as beneficial as in-person classes, it is clearly preferable to none at all.

It is for this reason that several modalities are adapted including distance learning through modular, online, and blended learning. As these modalities are implemented, DepEd (2020) required teaching personnel to provide innovative teaching strategies to meet the learning needs of learners despite the absence of face-to-face interaction. This caused the researcher to design and develop an interactive application software as a supplementary tool in enhancing kindergarten learners' alphabet knowledge.

METHODOLOGY

Research Design

This research utilized two research designs to develop an instructional material and to establish the significant influence of that material in developing alphabet knowledge among kindergarten learners. The research designs are the sequential developmental research design and the quasi-experimental research design.

In the first phase of this study, a sequential developmental research design was utilized to develop the instructional material that would develop alphabet knowledge of kindergarten learners (Pian, 2009). It made use of the sequence or process of the ADDIE model since the design highlights the development of such instructional material (Yu, 2010). Furthermore, the five phases—Analysis, Design, Development, Implementation, and Evaluation—represent a dynamic, flexible guideline for building effective training and performance support tools. In this research design, the data were evaluated as they are collected. Further sampling was stopped when significant results were observed.

The ADDIE Model is an iterative instructional design process, where the results of the formative evaluation of each phase may lead the instructional designer back to any previous phase (Cien, 2013). The end product of one phase is the starting product of the next phase. The analysis defines the problem, identifies the source of the problem, and determines possible solutions. This stage's outputs frequently contain instructional goals and a list of tasks to be undertaken. The findings from the analysis are used to establish a strategy for developing the instruction, which is known as design. This step entails laying up a plan for achieving the educational goals identified during the analysis phase while also broadening the instructional foundation. Development generates lesson plans and lesson materials. Implementation represents the actual delivery of the instruction, whether it is classroom-based, lab-based, or computer-based. The purpose of this stage is the effective and efficient delivery of instruction. Lastly, the evaluation measures the effectiveness and efficiency of the instruction (McGill, 2000).

In this research, ADDIE model instruction design was implemented following two phases. The phase 1 of instructional development involved the analysis, design and

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development while the phase 2 involved the implementation and summative evaluation phases.

First Phase of Instructional Material Development

Analysis. In the analysis phase, the researcher sought the need to develop an instructional material by conducting an alphabet knowledge learning needs analysis to identify the difficulties encountered by the kindergarten learners in learning alphabet knowledge and the appropriate intervention tools to support and enhance learning. The outputs of the analysis phase were the inputs for the design phase.

Design. This phase involved using the outputs from the analysis phase to design instructional strategy to address the learning needs. During this phase, the researcher designed the sequence of instruction, the features of the instructional material, what the learners would see and hear, how will the content enhance teaching and learning, and the required resources in creating the material. The outputs of the design phase were the inputs on the development phase.

Development. The last step in the first phase of development of instructional material is the development phase. This phase was built on both the analysis and design phases. The purpose of this phase is to generate content and lesson material of teachers based on the specifications defined in the design phase. During this phase, the researcher developed the instruction, all media that will be used in the instruction, and any supporting documentation.

Second Phase of Instructional Material Development

Implementation. The second phase of the instructional material development was composed of implementation and evaluation. The implementation phase refers to the actual delivery of the instruction towards learners. During this phase, the parents were trained on how to facilitate learning at home with the use of the instructional material. Kindergarten learners use the instructional material as supplementary tool to enhance learning the letter names and sounds at home.

Evaluation. There were two processes of evaluation: the formative and summative. Formative evaluation is ongoing during and between phases. The purpose of this type of evaluation is to improve the instruction before the final version is implemented. On the other hand, the summative evaluation was undertaken after the final version of instruction is implemented. Its influence on the participants' alphabet knowledge learning will determine the effectiveness of the instructional material. To determine the effectiveness of the instructional material developed in helping learner develop and improve their alphabet knowledge, this research carried out quasi-experimental design. The significant influence of the instructional material developed after the use of the instructional material was established using Wilcoxon signed ranks test statistical analysis.

Participants

Purposive sampling was utilized in the selection of the participants. It is a non-probability sampling design wherein the researcher decides the individuals to be included on the study based upon varied criteria like expertise on the topic, capacity and skills, or simply because of the willingness to participate in the study (Lund Research, 2012).

With this, the researcher was able to include five kindergarten learners who were struggling with alphabet and their parents. Aside from the difficulty of kindergarten learners with alphabet knowledge, their parents' willingness and interest in using an interactive application software to enhance learning formed part of the selection criteria. It was important that parents are willing and interested since they would facilitate the use of the instructional material at home.

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This research also involved three experts in early childhood education to evaluate and validate the instructional material to ensure its appropriateness of use by the kindergarten learners to enhance the development of alphabet knowledge.

Research Instrument

The following data collection instruments were used to gather data in each phase of the instructional material development:

Analysis Phase

Researcher-made Alphabet Knowledge Assessment Tool

A validated teacher made-assessment tool was utilized to find out the alphabet knowledge profile of kindergarten learners. The same tool was utilized to establish the current alphabet knowledge level of development of the kindergarten learners before the use of the application software. Moreover, the tool was evaluated and validated by two Master Teachers and an early grade reading coordinator who are considered experts in the field of early childhood education.

Learners' Records

To learn more on the challenges of the kindergarten learners in learning letter names and sound, the researcher conducted document analysis on learners' activities and output.

Interview Guide

The interview guide was used to find out how the learners are doing the learning activities at home through the lenses of their parents. The parents were also asked the available electronic gadgets which can run the application software.

Design Phase

Instructional Design Review Tool

The results in the analysis phase were used as bases in crafting an application software that would enhance alphabet knowledge of the kindergarten learners. The researcher crafted a draft of the instructional material to illustrate the design of the application software and how it will work. The design and the draft of the instructional material were reviewed and validated by the experts in early childhood education using an instructional design review tool that was based on the DepEd's Learning Resource Management and Development System instructional design guidelines. The purpose of its use is to ascertain the design's consistency with the targeted need.

Development Phase

Instructional Material Development Plan

During this phase, the instructional material development plan was carried out by developing the specific lesson materials which were deemed helpful in alphabet knowledge development. Further, such instructional material development plan guided the researcher to develop the right materials.

Non-Print Instructional Material Evaluation Tool

The researcher sought the help of the experts in early childhood education to review and validate the developed instructional material using a Non-Print Instructional Material Evaluation Tool that was adopted from DepEd's LRMDS instructional material evaluation instrument. Revisions on the instructional material were made based on the comments and recommendations of the experts of the early childhood education.

Implementation

Teacher-made Application Software

The kindergarten learners used the developed instructional material to learn the letter names and sounds of the identified least learned letters. Before its use, the researcher sought the opinion and validation of experts in early childhood education on the implementation plan to ensure that it is appropriate for such use.

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Evaluation

Non-Print Instructional Material Review Tool

The researcher sought the help of the experts in early childhood education to review and validate the appropriateness in terms of content quality, instructional quality and technical quality of instructional material prototype using a Non-Print Instructional Material Review tool that was adopted from DepEd's LRMDS instructional material evaluation instrument. It was used to find out issues on its use and ensure its appropriateness for the development of alphabet knowledge among kindergarten learners. Revisions on the instructional material were made based on the comments and recommendations of the experts of the early childhood education.

Researcher-made Alphabet Knowledge Assessment Tool

To test the efficiency of the application software in enhancing the alphabet knowledge of the kindergarten learners, an alphabet knowledge post assessment was conducted utilizing the alphabet knowledge assessment tool designed by the researcher and validated by experts in the field. The results of the alphabet knowledge post assessment were compared to the pre-assessment results to determine if the software caused significant changes on alphabet knowledge or not.

Data Gathering Procedure

In obtaining the data needed for the study, the researcher followed the standard research protocol guided with the different phases of ADDIE model which are as follows:

1. Analysis Phase

In this phase, the need to develop an application software to enhance alphabet knowledge of the kindergarten learners was established. It was done by first using the teacher-made alphabet knowledge assessment tool. Using it, the researcher identified the alphabet knowledge profile of the kindergarten learner participants to find out the least learned letters in the Third Quarter of School Year 2020-2021. Next, the researcher reviewed the activities undertaken by the kindergarten and their outputs in learning the letter names and sounds to determine the difficulties and the possible constraints in learning the letter names and sound. Then, researcher conducted an interview with the parents to find out how the kindergarten learners are learning at home. The parents were also interviewed with regards to their available electronic gadgets that can be used as a platform to run the application software to enhance learning.

2. Design Phase

In this phase, the researcher has done several steps to be able to design the instructional material in such a way. First, the researcher crafted a plan of strategy on how the instructional material will be developed based on the results of the analysis phase. It consists of the targeted goals, content and features of the instructional materials as well as the sequence of instruction. Second, the researcher created a draft of the instructional material through a PowerPoint presentation to show how the instructional material will work. Finally, the researcher sought validation from three experts in early childhood education of the design and draft of the instructional material.

3. Development Phase

Using the designed instructional plan, the researcher carried out the development of the instructional material. During this phase, the researcher developed the instruction and all media that are needed in developing the instructional material in accordance with the design and specifications in the instructional plan.

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4. Implementation Phase

The data driven software developed by the researcher is implemented in this phase. Here, the identified five kindergarten learners used the software under the supervision of their parents to learn the letter name and sounds of the least learned letters.

5. Evaluation Phase

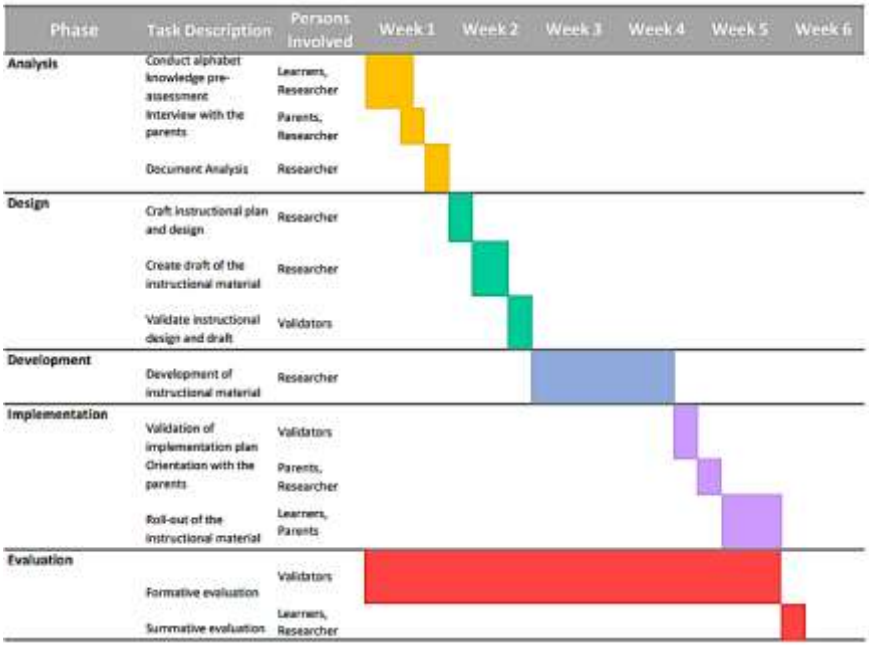
Evaluation occurred throughout the entire instructional design process. There were two kinds of evaluation which happened in the study: the formative and the summative evaluation.

Formative evaluation was undergone during and between phases of instructional development. The researcher went back to earlier stages of development to identify the necessary revisions to undertake for the improvement of the material. Prior the implementation phase, the instructional material was evaluated by the experts in early childhood education using the DepEd's LRMDS review tool for non-print instructional material.

On the other hand, summative evaluation was done after the final version of instruction was implemented to assess the overall effectiveness of the instruction. To find out its effectiveness, an alphabet knowledge post assessment was administered to the participants of the study. The result of the pre-assessment and post-assessment were compared to see the significant difference in the participants' competency prior and after the use of the instructional material.

The Gantt chart below shows the summary of data gathering timeline and tasks that were carried out:

Figure 1. Data Gathering Tasks and Timeline Gantt Chart



Data Analysis

The study used the following to analyze and interpret the data gathered in the light of the purpose of the study:

Document Analysis

This was used to determine learners' difficulties in learning alphabet knowledge as shown in the previous activities they were engaged in as well as the submitted outputs prior the study. This analysis is a form of qualitative research in which documents are interpreted by the researcher to give voice and meaning around an assessment topic (Bowen, 2009).

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Thematic Analysis

This was used to know how learners are at home when they do the learning task as perceived by their parents. This method entails coding content into themes similar to how focus group or interview transcripts are analyzed (Bowen, 2009).

t-Test

The results of the summative evaluation were statistically analyzed and interpreted using this tool to rule out whether the developed instructional material met the focus of the study.

RESULTS AND DISCUSSION

This section explored the results of the study in the context of the issues that prompted the conduct of the research and development of the instructional material.

The least learned letters and the applicable technology tools to support learning

Using the researcher-made alphabet knowledge assessment tool, conducting document analysis, and interview with parents, the data in Table 1 were found out. Generally, it presents the learning needs analysis to point out the difficulties of the kindergarten learners in learning the letter names and sounds. It consists of the identified least learned letters of the kindergarten participants in the Third Quarter of School Year 2020-2021, the learning activities undertaken by the learners, the mode of learning and resources used, and the identified learning constraints that impede learning.

The results of the data gathered show that despite the various activities given to the learners, they still have difficulty in learning the letter name and sound. The identified least learned letters of the kindergarten participants on the third quarter were: Ii, Ee, Nn, Pp, Bb and Dd. Similarly, it reveals that most of the activities experienced by the kindergarten learners were through pencil and paper activities.

As young learners as they are, it is a must that they will be engaged to a variety of interactive activities. Stahl (2014) emphasized the importance of engaging learners to a variety of instruction such as games and simulation to facilitate emergent literacy skills. Engaging learners in interactive activities is a good avenue to facilitate the practice of identifying and using the letters in different ways. According to Walker (2016), learners gain more confidence in learning when technology is incorporated, and they are fully engaged in lessons. Lastly, when they are exposed to various fun and interactive activities, young learners gain awareness of letters.

On the other hand, parents point out the insufficient learning facilitation at home due to busy schedule is a factor that limits learning. Due to the adoption of distance learning, parents become the main facilitators of learning at home. However, parents expressed their difficulty in motivating the learners to do the learning activities. To them, children are easily distracted, and they do not receive enough supervision and guidance while learning at home. This is contrary to the idea that teaching foundational skills in the early childhood requires a well-organized learning facilitation that caters the learners' learning needs.

A joint position of NAEYC and the Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College (2012) proposed interactive media and technology tools that can be used to facilitate active and creative use, and encourage social engagement of children with others. Technology can be used as a learning scaffold to help the advancement of emergent literacy skills when used appropriately and creatively.

Technology tools to support learning at home

Using an interview guide, kindergarten learners' parents were asked on the available technology tools that could run a learning application software. Technology tools refer to the digital infrastructures like desktop computers, laptops and mobile devices used for various

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purposes such as to communicate, create, disseminate, store, and manage information. The learning application was developed based on these answers.

Result of the interview shows that none of the learners have desktop and mostly have no laptop computer at home, but they have smartphones and an access to the internet that can be used for learning. Thus, with the learners' availability of smartphone and access to the internet, it is practical to develop a learning application that could run online and/or offline through smartphones.

The result of the analysis implies the significance and feasibility of designing and developing a technology-driven instructional material. In this research, that instructional material is an interactive software application that will be used as a supplemental learning material to help learners identify the name and sound of the least learned letters.

Software Application Instructional Design

Based on the result of the analysis, the researcher crafted an instructional design that specifies the sequence of instruction. That is, how will lessons be presented to the users, and what media and components to develop the instructional material.

Instructional Design

To establish the instructional design, the learning activities and sequence of instructions, the actions that the instructional material will perform, and the media needed were identified. Table 1 summarizes, instructional sequence, the actions, and media needed to deliver the instruction.

Table 1. Instructional Design

Instruction Sequence	Actions	Media Needed
Gaining Attention Introduction of the focus letter	Display and animate focus letter Narrate the letter to be learned	Voice over audio Sound effect audio jpg and png image video gif image
Demonstration Presentation of the name and sound of uppercase and lowercase letters Show example words that start with the letter sound. Show and narrate how the letter is used in a word Demonstrate how the letters are formed or written	Display the uppercase and lowercase letter Display and animate the word and picture that start with the letter Animate how letters are formed or written	Voice over audio Sound effect audio jpg and png image video gif image
Practice Find the letter in a given set of letters Form the letter Trace and write the letter	Display clickable and draggable elements through bookwidget Display user's response Show user's progress	bookwidget voice over audio sound effects audio jpg and png image video gif image
Formative Letter name and sound identification assessment activities	Display clickable and draggable elements through bookwidget Display user's response	Voice over audio Sound effect audio jpg and png images gif image
Summative Letter name and sound summative assessment	Display the letters	Voice over audio jpg and png image

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The sequence of activities was derived from Gagne's Nine Steps of Instructional Events (gaining the attention of the students, informing the learner of the objective, stimulating recall of prior learning, presenting the content providing learning guidance, eliciting the performance, providing feedback, assessing the performance and enhancing retention and transfer) (Faryadi, 2009; Aytekin & Isman, 2011). This is important because a systematic approach to instructional design produced several advantages for instructional development.

With this, the learning activities were selected and organized in way that facilitate and support active engagement of learners in the learning activities. Moreover, learners' active participation in the learning experience immersed them to new information, which aids in knowledge retention (Pence-Turnbull & Justice, 2012). This was in line with the findings of Parvin & Salam (2015), who discovered that technology-based learning has an impact on learners' engagement in their lessons, they learn faster.

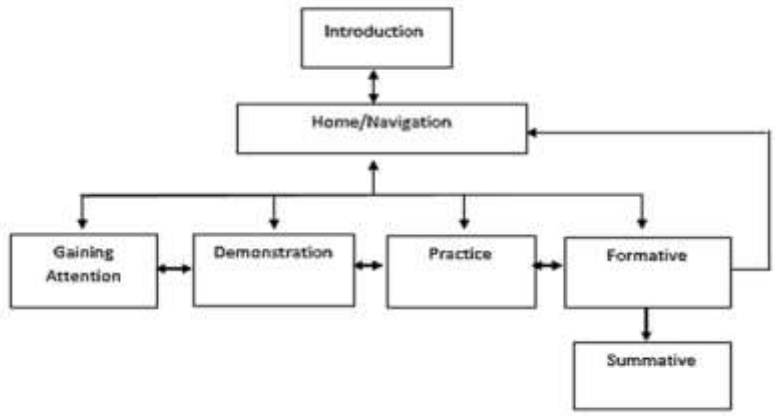
Software Application Instructional Development

The software application was authored and produced by creating and packing all content and components, constructing the teaching and learning program structure, and making the program available on selected media of delivery.

Before the instructional material was used by the kindergarten learners, the instructional material went through evaluation and validation by the experts in early childhood education. Their feedbacks were gathered and were used as bases to improve the application, make it feasible for users to use, and achieve the instructional goals. The application went through revisions before it was deployed based on the comments and recommendations of the experts. The following table presents the application software issues found out during the evaluation of the application software and the actions undertaken to address the issues.

The Interactive Learning Application Software

The developed instructional material is an interactive software application designed for kindergarten learners to develop and enhance learning the letter names and sounds. Learners can play the learning application software through IOS and android mobile devices. It was also packed as desktop application and web application to provide option for learners to access the learning application. The learning application was filled with a variety of learning activities to help learners identify the letter names and sounds. With its interactive feature, learners can watch and listen the lessons, write and trace letters, and play activities through tap and touch, and drag and drop capabilities.



The Overall Structure of the Learning Application

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Deployment of the Interactive Learning Application Software

The learning was used by five kindergarten learner participants for five consecutive days. Parents were given an orientation on how to facilitate the use of the learning application at home. Learners used the application through their parents' mobile phone, tablet, and laptop. Observing appropriate use of electronic gadgets, learners were only allowed to use their gadgets for not more than two hours in a day. According to Schepper as cited by NAEYC and the Fred Rogers (2012) parents and caregivers are advised to work together to limit children to one to two hours of quality screen time per day.

The first day of using the application was through guided learning by the kindergarten learners' parents to guide learners on how to use the application. The kindergarten learners were able to use the application independently after the guided learning with their parents.

Effectiveness of the Interactive Application Software

This section outlines the statistical output that presents comparison of the learners' performance in identifying the name and sound of the letters before and after the use of learning application. Using Wilcoxon signed ranks test, the effectiveness of the use of learning application software in identifying the letter name and sound was concluded with the evidence of significant improvement on the learners' performance.

Results of the statistical analysis are presented in the tables below.

Letter Name Test of Difference using Wilcoxon *Signed Ranks Test*

PreTest-Posttest (Letter Name)	-2.070	0.038	Reject H_0

The Wilcoxon signed ranks test (T=-2.070, n=5, p<0.05) indicated that the pretest and posttest scores was significantly different. Therefore, the analysis provides evidence that the use of interactive learning application as a supplementary learning material is providing benefits toward the improvement of students' scores in letter naming.

Letter Sound Test of Difference using Wilcoxon *Signed Ranks Test*

PreTest-Posttest (Letter Sound)	-2.236	0.025	Reject H_0

The Wilcoxon signed ranks test (T=-2.236, n=5, p<0.05) indicated that the pretest and posttest scores was significantly different. This statistical evidence suggests the instructional developed yield significant improvement on the students' knowledge of the letter sounds.

The results of statistical analysis established the use of the interactive learning application as an effective tool to help learners that are struggling with alphabet knowledge. This finding affirms with the result of the study of Walker (2016) that incorporating technology on learning has positive effects when children when learners are engaged in learning activities. The learning application was designed in a way that it requires users to use multiple senses to play the application making them so engaged in the learning activity. Learning activities that are interactive provides more opportunities for young learners to grow their alphabet knowledge (Model Teaching, 2019). This was additionally tied to the findings of Zomer and Kay (2016) that ICT-based teaching media has a significant impact on students' phonological awareness, vocabulary, and general literacy.

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During this time of pandemic where in-person instruction is highly discouraged, instructive innovations that highlight the utilization of technology tools and digital materials are needed to deliver and enrich learning despite the distance (Deped Order 12, S.2020). The instructional material developed made it possible to reach the learners and achieve its instructional goal despite the distance.

CONCLUSION

This section discusses the findings of the study in relation to the issues that motivated the research and the development of instructional materials. The study revealed the challenges kindergarten learners face in mastering letter names and sounds, highlighting specific letters such as Ii, Ee, Nn, Pp, Bb, and Dd as the least learned in the third quarter of the 2020-2021 school year. Despite various learning activities, the learners struggled with these skills, primarily due to the reliance on pencil-and-paper activities. The study also revealed that many parents, due to busy schedules and the shift to distance learning, faced difficulties in providing adequate support at home. Parents expressed concerns about their children's distractions and lack of supervision. To address these challenges, the study introduced technology-driven instructional materials, including an interactive software application that could be used on mobile devices. This approach aimed to engage learners through interactive, fun activities that foster letter recognition and phonemic awareness. The application was designed based on feedback from both educators and parents and was evaluated by early childhood education experts before being deployed. A subsequent statistical analysis confirmed the effectiveness of the software in improving learners' performance in letter name and sound recognition. The findings align with previous research indicating that interactive technology enhances learning engagement and literacy skills, especially during the pandemic when traditional classroom settings are limited.

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