Chapter 1

THE PROBLEM AND ITS SCOPE

INTRODUCTION

The Rationale of the Study

Learning has been greatly affected by the Coronavirus 2019 (COVID-19) pandemic. While many schools have been closed due to the pandemic, others have accepted the challenge and implemented a new learning modality. Different modalities have been used to provide a continuation of the learning experience while learning in the comfort of their homes. These modalities include blended learning, remote and modular distance learning, online learning, and the radio broadcast and television learning modality. With the implementation of these modalities, one of the challenges is the technical support or the educational technology. This also becomes prevalent nowadays. These math applications and websites have been useful as supplementary materials and resources to students as observed in Patronage of Mary Development School (PMDS), Southwestern University PHINMA (SWU PHINMA), and the Cebu Bradford School Inc (CBSI).

Southwestern University has been challenged on how to successfully deliver the full remote distance learning modality. Since there is no face-to-face set-up, different resources have been used to supplement the learning of the students. The set of resources which includes the websites, Youtube links,

articles, and applications is called the OERs or the Open Educational Resources. These have been given to students by the teachers to provide the necessary support and discussions. Students open the links and watch videos from the different websites most especially from the lessons which are complicated on their part. Aside from these links and websites, the school also has utilized a free online learning management system, particularly Google Classroom. Google Classroom allows the teachers to post the weekly lessons and instructions through the format Connect, Coach, and Check. Even if the students are given hard copies of the modules, soft copies are still provided so that they can access the materials anywhere and anytime. Applications are also used to support learning. These include the use of Kahoot which gives a live and real-time quiz that serves as a formative assessment. Students also are allowed to open apps including the Bioman, online calculators for mathematics, and other related apps helpful in Science, Math, English, and other subjects. Although it is not required to have synchronous classes, some teachers hold synchronous classes just to discuss important and complex topics through Google Meet. Others pre-record themselves discussing the concept and post these in their online classroom. Students are also given a 10 GB load allowance to access these applications and sites.

Another school also has utilized Google Classroom as the learning management system is the Patronage of Mary Development School (PMDS). Teachers post the instructional packet online and the students can download it as their copy. Those who can’t download the file can get it from the school since

they live near it. The PMDS has utilized both remote and online learning modalities. Students who are under the remote learning modality do not have online classes. They can access the materials offline and can submit the output as scheduled where they can submit these in the school through their parents. They are also given support through the different videos which they can watch anytime, and anywhere at their own pace. On the other hand, those who are having online learning modalities, are met regularly and have synchronous classes. The applications used are Google Meet and videos played from websites like Khan Academy and Youtube. There are also available reading passages online where the students can practice their reading comprehension skills.

The Cebu Bradford School Inc (CBSI) teachers are using all means of opportunity to explore different mathematics websites and applications to supplement students' understanding of their mathematics instruction that uses various scaffolding techniques. These apps and websites include adaptive teaching, group games, and analytics. As well, these routines go beyond simple math drills by providing the personalization, tracking, and differentiation each learner needs to be ready for learning. As a result, the teacher finds these apps and websites beneficial especially for difficult students who require additional time to complete a certain task. Moreover, leveraging its use enables individual learners to receive rapid feedback about their performance which is difficult to accomplish especially in the online setting of classroom instruction.

Although these schools have utilized websites and applications as supplementary tools, it can't be denied that they lack the necessary training on how to properly assess the students in the online and remote set-up. It still poses problems for academic integrity and performance and learning accountability to students.

Studying the effectiveness and the relationship between the utilization of applications and websites and the performance of the students has been done even before the pandemic. However, it has been more focused on the experimental study of a particular mobile technology and application whether it is effective or not, and forgetting to cover other factors which can improve the performance of the students even during the pandemic and after the pandemic time. Another issue is the output of the study since it is more on the improvement of the tool or technology rather than coming up with a solution on how to integrate the websites and applications in the instructions which will provide the avenue for the remediation of the students.

Since the researchers are Mathematics teachers, it is very beneficial to study how mathematical apps and websites help in the mathematical achievement of the students. The researchers consequently considered applying the advantages of math applications to students' learning. The researchers are interested in determining whether math applications and websites are effective and capable of improving students' math abilities. The main objective of this study is to determine the relationship between the

utilization of mathematical applications and websites and the mathematical achievement of Grade 10 students in Arithmetic Sequence and Series. The expected output of this study is the strategic intervention materials to improve the mathematical achievement of students with the integration of math applications and websites which are beneficial to students, teachers, and curriculum planners. This study will be beneficial to those who create curricula that will be examined, evaluated, and adjusted over time to account for students' unique and growing learning styles and integrate the various resources that fall under the umbrella of educational technology. Lastly, this will act as the cornerstone for putting the expanded curriculum into practice and for figuring out how to make learning more effective for 21st-century learners.

Theoretical Background

This study is based on two theories, namely: John Bransford's Anchored Instruction theory and Lev Vygotsky's Zone of Proximal Development & Scaffolding which are also interrelated to the legal bases postulated in the Aide Memoire of DepEd Computerization Program in the view of Covid-19 pandemic and the DepEd Digital Rise - ICT-assisted Teaching and Learning.

Numerous studies have examined the effects of technology on the teaching and learning of students. They have shown that it can help improve various aspects of students' learning, such as problem-solving and reasoning.

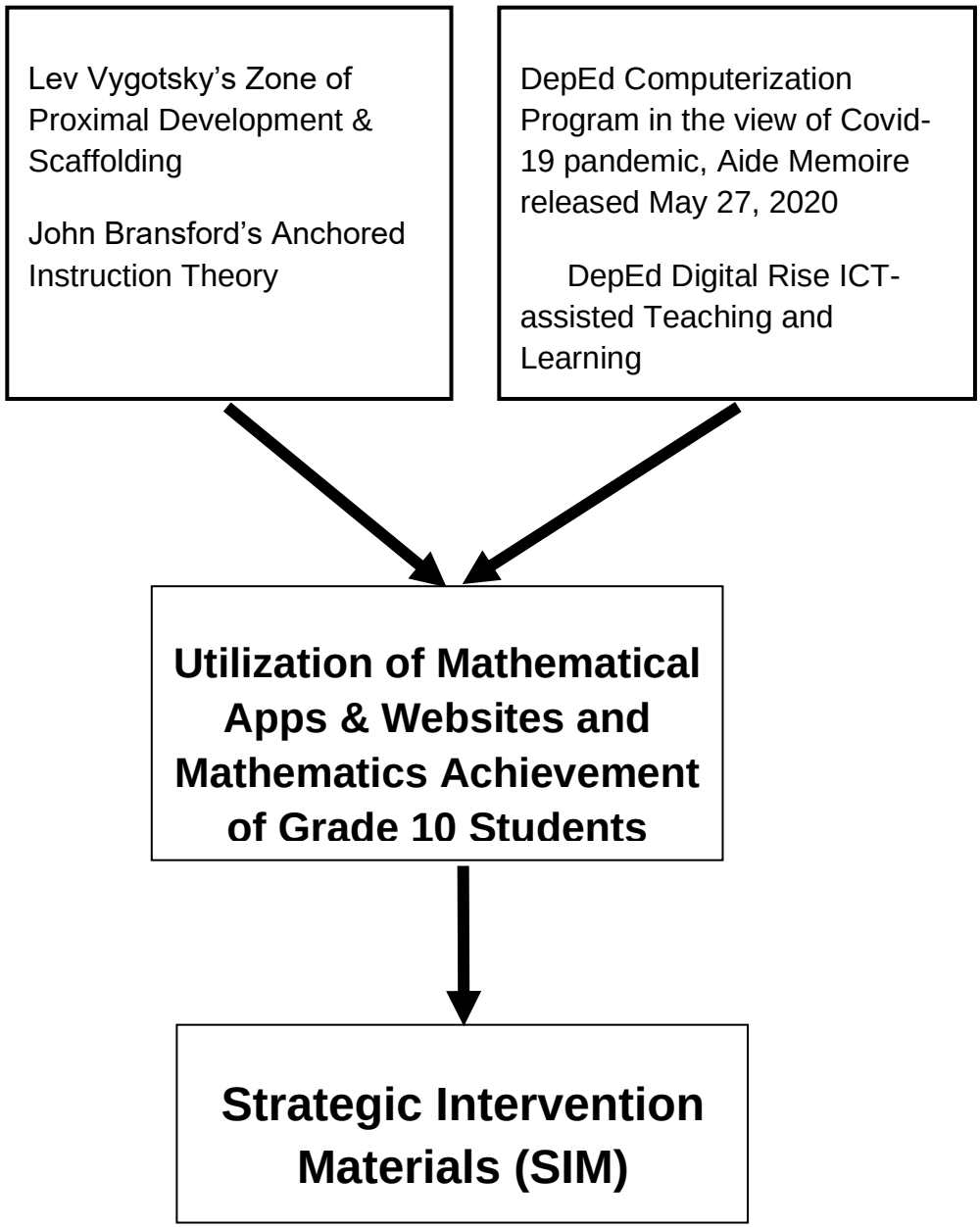


Figure 1. Theoretical/Conceptual Framework of the Study

Through technology, students have more opportunities to explore and visualize math concepts. This can help them develop their critical thinking and creativity. Today's educational activities and assessments are more technological than ever before especially during these hard times of the pandemic. Due to the increasing number of students and teachers using technology, the Division of Cebu Province issued Memorandum no. 184 s. 2021 Reopening of the Virtual In-Service Training (VINSET) Course participated by 475, 115 certified participants nationwide which included public and private school teachers, college and university professors, and college education, students. The increase of unique users during the 2021 VINSET Week leaped from 9, 814, 486 to 10, 239, 947 as educators and others grabbed the opportunity to explore and enhance their knowledge of Educational Technology (EdTech) through the week-long series of webinars. This manifests the willingness and strong determination of the education sector to learn new things especially related to ICT-assisted teaching and learning. Effective professional development is unquestionably required to ensure that yet another technological change in the classroom is as successful as feasible.

With a legal mandate to promote all citizens' right to education by taking suitable procedures to improve accessibility to all, the Department of Education (DepEd) is working to transform education through the DepEd Computerization Program (DCP), as stated in DO 78, S. 2010 Guidelines for Implementing the Department of Education's Computerization Program (DCP). The two main elements of this initiative were the computerization project and the School of the

Future project. Information technology was added as part of the modernization initiative to improve the teaching and learning process, educational management, and operations. As a result, ICT usage has increased across the educational system. Aide Memoire dated May 27, 2020, was issued to expedite the DepEd Computerization Program in light of the COVID-19 Pandemic. It states that the Department of Education (DepEd) is responsible for ensuring that all learners have access to and receive basic education at all times. DepEd must improve its ICT capabilities to achieve this goal. It must, in particular, accelerate the DepEd Computerization Program (DCP) and be ready for any set of circumstances.

Henceforth, ICT-assisted teaching will be the second significant aspect that Digital Rise will prioritize. As part of this scheme, DepEd will equip every classroom with a digital board or television and give every teacher a laptop loaded with e-learning materials that they can utilize in the classroom. From the aforementioned case, teachers have access to e-learning tools that they may project in their classes, they will no longer need to produce visual aids on manila paper. Additionally, ICT-assisted learning is the third outlook that the Digital Rise will cover. Under this program, DepEd will give each student a tablet or laptop that they can use to access the online and offline e-learning resources. It is not about giving the schools cutting-edge technology. It is one of the DepEd's mission to provide instructors with the information and tools they need to foster learning. In all of these endeavors, the learners are at the center of the vision and are provided with the necessary knowledge and tools to independently

study and comprehend the curriculum's fundamental skills.

The notion of education and educational institutions are being reformed to educate individuals who research, acquire knowledge, question, relate, discuss, and construct new information to the needs of society. Curricula and course books have changed as a result of the adoption of the constructivist a roach, and teachers have been informed about issues such as guiding the learning process and how they will plan and implement activities in the classroom such as assessment and evaluation activities through in-service training. According to Vygotsky, learning happens through interactions with the environment and the people in it. It also emphasizes that learners actively construct knowledge in constructivism based on their existing experience, ski, and competencies. Scaffolding has emerged as a particularly intriguing and promising topic for assisting instructional strategies. The scaffolding paradigms have been enhanced by the use of online math resources and applications in practical technological contexts. Several research studies have shown how technological applications have substantially expanded the ZPD's processes for supporting student cognition. To interest learners in learning new skills, tasks, skills, and concepts can be modeled while maintaining their complexity and authenticity. This is also supported by Han et al., (2021) who stated that scaffolding can be a useful approach to internalizing thinking, fostering students' knowledge production, developing higher-order thinking, and enhancing cognitive and metacognitive levels.

Under the viewpoint of John Bransford, the Cognition & Technology

Group at Vanderbilt (CTGV) has established a significant paradigm for technology-based learning called Anchored Instruction Theory. It seeks to overcome and resolve the issue of inert knowledge, which is the circumstance of students being able to readily recall pertinent information when specifically asked but is inherently not used when attempting to solve a problem. The goal of anchored instruction is to build up a context in which students can investigate and comprehend issues that they could encounter in the actual world. Its objective is for students to come up with problems, hunt for pertinent information, and come up with answers using the practical exercises that are demonstrated in multimedia programs that can be found on the web, videos, and computer animations. The findings in the study of Cakiroglu & Yilmaz (2017) emphasize that resources that include videos and computer animations helped students better understand concepts through features including concretization, pausing, slowing down, and replaying. Thus it opposes the issue of inert knowledge by allowing the learners to process the presentation of the lesson material in actual circumstances and encouraging positive and generative learning. In this regard, the development of a metacognitive process is fostered as they actively generate information and engage in critical thinking.

One of the anchored instruction's main objectives is overcoming the problem of inactive knowledge which can be achieved by developing environments that encourage continuous inquiry among students and teachers, allowing them to comprehend the kinds of challenges and chances that specialists in numerous fields face, as well as the information that these experts

employ as a tool. Additionally, the materials that are part of programs based on anchored learning are frequently technology-based and positively impact students' progress. When using an anchored instruction strategy, the utilization of multimedia tools or programs is strongly advised. The role of a teacher throughout the instruction is to assist the students in assessing the problems and to give them the support they need to resolve them. Furthermore, a key component of anchored instruction is intrinsic motivation, which is achieved by giving students engaging activities that are sufficiently difficult to start the discovery learning process.

The dynamic, realistic, and captivating aspects of Anchored Instruction could be used to effectively teach mathematics instruction. Moreover, this theory emphasizes the significance of situating knowledge within a relevant, problem-solving context. It has also explicated that students have more influence over the process since they are engaged in the instruction. With the aid of interactive media technologies, students may quickly investigate the subject matter, and these experiences act as "anchors" for all other learning and instruction that comes after. The resources used in instructional materials are ones that students can easily explore when deciding how to resolve the given problem, like interactive web-based simulations, video tutorials, mobile applications, etc. This will act as an information source as well as an anchor to help them establish a solid foundation for their initial ideas and develop solutions to the problem.

By incorporating technology, classes where teachers predominate become more student-focused. However, it's not fair to think of technological gadgets and tools as a panacea for all of the challenges that instructors and students confront, and it's also crucial not to underestimate the usefulness of traditional teaching devices and instruments. It's vital to remember that technology is just one tool a teacher can use, therefore we should concentrate on learning with the technology rather than from or about it. Educators as facilitators in constructivist learning theory must also understand how to put it into practice in their classrooms. Their mission is to provide a friendly environment that encourages active learning. They must encourage collaboration and adapt their teachings to the class's prior level of understanding and expand students' understanding in those areas once they have identified their existing knowledge.

In the new normal education, technology must be integrated to support learning. Teachers must therefore master the technology tools chosen for education. They should be allowed to choose the best technology tools that are both available and accessible to everyone. A smart educator is adaptable and flexible enough to deal with the impending educational crisis, wisely utilizing the tools and materials procurable to improve teaching and learning. Greater use of the Internet in math instruction is supported by the rising percentage of websites that are freely accessible. Websites frequently include images, videos, and animations, which help to explain concepts clearly and facilitate learning. Online resources could partially replace physical textbooks and problem sets.

Over the last two decades, studies have focused primarily on the use of technology in mathematics instruction. Web-based mathematics instruction has aided in overcoming educational and instructional hurdles most especially during the pandemic by allowing students to learn and teach mathematics at any time and from any location (Misirli & Ergulec, 2021). The free math websites can be categorized using a variety of factors, such as their focus or target audience's age. They can be divided into many categories based on their content and design, such as wide-ranging websites which include explanations, exercises, tests, and online program websites. Graphing calculators and computer-based tools such as presentation software, interactive games, collaborative whiteboard, online learning resources, and computer/web-based training and practice are part of the technologies covered. Among these items that are widely used are Desmos, Khan Academy, Mathway, Wolfram MathWorld, Google Jamboard, and the list goes on. Some of these websites feature a huge impact, and their incorporation has demonstrated that it helps students come to stronger conclusions and perform better on tests. The objective is to integrate technology into the classroom with purpose. Desmos, a newer graphing calculator, has the advantage of being a free calculator that is easily accessed and downloaded to mobile devices. Montijo (2017) rationalizes that students benefit from this technology since it reduces or eliminates intricate graphing computations that are prone to errors when carried out manually. Teachers can substantially reduce the occurrence of written and verbal instruction supplied to the learners by mitigating the processes that are required in solving arithmetic problems.

Math Apps with the incorporation of manipulable design and advanced technology are recognized as manipulatives (Barrientos, 2021). Graphing calculators' usefulness and ability to handle mathematical problems continue to progress as a result of continual societal innovation. As a result, new avenues for investigation into a student's problem-solving abilities open up. The principles of social cognitive theory provide a foundation for understanding how usability and problem-solving impact student learning. Because of their simplicity and ease of operation, as well as the potential to facilitate interaction, these systems can enhance the teaching and learning process. Students can use a dynamic combination of tools and visual representations to record individual or group presentations of mathematical processes, strategies, and solutions (Calder & Murphy, 2018). Videos, animations, and arithmetic manipulatives are common mediums used to effectively visualize math topics in both mobile and computer-based learning contexts. The learners' surroundings, however, provide an additional medium for visualization via mobile devices, creating a connection between abstract arithmetic concepts and the real world. From this point of view, many students in the study of Fabian et al., (2018) believed that this new approach to math had improved their understanding of abstract math ideas and, as a result, their memory. In contrast, the biggest challenge in the use of these mobile apps is cheating and plagiarism.

The use of mathematical websites and applications in educational contexts has grown over the past few years. However, the successful

implementation of technological advances predominantly demands financial resources, which may impede the education stakeholders from seeking them. In the same study by Fabian et al., (2018), there were aforementioned technical considerations that must be addressed before these technologies are implemented in the classroom. They highlighted the following practical concerns: (a) should schools invest in these technologies or should students be allowed to bring their own devices; (b) what technical capabilities should teachers have to facilitate learners in completing their learning tasks if technological challenges arise; (c) although schools may have wifi connectivity, could it handle an inflow of wireless devices? This signifies how mobile learning is a relatively major trend, and the technology that supports it is rapidly evolving. Desmos offers an edge in terms of pricing because it is free to download, as long as a school district has connectivity to a platform that can run it, such as a computer, laptop, tablet, phone, or another comparable device that connects to the Internet.

The role of the teacher, not just the technology, is the primary catalyst for change in the classroom. Well-thought-out web-based mathematics instruction is not an easy process; rather, it is a complex one that necessitates elaborated teaching design, practice, and evaluation to establish a fruitful learning environment (Misirli & Ergulec, 2021). The meta-analysis conducted by Akin (2022) revealed that the use of well-planned web-based mathematics learning environments leads to higher mathematics performance. Given that web-based mathematics learning environments will be used more quite often and

extensively in the post-pandemic world, educational administrators and mathematics educators should provide opportunities for well-planned learning environments in terms of WBMI, rather than simply encouraging mathematics teachers to use WBMI (Hillmayr et al., 2020). Technical concerns, students' educational experiences, and learning styles are all considered teacher duties and responsibilities, thus it's significant to look into how they are being trained to encourage collaboration and solve these challenges as well as how to use new technologies. The paper of Llinares and Borba (2020) has identified three domains in which mathematics educators are developing new approaches: tools and resources, principles of new set design, social interaction, and construction knowledge. To best employ the functionality of technology in their classrooms, teachers must undergo effective training. Previous research studies show that teacher training has already been proven to be critical to the effectiveness of technology-based programs. This is also supported by (Hartman et. al 2019) that teachers must be able to adapt to rapidly changing technology and be open to technologically advanced teaching and learning environments to effectively meet the learning patterns of generation Z.

THE PROBLEM

Statement of the Problem

This research determined the utilization of mathematical apps and websites, and the mathematics achievement of Grade 10 students in Arithmetic Sequence and Series at the identified private high schools in Cebu for School Year 2022-2023 as the basis for proposed mathematics strategic intervention materials.

Specifically, this study sought to answer the following sub-problems:

1. What is the profile of respondents in terms of:

    1.1 age and gender,

    1.2 parents' highest educational attainment,

    1.3 combined family monthly income,

    1.4 sources of internet connectivity, and

    1.5 types of devices used?

2. To what extent do the respondents utilize math apps and web page applications in learning mathematics?

3. What is the level of mathematics achievement of the respondents in Arithmetic Sequence and Series?

4. Is there a significant relationship between the:

4.1 demographic profile variables and the extent of the utilization of math apps and websites;

4.2 demographic profile variables and the math achievement in Arithmetic Sequence and Series;

4.3 extent of the utilization of the mathematical applications and websites and the mathematics achievement in Arithmetic Sequence and Series?

5. Based on the findings, what mathematical strategic intervention materials (SIM) may be developed?

Statement of the Null Hypotheses

Based on the objectives of the study, the following null hypotheses were tested at a 0.05 level of significance:

Ho_1: There is no significant relationship between the demographic profile variables and the extent of the utilization of math apps and websites

Ho_2: There is no significant relationship between the demographic profile variables and the math achievement in Arithmetic Sequence and Series;

Ho_3: There is no significant relationship between the utilization of mathematical applications and websites and the mathematics achievement of

the respondents.

Significance of the Study

The researchers deemed it essential to identify the relationship between the utilization of mathematical apps and websites and the mathematical achievement of students to arrive at strategic intervention materials to help in the improvement of their math performance of the students.

The findings of this study will give significance to:

Department of Education Officials. This study will be helpful to those who design curricula that will be reviewed, assessed, and modified over time to accommodate students' various and evolving learning styles and integrate the different tools of educational technology. Additionally, this will act as the basis for putting the expanded curriculum into practice and for figuring out how to make learning more effective for 21st-century learners.

Curriculum Planners. This study will serve as a basis for planning a curriculum that will include ICT integration. This will help craft the curriculum which will consider the use of open educational resources and other applications and websites which can supplement learning.

School Administrators. This will help them to come up with an idea on possible ways how to make the teachers utilize Math Apps and websites in teaching Mathematics. This will also help them understand the importance of using applications and websites in the teaching and learning process making

them supportive of the possible requests that the teachers will have in terms of technology and other ICT integration tools.

Students. This research provides students with information on how to utilize Math Apps and websites to improve their learning and performance in Mathematics. They will be more knowledgeable about the different applications and websites and how these may supplement their learning. It will also provide them the chance to explore different tools which can be beneficial to their learning.

Teachers. This study provides teachers with the knowledge of how effective the utilization of Math apps and websites is in the learning of Senior High School students in Mathematics based on skills and strategies. This will also help them design plans on how to integrate and utilize math apps and websites.

Parents. This study will help the parents to engage more in school activities with the new normal setup and allow their children to utilize mathematical apps and websites in helping their child's learning. They will become more hands-on in selecting the websites and applications which can help their children learn the concept better. Also, this study will help them realize how to guide their children in the selection of useful and student-friendly applications and websites.

Researchers. This study will help them in crafting and planning lessons

that involve the use of applications and websites so that their teaching-learning process will be meaningful. This will also help them become more resourceful in providing materials and tools which can supplement learning.

Future Researchers. The result of this study can serve as the basis for further study on students' and teachers' related factors utilizing Math apps and websites affecting the students' mathematical achievement.

RESEARCH METHODOLOGY

Research Design

The study utilized the descriptive-correlational research methodology. The Center for Innovation in Research on Teaching (2019) from Grand Canyon University defines correlational research design as a useful tool to investigate the connections or relationships between variables. It gauges how closely two variables are connected. In this study, this design was used to identify the relationship between the two variables, namely the utilization of mathematical applications and websites and the mathematical achievement of Grade 10 students in arithmetic sequence and series. A modified questionnaire was used to gather the responses to students' utilization of mathematical apps and websites while a test questionnaire or assessment from the Department of Education modules was administered to collect their mathematical achievement in arithmetic sequence and series. A complete enumeration technique was utilized due to the small population of respondents.

Flow of the Study

Figure 2 describes the flow of the study wherein the input consists of the following: Transmittal letters, Age, Gender, Parent's highest educational attainment, Combined family monthly income, Source of internet connectivity, Devices used, Mathematics Achievement of the respondents in Arithmetic Sequence and Series, Utilization of the mathematical applications and websites.

These input data were processed by sending a transmittal letter first. After the approval of transmittal letters, a questionnaire was used to collect the data on the utilization of math apps and websites, and assessment tools were used to get the mathematics achievement. Moreover, Descriptive Correlational Design was used. Simple percentage, Mean, Chi-square, and Pearson r and Coefficient of Contingency using the Chi-square were used as part of the statistical treatment of data.

Lastly, the expected output of this study is the strategic intervention material. This material is used to help in improving the mathematics achievement of the students with the consideration of the utilization of math apps and websites

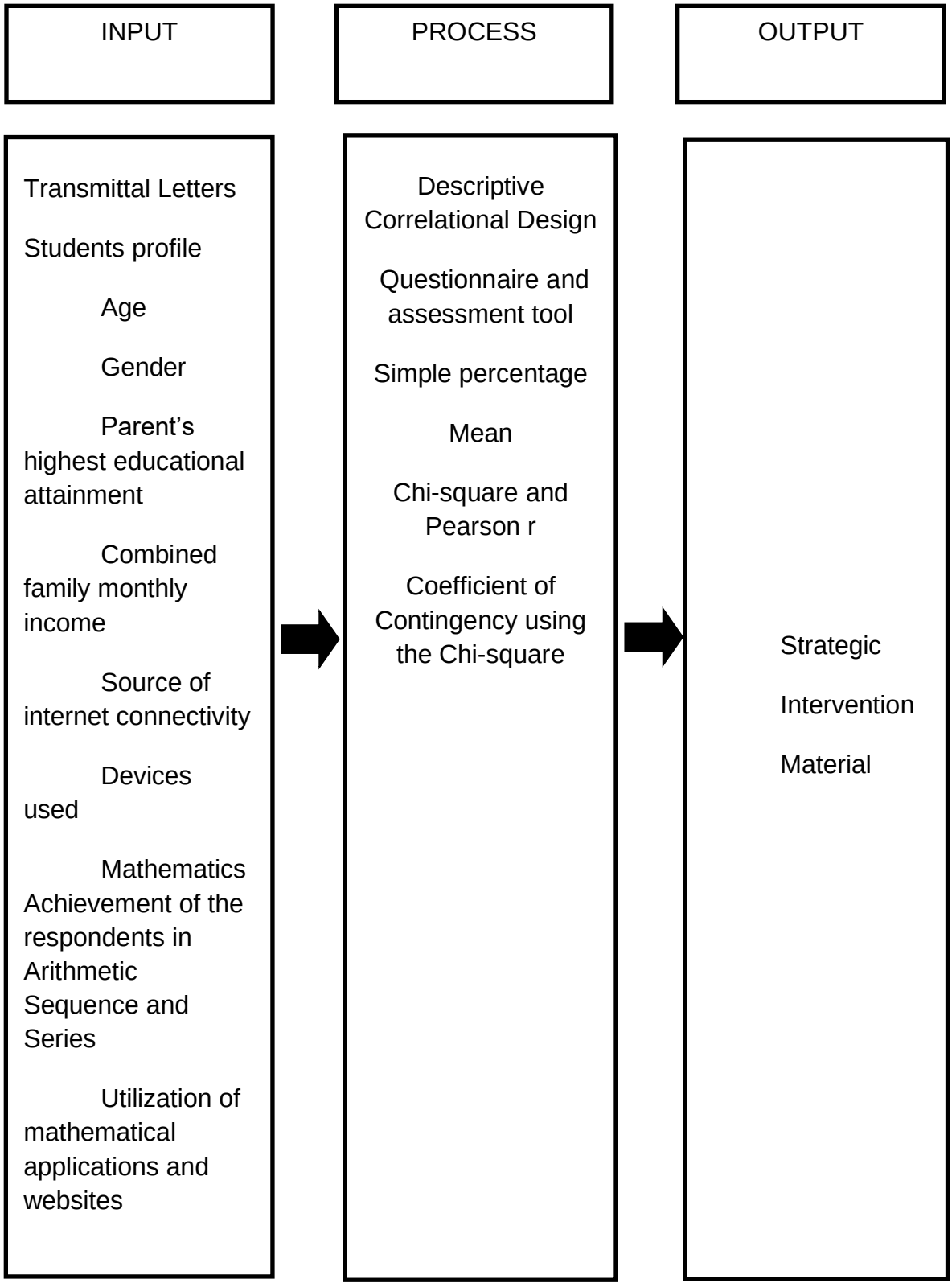


Figure 2. **The Flow of the Study**

Environment

This study was conducted at the schools namely the Patronage of Mary Development School, Southwestern University PHINMA – Main Campus, and the Cebu Bradford School Inc.

The Patronage of Mary Development School (PMDS), located in Boljoon, Cebu is a private school institution founded last January 8, 2009. The school offers from Kindergarten to Grade 12 (K to 12). For the Senior High School department, they have GAS, ABM, STEM, HUMSS, and TVL strands with 31 teachers. Patronage of Mary Development School, as a new educational institution of learning, strives to instill Christian values in each learner. Intellectual, spiritual, and social activities help to reinforce these values. PMDS observes feast days of saints and martyrs, as well as holy days, as part of its spiritual formation, and the first Friday masses are held at the school. Patronage of Mary Development School encourages collaboration among parents, teachers, and members of the community to ensure holistic and productive teaching-learning.

The Southwestern University PHINMA (SWU) is a private university in Cebu City, Philippines founded in 1946 by two pharmacists. It started as Southwestern College in the summer of 1946 and became a university on December 11, 1959. It is owned and operated by the Aznar family. It presently offers over 50 degrees and programs.

Figure 3: Research Environment

The Basic Education Department is composed of grade levels from 7 to 10. Southwestern University has been known for its health and allied health programs which have always been one of the leading universities which produces topnotchers almost every year. In the Junior high school, 8 teachers are administering the department, 43 teachers are teaching in the Senior high school department and over 50 teachers are in the college department. Southwestern University PHINMA is a school for dedicated students who want to reach the pinnacle of their field. Students are the top priority at Southwestern University PHINMA, and we make every effort to assist them in their learning journey to become the best that they can be.

The Cebu Bradford School Inc (CBSI) is a dynamic Christian school that was founded as Bradford Kindergarten School in 1956 under the Christian Education program of Bradford Church. The school is situated at 340-P Ascencion St. Sambag 2 Urgello Cebu City. 9. Under the resolution mandated by the Department of Education, it implements the K–12 basic education curriculum, which provides preschool, grade school, junior and senior high school (DepEd). The Cebu Bradford School Inc. has 25 full-time teachers from preschool to Senior High School. The following are the existing facilities to provide adequate, up-to-date educational services: fully air-conditioned classrooms, a Science laboratory, a Robotics Laboratory, Physics and Chemistry Laboratory, an audio-visual room, a music room, a clinic, a library, a Technology-Livelihood Education room. The school has also prepared an array of equipment per classroom such

as air purifier, alcohol, and face mask stand for safer new normal education for the Bradfordians.

Respondents

The research respondents were Grade 10 students. The criterion for inclusion is that the respondent is a bona fide and full-time student of the aforementioned schools during the academic year of 2022 - 2023. There were 36 respondents from PMDS, 32 respondents from Southwestern University, and 14 respondents from Cebu Bradford School Inc (CBSI) who took the Mathematics subject during their Grade 10 in the School Year 2022 – 2023. We used the complete enumeration technique due to the small population of respondents. It can be observed that 82 students will be included in the study. These students are Grade 10 students and part of their curriculum in Math is the Arithmetic Sequence and Arithmetic Series.

Table 1

Distribution of Respondents

Name of Schools	n	**%**
Patronage of Mary Development School	36	43.90
Southwestern University	32	39.02
Cebu Bradford School Inc (CBSI)	14	17.07
Total	82	100.00

Instrument

To attain the objectives of the study, this research used a modified rating scale questionnaire. This questionnaire was used to gather information in response to the given problem. A modified questionnaire was used to measure the utilization level of mathematical applications and websites. The statements were collated from the study of Stanojevic, L. & Rakic, B (2018), the study of Kirkwood, A. & Price, L. (2016), and Kulm, G. & Nguyen, D. (2005).

The modified survey questionnaires were composed of 25 statements to measure the utilization of math apps and websites of the respondents. The respondents selected among the four choices in each statement. A four-point Likert scale was used. They selected among the choices namely Strongly Agree, Agree, Disagree, or Strongly Disagree. Because of the limited face-to-face interaction with the students due to the COVID-19 pandemic, this survey was converted into a Google Form. Respondents were given the link and they filled out the form to complete the process.

Moreover, a standardized assessment tool was used to measure the mathematical achievement of the respondents in arithmetic sequence and series. These test items were taken from the assessment section questions from the Department of Education 1st Periodical test and Self-Learning Module 2 Quarter 1 in Grade 10 Mathematics. There were 30 questions in all which are limited to Arithmetic sequence and series. Each respondent read and analyzed each question before choosing the best answer. The respondents selected only one

answer from the choices given. One point was allocated for each item. The number of correct answers was counted and served as the score of the respondents.

All the gathered data were held with the utmost confidentiality and under the Data Privacy Act.

Data Gathering Procedure

The data were gathered through a questionnaire that was answered by the respondents. Their responses were treated and interpreted accordingly.

Preliminary Stage. A transmittal letter was submitted to the Principals of the three schools namely: Patronage of Mary Development School, Southwestern University, and Cebu Bradford School Inc (CBSI). Upon approval, the following steps were followed:

Data Gathering Stage. Questionnaires were distributed to the students. They were asked to answer the items honestly about their profiles and the level of utilization of mathematical applications and websites. After this, the standardized questionnaire about the arithmetic sequences and series was administered to students. This measured their mathematical achievement in Arithmetic Sequence and Series. All these were administered through the use of Google Forms.

Post Data Gathering Stage. Scores were collected, tabulated, and analyzed. The responses and the scores of the respondents were collected

individually, tallied, and encoded through an Excel program. A summary sheet was extracted containing all the data needed by the variables found in the statement of the problem. After tabulating these data, statistical treatment then followed where the data was analyzed. Interpretations followed based on the results from the statistical tools used. Discussions in each data were given parallel to the arrangement or format from the statement of the problem. Related studies were also given to support each discussion.

Statistical Treatment of Data

This study utilized the following statistical measures to analyze the data which answered the problems of the study.

Simple Percentage. This was used to get the percentage of the responses of the students under the profile variables.

Mean. This was used to get the average level of utilization of mathematical applications and websites.

Chi-square and Pearson r. This was used to get the relationship between the variables mentioned in this study.

Coefficient of contingency using chi-square. This was used to determine the association between the utilization level of mathematical applications and websites and the mathematical achievement in arithmetic sequence and series.

Scoring Procedure

To gauge the extent of use of mathematical apps and websites, the following numerical and descriptive rating was adopted:

Scale	Numerical Rating	Descriptive Rating	Verbal Interpretation
4	3.25 - 4.00	Highly Utilized	The respondents strongly agree with the statement describing their utilization of the web page application while learning mathematics.
3	2.50 - 3.24	Utilized	The respondents agree with the statement describing their utilization of the web page application while learning mathematics.
2	1.75 - 2.49	Less Utilized	The respondents disagree with the statement describing their utilization of the web page application while learning mathematics.
1	1.00 - 1.74	Not Utilized	The respondents strongly disagree with the statement describing their utilization of the web page application while learning mathematics.

Additionally, the 30 items standardized evaluation tool all of which are restricted to mathematical series and sequence was employed to measure the respondents' proficiency in arithmetic sequence and series. The following scoring range and their respective descriptive rating were used:

Scoring Range	Descriptive Rating	Verbal Interpretation
25 - 30	Outstanding	The Grade 10 student's performance represents an extraordinary level of achievement and commitment in math subjects.
19 - 24	Very Satisfactory	The Grade 10 student's performance in math exceeded the expectations of the teacher.
13 - 18	Satisfactory	The Grade 10 student's performance in math met the expectations of the teacher.
7 - 12	Fairly Satisfactory	The Grade 10 student's performance in math failed to meet the expectations of the teacher.
0 - 6	Poor	The Grade 10 student's performance in math was consistently below the expectations of the teacher.

DEFINITION OF TERMS

To fully understand the terms being used in the study, the following terms are defined operationally on how they are used in this study:

Arithmetic Sequence - a sequence whose each term increases or decreases by adding or subtracting a number or any value to the previous term.

Arithmetic Series - refers to the sum of all the terms in a finite arithmetic sequence.

Mathematics Achievement – refers to the scores of the respondents in the achievement test about arithmetic sequence and series.

Mathematical Apps and Websites - tools to improve teaching and learning which includes videos, games, and online resources with subject-related content to promote engaging and fun learning.

New Normal - refers to the change in education where schools have implemented blended learning modalities and limited face-to-face interactions among students and teachers which makes it non-traditional.

Strategic intervention material - refers to a material that can develop the academic achievement of the students in Mathematics based on our research.

Utilization of Mathematical Apps and Websites – refers to the level of how students use Mathematics Apps and Websites.

Chapter 2

PRESENTATION OF DATA, ANALYSIS, AND INTERPRETATION OF DATA

This chapter presents the data, analysis of findings as a result of the statistical treatments, and in-depth interpretations. The arrangement of the specific problems given in the problem is followed by the presentation of findings with tabulated statistical support and the narrative discussions are given before each table. A more comprehensive discussion follows each table.

RESULTS OF THE DATA GATHERED FROM CEBU BRADFORD SCHOOL INC.

Based on the responses from Cebu Bradford School Inc. survey respondents, the following results and findings are hereby presented and analyzed. In the parts that follow, empirical data from each of these findings are taken into account.

PROFILE OF THE RESPONDENTS

This section outlines the demographic profile of the respondents which is crucial for interpreting the results that are later provided in this study. To examine the association between the demographic profile elements, the researchers utilized a Google form survey questionnaire to gather this information.

Age and Gender

Ages and gender have a different impact on how exposed people are to technology apps. In terms of how men and women use the internet and other technologies varies differently. Table 2 below shows the frequency distribution of the responses by age and gender of Grade 10 students of Cebu Bradford School Inc.

Table 2
Age and Gender of the Respondents

Age	Male		Female		Total	
	f	%	f	%	f	%
17	1	7.14	0	0.00	1	7.14
16	1	7.14	0	0.00	1	7.14
15	7	50.00	4	28.57	11	78.57
14	0	0.00	1	7.14	1	7.14
Total	**9**	**64.28**	**5**	**35.71**	**14**	**100.00**

Most of the respondents with age 15 comprise 50.00 percent of the total population, and most of these were males. It is also revealed in the table that there were only 28.57 percent or four female respondents with age 15. In addition, respondents with 7.14 percent are shown in Table 2 above. One male respondent was 16 years old, another male respondent was 17 years old, and one female respondent was 14 years old. In this context, this shows varied ages of the respondents that ranges from 14 to 17 years old. This will be viewed as a challenge for the education stakeholders to provide the instructional resources

necessary to guarantee effectiveness in instruction and lasting learning for High School students of all genders and ages. According to Aransi (2018), teaching strategies at the high school level should take into account the age and gender diversity among students. From this perspective, learning about diverse cultures in school helps students feel more at ease and secure with these differences later in life. As a result, they can socialize with a larger variety of social groupings and feel more at ease both with themselves and with other people.

Parents' Highest Educational Attainment

The significance of education has been demonstrated by parents with advanced degrees. Parents with higher academic achievement prioritize their children's academic performance and promote the qualities that are important to them. Table 3 below presents the parent's highest educational attainment.

Table 3
Parents' Highest Educational Attainment

Highest Educational Attainment	f	%
College Graduate	14	100.00
Total	**14**	**100.00**

100.00 percent of their parents were college graduates. This suggests that all of the respondents' parents received a formal education. According to research, parents' educational attainment significantly affects their children's success. A United States research released in 2018 by the National Center for Education Statistics of the Department of Education discovered the following: the

people who entered the profession right out of high school and whose parents did not have a degree were more likely to think that a college education was not necessary to pursue their desired careers. Numerous studies are being conducted to suggest that children whose parents exhibit achievement-oriented behaviors and provide opportunities for achievement such as after-school enrichment programs are more likely to value and pursue achievement. The quest for advanced learning should, in turn, motivate individuals to pursue greater education and successful careers. In this way, parental engagement in a child's education starts at home, where parents provide a good example for their children by providing a safe and healthy environment, suitable learning opportunities, encouragement, and a positive outlook on school (Durisic & Bunijevac (2017).

Combined Monthly Family Income

The educational attainment of children is significantly influenced by family income. For this reason, the government provides financial assistance and fair education opportunities to low-income families to support their children's educational needs. Table 4 below shows the combined income of both parents of the respondents.

Table 4
Combined Monthly Family Income of the Respondents

Combined Monthly Family Income	f	%
Above P 30, 000	7	50.00
P 25, 000 - P 30, 000	1	7.14
P 20, 000 - P25, 000	3	21.43
P 15, 001 - P 20, 000	3	21.43
Total	**14**	**100.00**

From the data shown above, there were three respondents, or 21.43 percent of the population whose parents' combined income ranges from Php 15,001 to Php 20,000. Moreover, around 50.00 percent of the students believed that their parent's combined income is above 30,000. Meanwhile, the average school fee of Cebu Bradford School Inc. grade 10 students is around 50,000 a year. From this point of view, we can deduce that the student's financial situation is influenced by their parent's education, occupation, and profession. Their educational attainment, competitiveness, and performance are significantly influenced by the family's income. The study by Tao & Han, 2017 concluded that the educational level of children is greatly influenced by family income, a family with ample resources, particularly in the area of education, may provide more. It is further validated by Cabrera et al., (2018) that high-income and highly educated parents are more likely to be involved in their children's education, which is a key factor in adolescents' educational successes

Source of Internet Connectivity

The amount of time people spend online has significantly increased since the pandemic began. In the modern world, the internet is a crucial component of academic institutions' teaching, research, and learning processes. Thus, there is an increasing demand for digital technology in educational settings. Table 5 demonstrates the source of internet connectivity of the respondents.

Table 5
Source of Internet Connectivity

Source of Internet Connection	f	%
Wi-Fi Only	14	100.00
Total	**14**	**100.00**

From the data shown in table 5 above, it is essential to note here that 100.00 percent of the students have Wi-Fi access in school and at home. It cannot be denied that one of the key challenges to resolving the learning issue is the accessibility of technological equipment and internet connectivity which enables students to improve their academic performance, and experience, acquire vital academic material, and interact with others. During the pandemic, education continues with the help of internet accessibility. According to a related article, 82 percent of students in the study Tarimo and Kavishe (2017) conducted utilize the internet for academic purposes. With these concepts and details, Hossain & Rahman (2017) emphasized the necessity for students to increase their internet usage for academic purposes and further recommended that the

university provide online resources and a supportive environment for students. There is also a rapidly expanding demand from educators to support learning using digital tools, engage students in authentic ways, and enhance access to digital content. This calls for new solutions to be developed, adapted, tested, refined, implemented, and evaluated, as new technologies become more accessible and viable. These new developments are essential to make the most of new digital opportunities. It is therefore essential that education is put at the forefront of this effort.

Types of Devices Used

The pandemic that the world is presently going through has an impact on how quickly the educational system was able to address the issue with student learning. At present, both the ability of the students to connect to the internet and the accessibility of learning resources within reach were crucial elements. In this study, respondents were asked to list the information sources they rely on most frequently to establish what electronic information resources they use as their academic resources shown in table 6 below.

Table 6
Types of Devices they Used

Device	f	%
Desktop computer only	1	7.14
Smartphone only	1	7.14
Laptop only	1	7.14
Smartphone and Laptop	4	28.57
Desktop computer, Smartphone	2	14.29
Smartphone, Laptop, TV	1	7.14
Desktop, Smartphone, Laptop, and Tablet Devices	4	28.57
Total	**14**	**100.00**

There were four students or 28.57 percent who have smartphones and laptops compared to those who own desktop computers only (7.14 percent), smartphones only (7.14 percent), and laptops only (7.14 percent). Previous studies show that mobile phones have the potential to enhance the processes of both teaching and learning due to their affordability compared to other ICTs. It is also interesting to note that 28.57 percent of the respondents have desktop computers, smartphones, laptops, and tablet devices. Concerning the new normal learning, in particular, the accessibility of learning equipment and internet connectivity, the students' basic requirements and resources are in line. Even though not many students own tablets, laptops, or personal computers, they can nevertheless use these tools as an alternative to cell phones for studying. This will be a challenge for educators to determine what actions should be performed

to deliver learning in an academically effective way. Mohammadi et. al (2020) pointed out that mobile applications have a variety of benefits in the educational process as a teaching tool that includes enhancing individual participation in the teaching-learning process, usefulness as an additional teaching tool, facilitating the management and planning of the teaching process, and students' perception of mobile applications as an important prerequisite. A learning platform that integrates the benefits of both digital and traditional learning approaches would help to achieve this. At the same time, it should support the development of digital skills to enable students to explore and critically reflect on their learning.

EXTENT TO WHICH THE RESPONDENTS UTILIZE MATH APPS AND WEB PAGE APPLICATIONS IN LEARNING MATHEMATICS

Math applications help high school students learn math by assisting them to visualize some of the most challenging ideas, checking their work, and exploring complete solutions. Students can also use math applications as their primary or secondary math learning method which further offers an opportunity to build on previously taught concepts. In such cases, learning and understanding basic math ideas are extensively promoted. Academic success can be achieved by using a well-rounded mix of basic arithmetic, practical practice, and engaging math activities. The overall mean result of 3.17 drawn in Table 7 that follows imply that the respondents utilized math apps and web page applications in learning Mathematics, which benefited education and improved students' academic experiences.

Table 7
The extent to which the respondents utilize math apps and web page applications in learning mathematics

S/N	Indicators	WM	Verbal Description
1	Math apps and websites help me get better results in my subjects.	3.43	Highly Utilized
2	Math apps and websites help me understand the subject material more deeply.	3.21	Utilized
3	Math apps and websites make completing work in my Math subjects more convenient.	3.29	Highly Utilized
4	Math apps and websites motivate me to explore many topics I may have not seen before.	3.21	Utilized
5	Math apps and websites allow me to collaborate with others easily, both on and outside of campus.	3.00	Utilized
6	I get more actively involved in my Math class with the use of Math apps and websites.	2.86	Utilized
7	Math apps and websites help my ability to concentrate and think deeply about our lesson/topic.	2.93	Utilized
8	The use of Math apps and websites in class improves my engagement with the content and class	3.00	Utilized
9	Multitasking with Math apps and websites sometimes prevents me from concentrating on or doing the most important work.	2.50	Utilized
10	I find it useful that I can learn mathematics on the phone anywhere and at any time by accessing Math apps and websites.	3.43	Highly Utilized
11	The Math apps, websites, and learning activities on the phone were easy to use.	3.29	Highly Utilized
12	Using Math apps and websites makes sophisticated concepts accessible to students.	2.93	Utilized
13	I can learn through the application independently of time and place with the help of Math apps and websites.	3.14	Utilized
14	The utilization of apps and websites increases the quality of education.	3.36	Highly Utilized
15	Teaching Math concepts using Math apps and websites helps me evaluate my understanding and performance.	3.36	Highly Utilized
16	Math applications and websites are useful tools for my study.	3.36	Highly Utilized
17	Math applications and websites can offer opportunities for communication and team-working.	3.21	Utilized
18	Math applications and websites can help me in finding resources related to my study.	3.14	Utilized
19	Math applications and websites bring many opportunities to the learning process.	3.43	Highly Utilized
20	Math applications and websites can help me to access the course material anytime, anywhere.	3.21	Utilized
21	Math applications and websites can be an easy way to get feedback and notifications from my instructors.	3.21	Utilized
22	Math applications and websites can help me to exchange the course material with my friends.	3.21	Utilized
23	Math applications and websites can help me to manage my study.	3.14	Utilized
24	Math apps and websites help students understand math concepts better.	3.21	Utilized
	Aggregate Weighted Mean	**3.17**	**Utilized**

Legend: 3.25-4.00-Highly Utilized; 2.50– 3.24- Utilized ;1.75 – 2.49- Less Utilized ; 1.00 – 1.74– Not Utilized

Eight (8) out of 24 statements (i.e. items 1, 3, 10, 11, 14, 15, 16, and 19) which the respondents addressed as “highly utilized”. This implies the wide use of these modernized tools in getting better subject results, quickly accessing

knowledge, learning at any time and from anywhere, engaging with friends, and facilitating learning are all considered to be crucial elements in completing their Math activities. The following 7 statements (i.e items 2, 4, 17, 20, 21, 22, and 24) with a higher mean of 3.21 are interpreted as “utilized” are the usage of math apps and websites in getting feedback and notification from their teachers that helps them understand math concepts better. Students also used this as a tool for communication to encourage teamwork and collaboration which motivates them to explore many topics they have not seen before. The study conducted by Radovic et. al (2019) revealed that students were open to integrating new technologies into their pedagogy, curriculum, and learning settings in unconventional ways. It follows that they see and engage mathematical ideas with the aid of games, simulations, and technological resources to which they can explore and discover new things.

On the other hand, statement no. 9 has the lowest mean of 2.50 and is interpreted as “utilized”. This acknowledges that multitasking with math websites and applications inhibits the respondents from focusing on or completing the most crucial work. This might be a result of their visiting online gaming sites and social media platforms like Facebook, Instagram, Twitter, and other similar ones, which might provide them with distractions and cause them to focus on other notifications or features. According to research in cognitive science, performing two tasks at once results in lower-quality work than performing one item at a time. Flynn (2021) supports this claim that multitasking might be possible, but it might have a negative effect on the output's quality.

LEVEL OF MATHEMATICS ACHIEVEMENT OF THE RESPONDENTS IN ARITHMETIC SEQUENCE AND SERIES

Students' academic performance is a reliable indicator of how well they are performing in their many academic areas. By educators and school administrators, academic achievements, the overall grade average, test scores, and exam outcomes are often used as measures of success. Table 8 below displays the respondents' math achievement.

It demonstrates that the majority of respondents received a Satisfactory rating. Seven students, or 50.00 percent of the total, achieved a satisfactory level of success. Four respondents, or 28.57 percent, received ratings of very satisfactory, while only two, or 14 percent received outstanding ratings. There was only one respondent who received the lowest score and interpreted it as fairly satisfactory.

Table 8
Level of mathematics achievement of the respondents in Arithmetic Sequence and Series

Descriptive Rating	Numerical Range	f	%
Outstanding	25 - 30	2	14.28
Very Satisfactory	19 - 24	4	28.57
Satisfactory	13 - 18	7	50.00
Fairly Satisfactory	7 - 12	1	7.14
Poor	0 - 6	0	0.00
Total		**14**	**100.00**
Mean		18.86	
Standard Deviation		4.83	

This indicates that the majority of the respondents passed the achievement test. After using math apps for activities requiring recall, comprehension, applications, and analysis, student learning performance improved significantly. According to the review of the literature with closely related findings, these were suggesting that the wide use of technological applications during instructional delivery is essential for students' engagement and their academic achievement. Moreover, the result is also supported by the study of Fabian, et. al (2018) who believed that the use of mobile apps as a new approach to math had improved the students' understanding of abstract math ideas and as a result, their memory. Additionally, the study of Ababa et. al (2021) stipulates that the development of mobile educational apps highly contributed to the educational system to maintain the availability of academically

necessary resources. Additionally, a study found that electronic training platforms for math are useful and simple to use for learning (Ahmadi & Suminar, 2017). There are many opportunities for educational platforms that allow students to access educational resources online from anywhere in the world to improve the learning experience for students. It enables students to access learning materials across the globe through the Internet have a lot of potential to enhance the learning experience for students. Based on this, it is now possible to have high-quality mobile apps that can be used by students anywhere and anytime. However, most of these platforms are still too expensive to be considered mainstream learning platforms. To increase the accessibility of resources, some educational institutions have begun using a wide variety of learning tools such as learning management systems (LMS), interactive whiteboards, educational calculators, and whiteboard-augmented learning, which allows students who are away from their desks to get instant access to their learning material. These learning devices are not only used for enhancing the classroom atmosphere and to encourage the student’s creativity but also for providing students with real-time learning experiences. Moreover, these learning technologies have also been shown to boost the performance of students and improve their academic skills. However, several problems have been reported with the use of mobile tools. Some of them are as follows: Users often become dependent on the apps and become unaware of their limitations. Previous research revealed that the majority of these apps have serious usability issues, which compromise students' ability to learn. Additionally, it's possible that the app wasn't made with each user's

specific needs in mind. Many students fail to meet their targeted learning objectives as a result of these issues, which have an impact on their academic progress when using such learning platforms. This makes it difficult for most learning programs to find a solution to these issues. Researchers and developers have worked very hard to create learning environments that are more appealing and user-friendly to overcome these problems. As a result, it is now crucial for us to identify the ideal learning environment design.

TEST OF SIGNIFICANT RELATIONSHIP BETWEEN THE PROFILE OF THE RESPONDENTS AND THEIR UTILIZATION OF MATH APPS AND WEBSITES

This section provides the relationship between the respondent's demographic profiles and their utilization of math applications and websites presented in table 9 that follows.

The p-value was found to be 0.405, which is not less than the level of significance of 0.05, therefore the null hypothesis is accepted given the age of the respondents and their use of math apps and websites. Thus, there was no significant relationship between age and the use of math apps and websites.

Table 9
Test of Significant Relationship between the profile of the Respondents and their Utilization of Math Apps and Websites

Variables	χ^2	p-value	Decision on Ho	Interpretation
Age	2.913	0.405	Accept Ho	Not significant
Gender	6.644	0.010	Reject Ho	Significant
Highest Educational Attainment	1.938	0.164	Accept Ho	Not significant
Combined Income	3.630	0.304	Accept Ho	Not significant
Source of Internet	0.598	0.439	Accept Ho	Not significant
Device used	7.830	0.348	Accept Ho	Not significant

***significant if p< 0.05

With the respondents' gender and their use of math websites and apps, it was discovered that the p-value was 0.010, which is less than the level of significance of 0.05 and rejects the null hypothesis. This indicates a significant relationship between gender and the use of math applications and websites.

The use of math applications and websites, along with the respondents' parents' greatest level of education, showed that the p-value was 0.164, which is not less than the level of significance of 0.05 and accepts the null hypothesis. Accordingly, the use of math apps and websites did not significantly correlate with the parent's greatest level of education.

As a result of the parent respondents' total household income and their use of math websites and apps, it was determined that the p-value was 0.304,

which is not less than the level of significance of 0.05 and so the null hypothesis is accepted. This indicates no significant relationship between the use of math applications and websites and the parents' total household income.

The use of math apps and websites among respondents and the type of internet connection they had revealed that the p-value is 0.439, which is not less than the level of significance of 0.05, and the null hypothesis is accepted. This indicates that there was no significant relationship between the source of the internet connection and the use of math websites and apps.

Considering the device used by the respondents and their use of math applications and websites, the p-value was found to be 0.348, which is not less than the level of significance of 0.05 and indicates that the null hypothesis is accepted. This indicates that there was no significant relationship between the respondents' type of device used and their use of math apps and web pages. The pandemic that the world is presently going through has an impact on how quickly the educational system addressed the issue of student learning. The ability of students to connect to the internet and the availability of learning resources at their homes are seen as being very advantageous from this perspective. However, the study by Affum (2022) discovered that having access to many forms of gadgets has drawbacks, which include distraction as time is wasted on social media rather than studying.

TEST OF SIGNIFICANT RELATIONSHIP BETWEEN THE PROFILE OF THE RESPONDENTS AND THEIR MATHEMATICS ACHIEVEMENT

The relationship between the demographic profile of the respondents and their proficiency in math in Arithmetic Sequence and Series is shown in Table 10.

The null hypothesis reflected in the following table 10 is rejected since the correlation between respondents' ages and mathematics achievement (p-value) is 0.006, which is less than the level of significance of 0.05. This proves that there was a significant relationship between math achievement and age. Older and younger students were compared in earlier literature, and it was found that younger students are often more dedicated to their academic goals than older ones. This might be a result of the older students' attention being diverted by more urgent non-academic concerns.

Given that the p-value between the respondents' gender and their math achievement is 0.211, the null hypothesis is accepted because it is greater than the level of significance of 0.05. Therefore, there was no significant difference between gender and math achievement.

Table 10
Test of Significant Relationship between the profile of the Respondents and their Mathematics Achievement

Variables	x^2	p-value	Decision on Ho	Interpretation
Age	22.909	0.006	Reject Ho	significant
Gender	4.511	0.211	Accept Ho	Not significant
Highest Educational Attainment	6.462	0.091	Accept Ho	Not significant
Combined Income	10.571	0.306	Accept Ho	Not Significant
Source of Internet	14.000	0.030	Reject Ho	significant
Device used	27.750	0.147	Accept Ho	Not significant

***significant if p< 0.05

The relationship between respondents' parents' greatest degree of education and their math proficiency was found to have a p-value of 0.091, which is not less than the level of significance of 0.05 thus the null hypothesis is accepted. This indicates that there was no correlation between the parent's greatest level of schooling and their math achievement.

The results showed that the p-value between the combined income of the parents' respondents and the math achievement, was 0.306, which is greater than the level of significance of 0.05, thus the null hypothesis is accepted. Therefore, there was no significant relationship between the parent's total income and the student's math achievement. In other words, although students' financial situations vary, their academic achievement is unaffected. The Department of

Education’s Sustainable Development Goals continues to promote all students to have access to inclusive, equitable education, and encourage opportunities for lifelong learning regardless of their financial situation. This further implies that improving academic success is more a function of personal commitment than of resources.

The p-value between the respondents' internet connection type and their math proficiency was found to be 0.030, which is less than the level of significance of 0.05 and rejects the null hypothesis. This indicates that there was a significant relationship between math achievement and the source of the internet connection.

The null hypothesis is accepted since the p-value between the respondents' device of choice and their math proficiency is 0.147, which is not less than the level of significance of 0.05. This indicates that there was no significant relationship between the respondents' type of device used and their math achievement.

Further analysis indicated that gender, parents' highest educational attainment, combined income, and the device used by the students revealed that these factors do not influence their academic performance. Although this finding differs from the majority of the literature, Hathella & Priyanath (2021) concluded that student success in mathematics is significantly influenced by their demographic characteristics and attitudes toward the subject.

Several other findings show there is a significant relationship between the respondent's age and their source of internet. Most students utilize software tools like apps to help them online; some of these apps are specifically meant for communication, entertainment, and instructional purposes. However, there were still difficulties posed by students' use of the internet. It was proven by Affum (2022) that numerous students struggle to keep up with their virtual classmates because their schools do not offer the high bandwidth or reliable internet connections needed for online courses.

TEST OF SIGNIFICANT RELATIONSHIP BETWEEN THE UTILIZATION OF MATHEMATICAL APPS AND WEBSITES OF THE RESPONDENTS' MATHEMATICS ACHIEVEMENT

Table 11 below depicts a test of the relationship between the use of math applications and websites and their mathematics achievement.

Table 11
Test of the Relationship between the utilization of the mathematical apps and websites and the mathematics achievement of the respondents

Variable	x^2	p-value	Decision on Ho	Interpretation
Utilization Level Vs. Math Achievement	5.911	0.116	Accept Ho	Not significant

***significant if p< 0.05**

The null hypothesis is accepted as the p-value was found to be 0.116, which is not less than the level of significance of 0.05. Therefore, there is no

significant relationship between the use of math applications and websites and mathematics achievement in Arithmetic Sequence and Series. However, even before the pandemic years of schooling, the paradigm change brought forth by mobile technology offers new chances for instruction and Math education in classrooms. Based on the investigation of Etcuban, et. al (2018), the Effects of Mobile applications in Teaching High School Mathematics, the results demonstrated an improvement in post-test scores for both the experimental and control groups. The student's performance and comprehension were found to have improved as a result of utilizing the mobile application to teach math. Furthermore, in the study of Obina et. al (2022), the research participants agreed that math applications help with math problems, compensate for a teacher's lack of instruction, encourage retention of particular lessons, and enhance students' academic success. However, the same respondents also concurred that the application of math had an impact on their study habits, making them dependent on it and resulting in procrastination and laziness. This implies that if the teacher lacks time to adequately teach each lesson, they will tend to skip over certain topics. But through the usage of these applications, students can practice problem-solving techniques on their own which they can benefit to enrich their problem-solving abilities.

RESULTS OF THE DATA GATHERED FROM SOUTHWESTERN UNIVERSITY

A comprehensive review of the results from the Southwestern University survey is presented in this section. The analysis follows each data implication with a narrative literature study to aid in the evaluation of the relevance of the findings of this investigation.

PROFILE OF THE RESPONDENTS

To properly evaluate the findings, a description of the respondents' demographic profile is necessary. This includes their gender, age, parental education level, combined family income, internet connection providers, and the devices they own to access the math apps and websites to determine their impact on how well students perform academically in mathematics.

Age and Gender

Teenagers' lives sometimes appear to revolve around their phones and technology. Students' lives are growing more and more reliant on technology, from the internet and social media to phones, applications, games, various websites, and technological platforms. Table 12 below shows the age and gender distribution of Southwestern University respondents.

Table 12
Age and Gender of the Respondents

Age	Male		Female		Total	
	f	%	f	%	f	%
18	0	0.00	1	3.13	1	3.12
17	1	3.13	1	3.13	2	6.25
16	2	6.25	7	21.87	9	28.13
15	10	31.25	10	31.25	20	62.50
Total	**13**	**40.63**	**19**	**59.37**	**32**	**100.00**

It reveals that there were more female respondents than male respondents. Female respondents made up 59.37 percent of the population, or 19 in total, while male respondents made up only 40.63 percent of the total population; this means that female students predominate in Grade 10. Furthermore, female respondents under 15 outnumbered males by ten, accounting for 62.50 percent of the total population. By classification of the UNESCO Institute for Statistics (2022), the Philippines is categorized to have a Gender Parity Index of 1.02, which indicates that girls are more advantaged than boys in terms of educational chances; this further implies that the status and capacities of women would rise with the elimination of gender differences in education. According to an article published in the Manila Times (2022), the United Nations Educational, Scientific, and Cultural Organization (UNESCO), in its Global Education Monitoring Report released on April 27, showed that Filipino girls outperformed boys in mathematics. The annual gender report from UNESCO analyzed data from 120 countries to provide a global picture of early

education, where boys outperform girls in primary school, but the gender gap disappears in secondary school. Similar findings apply to third-world countries.

Parents' Highest Educational Attainment

Because of the pandemic, parental involvement is the most effective way to increase access to education and reduce the achievement gap between socially disadvantaged children and their peers. When parents are exposed to these technologies, they can better supervise their children at home. Still, they are less involved when they perceive the technological devices to be complicated and beyond their abilities or knowledge. The following data of the respondent's parents' highest educational attainment is shown in Table 13.

Table 13
Parents' Highest Educational Attainment

Highest Educational Attainment	f	%
College Graduate	26	81.25
College Level	5	15.62
High School Graduate	1	3.13
Total	**32**	**100.00**

It reveals that 26 respondents, or 81.25 percent of the total population, had college-educated parents. There were five respondents, or 15.62 percent of the population, whose parents did not complete college, while only one had a parent who graduated from high school but did not continue to college. No respondents have parents who are only in high school, elementary graduates,

only in elementary school, or have no formal schooling; this implies that the respondents' parents earned a college degree or took a college course. A study by Kean et al. et al. (2020) found that parental educational attainment influenced children's academic performance. Parents can help their children by providing tangible or intangible support. According to Delgado (2019), parental involvement is critical for student development and provides numerous benefits. Degree-holding parents give their children a significant advantage in math. Academic performance improves, students are more motivated to learn, and grades improve.

Combined Monthly Family Income

Online techniques are becoming more critical in ensuring that students, regardless of economic status, have access to education. Because digital devices and online connections are so important, digital disparity can adversely affect educational and economic inequality. Table 14 displays the combined monthly family income of the respondent's parents.

Table 14
Combined Monthly Family Income of the Respondents

Combined Monthly Family Income	f	%
Above P 30, 000	17	53.12
P 25, 000 - P 30, 000	6	18.75
P 20, 000 - P25, 000	1	3.13
P 15, 001 - P 20, 000	4	12.50
P 10,001 – P15,000	1	3.13

P 10,000 and below	3	9.37
Total	**32**	**100.00**

Three respondents' parents' combined income was Php 10,000 or less. There is also one respondent who believes their parents' combined income is between Php 10,000 and Php 15,000. There were also four respondents (12.5 percent of the population) who thought their parents' combined income ranged from Php 15,001 to Php 20,000. There is also one respondent who believes their parents' combined income is between Php 20,0001 and Php 25,000. There were six respondents, or 18.75 percent of the population, who have parents with incomes ranging from Php 25,001 to Php 30,000, and the majority of respondents believed that the combined income of their parents was at least Php 30,000 with 53.12 percent of the population. The relevant theory emphasizes the importance of a family's social and economic standing for a child's development. According to the paper of Tao & Han (2017), children will process more resources for development when their parents have a higher social and economic position, which will actively encourage students' academic progress. However, learners from low-income households suffered from a lack of such resources, which made their lives difficult or even hampered their growth.

Internet Connectivity

The internet is already an essential part of education. We can be certain that its global educational significance will grow over the next decade. Students can learn at any time, from any location, and at any pace by using the internet.

Table 15
Source of Internet Connectivity

Source of Internet Connection	f	%
Wi-Fi Only	31	96.88
Mobile Data Only	1	3.12
Total	**32**	**100.00**

Table 15 shows the respondents' internet connection source. Only one respondent used mobile data, accounting for five percent of the population. In contrast, 31 respondents rely on wifi as the source of their internet connection, accounting for 96.88 percent of the population. In a study conducted by Asio et. al (2021), students with a strong internet connection have the readiness to learn; this demonstrates that most students relied on wifi as a demand for the blended learning modality. Since not all students have reliable internet access, a senator from the Philippines emphasized the importance of addressing poor internet connections and a lack of technology to ensure that students continue to receive an education during the pandemic, according to an article from The Manila Times (2021) the senator claimed that a recent survey on remote education brought to light the difficulties parents and students experienced in the wake of the health crisis.

Types of Devices Used

During the pandemic, students can use digital devices to discover, generate, discuss, and work collaboratively. It allows students to receive

feedback and suggestions from their teachers and peers when it is necessary to share student work. Table 6 below reveals the type of devices students in using the institution's LMS, watching videos, and engaging in simulations and games to learn. According to the results, the most respondents used smartphones and laptop computers to learn. Smartphones and laptops were used by eleven students, or 34.37 percent of the population. In addition, five respondents, or 15.62 percent of the population, only used smartphones. Four respondents only used a laptop to access online materials. There was also one respondent who only used one desktop. Seven respondents accessed math apps and websites via desktops and smartphones. In their studies, one respondent used a

Table 16
Types of Devices they Used

Devices	f	%
Smartphone Only	5	15.62
Laptop Only	4	12.50
Desktop Only	1	3.13
Desktop and Smartphone	7	21.87
Smartphone and Laptop	11	34.37
Smartphone, Laptop, and Tablet Device	1	3.13
Desktop, Smartphone, and Laptop	2	6.25
Desktop, Smartphone, Laptop, and Tablet Devices	1	3.13
Total	**32**	**100.00**

smartphone, laptop, or tablet device. Two respondents used desktop computers, smartphones, and laptop computers. One respondent used all of the devices

mentioned in the survey. A study by Adjei (2019) revealed that smartphones and laptops played a vital role among distance learning students. Students find that using smartphones and laptops in their learning activities is more convenient. Asio et al. (2021) postulated that the most popular students learning tool is likely to be their smartphone. As a result, and especially in light of the current epidemic, the institution can develop a flexible learning plan for the students.

EXTENT TO WHICH THE RESPONDENTS UTILIZE MATH APPS AND WEB PAGE APPLICATIONS IN LEARNING MATHEMATICS

This section shows how frequently respondents use math websites and apps. Table 17 below indicates the way respondents use the materials in the survey form below can be summed up as how these educational tools assist them in studying independently.

It reveals that out of 24 statements, seven are highly used by respondents. The mean of the seven statements is 3.50 for "Math applications and websites can help me in finding resources related to my study." This aids respondents in their related studies, which are presented on various platforms such as videos, animations, interactive games, or online programs, allowing them to perform better in Math. The following statement has a higher mean of 3.44, "Math apps and websites help students understand math concepts better."

This means that the math app and websites they used as references or resources aided them in their studies, resulting in higher grades. According to a study, teachers can reduce written or verbal discussions for students if math apps and websites help students understand math concepts better (Montijo, 2017) & (Tao & Han, 2017).

The statement, "Math apps and websites allow me to collaborate with others easily, both on and off campus," has the lowest mean of 2.71 and is interpreted as utilized. This means that the majority of students believed that

Table 17
The Extent to which the respondents utilize math apps and web page applications in learning mathematics

S/N	Indicators	WM	Verbal Description
1	Math apps and websites help me get better results in my subjects.	3.19	Utilized
2	Math apps and websites help me understand the subject material more deeply.	3.19	Utilized
3	Math apps and websites make completing work in my Math subjects more convenient.	3.38	Highly Utilized
4	Math apps and websites motivate me to explore topics I may not have seen before.	3.13	Utilized
5	Math apps and websites allow me to collaborate with others easily, both on and outside of campus.	2.72	Utilized
6	I get more actively involved in my Math class using Math apps and websites.	3.03	Utilized
7	Math apps and websites help me to concentrate and think deeply about our lesson/topic.	3.25	Highly Utilized
8	Use of Math apps and websites in class improves my engagement with the content and class	3.31	Highly Utilized
9	Multitasking with Math apps and websites sometimes prevents me from concentrating on or doing the work that is most important.	2.94	Utilized
10	I find it useful to learn mathematics on the phone anywhere and at any time by accessing Math apps and websites.	3.41	Highly Utilized
11	The Math apps, websites, and learning activities on the phone were easy to use.	3.13	Utilized
12	Using Math apps and websites makes sophisticated concepts accessible to students.	3.19	Utilized
13	I can learn through the application independently of time and place with the help of Math apps and websites.	3.13	Utilized
14	The utilization of apps and websites increases the quality of education.	3.22	Utilized
15	Teaching Math concepts using Math apps and websites helps me evaluate my understanding and performance.	3.09	Utilized
16	Math applications and websites are valuable tools for my study.	3.47	Highly Utilized
17	Math applications and websites can offer opportunities for communication and team-working.	2.91	Utilized
18	Math applications and websites can help me find resources related to my study.	3.50	Highly Utilized
19	Math applications and websites bring many opportunities to the learning process.	3.34	Highly Utilized
20	Math applications and websites can help me to access the course material anytime, anywhere.	3.22	Utilized
21	Math applications and websites can be an easy way to get feedback and notifications from my instructors.	3.09	Utilized
22	Math applications and websites can help me to exchange the course material with my friends.	3.06	Utilized
23	Math applications and websites can help me to manage my study.	3.31	Highly Utilized
24	Math apps and websites help students understand math concepts better.	3.44	Highly Utilized
	Aggregate Weighted Mean	**3.19**	**Utilized**

Legend: 3.25-4.00-Highly Utilized; 2.50– 3.24- Utilized ;1.75 – 2.49- Less Utilized ; 1.00 – 1.74– Not Utilized

math apps and websites were being used in ways that allowed them to share different ideas and learnings in math lessons, whether face-to-face or online. A

study from Oikarinen (2022) found that students' collaboration during peer tutoring, such as feedback, sharing new ideas, or group work activities, affects students' mathematical achievement and technological communication. According to a study by Cantonjos and Labo (2019), math apps were an efficient teaching tool for learners in grade 11. The Math Apps are particularly good at helping students perform better in Probability and Statistics classes.

LEVEL OF MATHEMATICS ACHIEVEMENT OF THE RESPONDENTS IN ARITHMETIC SEQUENCE AND SERIES

The average student performance on the Arithmetic Sequence and Series accomplishment test is covered in table 18; this is determined by simply averaging the students' test results after checking.

Table 18
Summary of Mathematics Achievement of the Grade 10 students in Arithmetic Sequence and Series

Descriptive Rating	Numerical Range	f	%
Outstanding	25 - 30	6	18.76
Very Satisfactory	19 - 24	15	46.87
Satisfactory	13 - 18	9	28.12
Fairly Satisfactory	7 - 12	2	6.25
Poor	0 - 6	0	0.00
Total		**32**	**100.00**
Mean		20.41	
Standard Deviation		4.29	

Table 18 displays the respondents' Math achievements. It reveals that the majority of respondents received a Very Satisfactory rating. There were 15 respondents, or 46.87 percent, who achieved a very satisfactory level of achievement. Only two respondents, or 6.25 percent, received a fairly satisfactory rating, nine respondents, or 28.12 percent, received a satisfactory rating, and six respondents received an 18.76 percent outstanding rating. No respondents received a poor rating, indicating that all respondents passed the math achievement test, revealing that they understood the math concepts using math apps and websites. Math apps, according to Wang (2022), provide students with long-term benefits. Students' math achievement improved after exposure to math apps and websites. Based on the research of Sari et al. (2020) found that using arithmetic sequence and series based on android or math applications or websites for project-based learning can increase students' learning motivation and direct involvement in group problem-solving. Because the content is packaged in an interesting application, students' learning motivation improves, and they can support the learning process independently outside the classroom.

TEST OF SIGNIFICANT RELATIONSHIP BETWEEN THE PROFILE OF THE RESPONDENTS AND THEIR UTILIZATION OF MATH APPS AND WEBSITES

This section determines whether there is a strong relationship between respondent profiles and the use of math websites and applications. In the following discussions, the effect of each responder profile on the use of math applications and websites will be investigated. Table 19 depicts the relationship

between the respondents' demographic profile and their utilization of math apps and websites. According to the age of the respondents and their use of math apps and websites, the p-value is 0.905, which is greater than the level of significance of 0.05, and thus the null hypothesis is accepted; this means there was no significant relationship between age and the utilization of math apps and websites.

Table 19
Test of Significant Relationship between the profile of the Respondents and their Utilization of Math Apps and Websites

Variables	x^2	p-value	Decision on Ho	Interpretation
Age	4.049	0.908	Accept Ho	Not significant
Gender	4.247	0.236	Accept Ho	Not significant
Highest Educational Attainment	2.154	0.905	Accept Ho	Not significant
Combined Income	7.743	0.934	Accept Ho	Not significant
Source of Internet	0.803	0.849	Accept Ho	Not significant
Device used	16.877	0.719	Accept Ho	Not significant

*significant if p< 0.05

The p-value between the gender of the respondents and the use of math apps and websites was 0.236, which is not less than the level of significance of 0.05, implying that the null hypothesis is accepted; this means that there was no significant relationship between gender and the utilization of math apps and websites.

The p-value between the respondents' parents' highest educational attainment and their use of math apps and websites was 0.905, which is not less than the level of significance of 0.05, implying that the null hypothesis is accepted; this means that there was no significant relationship between the parent's highest educational attainment and the utilization of math apps and websites.

The p-value between the combined income of the parent respondents and the use of math apps and websites was 0.934, which is not less than the level of significance of 0.05, indicating that the null hypothesis is accepted; this means that there was no significant relationship between the combined income of the parents and the utilization of math apps and websites.

The p-value between the source of internet connection among respondents and the use of math apps and websites was 0.849, which is not less than the level of significance of 0.05, implying that the null hypothesis is accepted; this means that there was no significant relationship between the source of the internet connection and the utilization of math apps and websites.

The p-value for the device used by the respondents and the use of math apps and websites was 0.719, which is not less than the level of significance of 0.05, implying that the null hypothesis is accepted. This means that there was no significant relationship between the device used by the respondents and the utilization of math apps and websites. The speed with which the educational system responded to the problem of student learning was impacted by the

pandemic that it is currently experiencing. In mixed-method research done by Brigula et al. (2021), pure online classes are conducted because face-to-face classes have been suspended. This situation has brought positive as well as negative impacts on students that include diversion because time is spent on social media instead of learning.

TEST OF SIGNIFICANT RELATIONSHIP BETWEEN THE PROFILE OF THE RESPONDENTS AND THEIR MATHEMATICS ACHIEVEMENT

Table 20 depicts the relationship between respondents' demographic profiles and their math achievement in Arithmetic Sequence and Series.

Table 20
Test of Significant Relationship between the profile of the Respondents and their Mathematics Achievement

Variables	x^2	p-value	Decision on Ho	Interpretation
Age	19.684	0.020	Reject Ho	significant
Gender	3.855	0.278	Accept Ho	Not significant
Highest Educational Attainment	6.840	0.336	Accept Ho	Not significant
Combined Income	25.771	0.041	Reject Ho	significant
Source of Internet	2.638	0.451	Accept Ho	Not significant
Device used	14.391	0.852	Accept Ho	Not significant

***significant if p< 0.05

The p-value between the respondents' ages and math achievement is 0.020, which is less than the level of significance of 0.05, so the null hypothesis is rejected. This means that there was a significant relationship between age and math achievement.

The p-value between the gender of respondents and their math achievement was found to be 0.278, which is not less than the significance level of 0.05, implying that the null hypothesis is accepted. This means that there was no significant relationship between gender and math achievement.

The p-value between the respondents' parents' highest educational attainment and their math achievement was found to be 0.336, which is not less than the level of significance of 0.05, implying that the null hypothesis is accepted. This means that there was no significant relationship between the parent’s highest educational attainment and the math achievement.

The p-value between the combined income of the parent’s respondents and math achievement is 0.041, which is less than the level of significance of 0.05, so the null hypothesis is rejected. This means that there was a significant relationship between the combined income of the parents and math achievement.

The p-value between the source of internet connection among respondents and math achievement was found to be 0.451, which is not less than the level of significance of 0.05, implying that the null hypothesis is

accepted. This means that there was no significant relationship between the source of the internet connection and math achievement.

The p-value between the device used by the respondents and their math achievement is 0.852, which is not less than the level of significance of 0.05, so the null hypothesis is accepted. This means that there was no significant relationship between the device used by the respondents and the math achievement. Further research based on the study The impacts of family income on children's education revealed that family income has a significant effect on children's educational achievement and that increasing family income can improve children's educational attainment (Tao & Han, 2017). Barrientos' (2021) study also recommended that students acquire various math apps because they can significantly improve their number sense, that math teachers highlight the apps and other relevant learning resources, and that the Department of Education works harder to meet the needs of the students in this New Normal Education.

TEST OF SIGNIFICANT RELATIONSHIP BETWEEN THE UTILIZATION OF MATHEMATICAL APPS AND WEBSITES OF THE RESPONDENT'S MATHEMATICS ACHIEVEMENT

Table 21 shows the relationship between using math apps and websites and math achievement in Arithmetic Sequence and Series.

Table 21
Test of the Relationship between the utilization of the mathematical apps and websites the and mathematics achievement of the respondents

Variable	x^2	p-value	Decision on Ho	Interpretation
Utilization Level Vs. Math Achievement	10.993	0.276	Accept Ho	Not significant

***significant if p< 0.05**

The p-value was found to be 0.276, which is not less than the level of significance of 0.05, implying that the null hypothesis is accepted. This means there is no significant relationship between the utilization of math apps and websites and math achievement in Arithmetic Sequence and Series. As suggested by the study by Demir & Akpinar (2018), the results imply that mobile learning might increase students' academic success. Both groups scored exceptionally well on attitudes toward mobile learning. The students also valued mobile learning as a strategy that might significantly boost their motivation. It has also been proposed by the study of Tomul et al. (2021) that it would be advantageous to enhance the quantity of in-class and extracurricular activities that will safeguard and boost students' math confidence. The concentration on academic accomplishment may be increased by the setting of goals by the school administration.

RESULTS OF THE DATA GATHERED FROM PATRONAGE OF MARY DEVELOPMENT SCHOOL

The results and findings presented and evaluated below are based on the responses that Patronage of Mary Development School survey respondents provided. The survey-based evidence supporting each of these research findings is provided in the following sections.

PROFILE OF THE RESPONDENTS

To interpret the study's subsequent findings, it is essential to have a description of the demographic profile of the respondents. The researchers used a Google form survey questionnaire to collect this data to investigate the relationships between the demographic profile components.

Age and Gender

Age is a concept that refers to a person's age at a particular time. It is described as the calculation of the amount of time that has gone from the date of the live birth to a specific date, usually the date the data was gathered. Age is determined by calculating the amount of time (often in complete years) that has passed between a person's birth date and a particular moment (e.g., date of a specific survey). On the other hand, gender is the socially constructed roles, behaviors, expressions, and identities of girls, women, boys, men, and persons of all genders. It affects how individuals behave and interact, how they see themselves and others, and how power and resources are distributed in society.

Table 22
Age and Gender of the Respondents

Age	Male		Female		Total	
	f	%	f	%	f	%
16	2	5.55	4	11.11	6	16.67
15	9	25.00	16	44.45	25	69.44
14	2	5.55	3	8.33	5	13.88
Total	**13**	**36.11**	**23**	**63.89**	**36**	**100.00**

The distribution of respondents' ages and genders at the Patronage of Mary Development School is shown in Table 22. It demonstrates that there were more women than men who responded. There were 23 total female respondents, making up 63.99 percent of the population overall, while male respondents made up just 36.11 percent of the population. This indicates that female students make up the majority of the 10 classes. Most of the female respondents in this group, who made up 44.45 percent of the total population, were under 15. Additionally, 25.00 percent of the male respondents were 15 years old, making up most of the group.

The table also reveals the age range, which is between 14 and 16 years old. The majority of the respondents were 15 or younger. The bulk of Grade 10 students was, therefore, 15 or older. 25 respondents, or 69.44 percent of the total population, fall into this category.

According to Ghasemi and Burley's article (2019), despite variability and some changes in the magnitude and direction of gender differences in math achievement, boys and girls perform similarly. The researchers discovered that students in some countries with a smaller adult gender gap have higher gender differences in mathematical concepts.

Parents' Highest Educational Attainment

The highest educational attainment is the highest level of education achieved by either the mother or the father. Higher educational attainment is associated with higher households income; those in the lowest income bracket are more likely to have only completed high school, while those in the highest income bracket are more likely to possess graduate degrees.

Table 23 displays the parents' greatest level of education. It reveals that

Table 23
Parents' Highest Educational Attainment

Highest Educational Attainment	f	%
College Graduate	19	52.78
College Level	7	19.44
High School Graduate	9	25.00
High School Level	1	2.78
Total	**36**	**100.00**

19 respondents, or 52.78 percent of the total population, had parents who had completed college. Parents who had completed high school were represented by

nine respondents or 25.00 percent of the total population. Only seven respondents, on the other hand, and just one respondent, respectively, have parents who attended college but did not complete their studies. No responders have parents who have completed elementary school; they only have elementary school education. This suggests that all of the respondents' parents received a formal education. The majority of them even completed a college course or degree. According to Idris et al. (2020), educated parents can also give their children the right advice because they have already gone through the educational process and are aware of the highs and lows of making educational decisions. As a result, they can share educational life experiences that are very effective at inspiring them to pursue their studies. These interactions at home, such as parental supervision, communication between parents and children, assistance in making educational decisions, and sharing educational experiences with children, have a terrific impact on student’s academic progress.

Combined Monthly Family Income

Combined monthly family income is defined as the total income the mother and the father earn on a monthly basis.It is the total of all products and services the family obtains or produces and any money or purchasing power earned by family members over a specific well as any money or purchasing power earned by family members over a specific period.

Table 24
Combined Monthly Family Income of the Respondents

Combined Monthly Family Income	f	%
Above P 30, 000	4	11.11
P 25, 000 - P 30, 000	7	19.44
P 20, 000 - P25, 000	2	5.56
P 15, 001 - P 20, 000	4	11.11
P 10,001 – P15,000	4	11.11
P 10,000 and below	15	41.67
Total	**36**	**100.00**

Table 24 displays the respondents' parents' combined income. The majority of the income, which is shown in the table as being between Php 10,000 and less, falls into the first category. 15 respondents, or 41.67 percent of the total population, reported having parents with annual incomes of Php 10,000 or less. Additionally, seven respondents, or 19.44 percent of the population, said they thought their parents' total income ranged from P25,001 to P30,000. However, just two respondents, or 5.56 percent of the population, reported having parents whose combined income was between P20,000 and P25,000. Additionally, there were four respondents for each group whose parents' combined income is between P10,001 and P15,001, P15,001 and P20,000, and above Php 30,000. It is manifested by Tao & Han (2017) that the financial situation of the family is shown to have an impact on the educational level of the family. If a family with low income can increase their income, they will be able to provide better conditions for their children's education. This claim is also supported by Li & Qui

(2018), that parents' participation in their children's education and their skills in doing so can have a direct impact on student's academic accomplishment.

Source of Internet Connectivity

The source of internet connectivity is categorized as whether the respondents are using the Wifi, mobile data, pisonet, computer shops, or a combination of these examples. It gives the students access to the world wide web or the internet, which is a rich source of information.

Table 25 lists the respondents' internet connection providers. The majority of survey participants rely excessively on WiFi. 52.78 percent of the population,

Table 25
Source of Internet Connectivity

Source of Internet Connection	f	%
Mobile Data Only	14	38.89
Wifi Only	19	52.78
Mobile Data and Wifi	2	5.55
Pisonet	1	2.78
Total	36	100.00

or 19 respondents said they connected to the internet using WiFi. The mobile data only is located next to this. Only 14 respondents, or 38.89 percent of the population, said they only utilized their mobile data to browse apps and websites. Only two respondents used mobile data and wifi simultaneously, and only one used Pisonet. These findings suggest that most respondents have access to a

reliable internet connection. Since the majority of institutions use a blended learning strategy that combines in-person instruction with online learning, it has already become necessary for the responders. Based on the study of Asio et al. (2021), 70 percent of students have home internet connectivity. The smartphone, on the contrary hand, tops the list of learning devices available to students.

Types of Devices Used

With the advancement of technology, there are already different forms of technology available for students to use that can help them with communication, connection, and even education. The type of devices used by the respondents refers to the gadgets the students frequently use to access information on the internet.

Table 26
Types of Devices Used

Devices	f	%
Smartphone Only	20	55.56
Laptop Only	2	5.55
Tablet Device Only	1	2.78
Smartphone and Laptop	7	19.44
Smartphone, Laptop, and Tablet Device	3	8.33
Desktop, Smartphone, and Laptop	2	5.55
Desktop, Smartphone, Laptop, and Tablet Devices	1	2.78
Total	**36**	**100.00**

Table 26 above lists the platforms on which the respondents accessed the websites and apps. It is evident that the majority of respondents exclusively utilized their smartphones to access internet resources. 20 students, or 55.56 percent of the total population, only utilized smartphones.

Additionally, seven respondents, or 19.44 percent of the population, said they had used laptops and smartphones to access websites and apps for math. Only one respondent, however, exclusively used a tablet device to access online resources. One respondent utilized a desktop, smartphone, laptop, and tablet, totaling four devices. According to the findings, students have probably already adapted to time demands. Since the epidemic, students have also tried to use technology that is highly helpful for their academic work. Additionally, this implies that learners have access to gadgets via which they can access websites and apps for math.

Six out of ten Filipino students used smartphones for distance learning during the epidemic, according to the most recent Social Weather Stations poll, which was published by the Inquirer. In rural areas, 86 percent of students purchased a smartphone, compared to 74 percent in urban areas. This is in contrast with the report handed by the Philippine Daily Inquirer, which states that purchasing laptops or desktops was more prevalent in urban regions (19 percent) than in rural areas (5 percent). It has also been mentioned by Tetzlaff (2017) that neither mobile apps nor traditional Math education techniques were significantly more effective in enhancing the math achievement or engagement of students with impairments. According to survey results, the teacher did not believe that

one condition was more beneficial than the other in enhancing math achievement or engagement.

EXTENT TO WHICH THE RESPONDENTS UTILIZE MATH APPS AND WEB PAGE APPLICATIONS IN LEARNING MATHEMATICS

This part discusses the extent of utilization of math apps and websites among the respondents. The utilization of math apps and websites can be defined as how respondents utilize the available resources, whether given by their teachers or based on independent searching and learning.

Table 27 below shows how many respondents use math apps and websites. It reveals that only one of the 24 statements has the highest rating. The statement "Math applications and websites are useful tools for my studies" has the highest mean of 3.28 and is interpreted as frequently used. This means that math applications and websites are widely used as useful study tools. The next statement, which has a higher mean, reads: "Math applications and websites can offer opportunities for communication and team-working, and Math apps and websites make completing work in my Math subjects more convenient." These two sentences are both interpreted as utilized and have a mean of 3.17. This indicates that the respondents used math websites and apps for teamwork-promoting activities and communication, which made it easier for them to complete their tasks. The statements that have the lowest mean of 2.81 and are regarded as utilized are, “I get more actively involved in my Math class with the use of Math apps and websites.” and “Math apps and websites allow me to

Table 27
The Extent to which the respondents utilize math apps and web page applications in learning mathematics

S/N	Indicators	WM	Verbal Description
1	Math apps and websites help me get better results in my subjects.	3.08	Utilized
2	Math apps and websites help me understand the subject material more deeply.	3.06	Utilized
3	Math apps and websites make completing work in my Math subjects more convenient.	3.17	Utilized
4	Math apps and websites motivate me to explore topics I may not have seen before.	3.08	Utilized
5	Math apps and websites allow me to collaborate with others easily, both on and outside of campus.	2.81	Utilized
6	I get more actively involved in my Math class using Math apps and websites.	2.81	Utilized
7	Math apps and websites help me concentrate and think deeply about our lesson/topic.	2.97	Utilized
8	Use of Math apps and websites in class improves my engagement with the content and class	2.86	Utilized
9	Multitasking with Math apps and websites sometimes prevents me from concentrating on or doing the work that is most important.	2.89	Utilized
10	I find it useful that to learn mathematics on the phone anywhere and at any time by accessing Math apps and websites.	3.08	Utilized
11	The Math apps, websites, and learning activities on the phone were easy to use.	2.94	Utilized
12	Using Math apps and websites makes sophisticated concepts accessible to students.	3.06	Utilized
13	I can learn through the application independently of time and place with the help of Math apps and websites.	3.06	Utilized
14	The utilization of apps and websites increases the quality of education.	3.14	Utilized
15	Teaching Math concepts using Math apps and websites helps me evaluate my own understanding and performance.	3.08	Utilized
16	Math applications and websites are valuable tools for my study.	3.28	Highly Utilized
17	Math applications and websites can offer opportunities for communication and team-working.	3.17	Utilized
18	Math applications and websites can help me find resources related to my study.	3.08	Utilized
19	Math applications and websites bring many opportunities to the learning process.	3.11	Utilized
20	Math applications and websites can help me to access the course material anytime, anywhere.	3.08	Utilized
21	Math applications and websites can be an easy way to get feedback and notifications from my instructors.	2.97	Utilized
22	Math applications and websites can help me to exchange the course material with my friends.	2.97	Utilized
23	Math applications and websites can help me to manage my study.	3.03	Utilized
24	Math apps and websites help the students understand math concepts better.	2.89	Utilized
	Aggregate Weighted Mean	**3.03**	**Utilized**

Legend: 3.25-4.00-Highly Utilized; 2.50– 3.24- Utilized ;1.75 – 2.49- Less Utilized ; 1.00 – 1.74– Not Utilized

collaborate with others easily, both on and outside of the campus." This means that students can collaborate on and off campus and become more involved in their math classes by using math applications and websites. This

suggests that out of the 24 statements, respondents believe math applications and websites somehow encourage group collaboration and make students active learners in math classes. This makes it simpler for teachers to manage the class. According to Minero's article (2020), some math teachers already had access to digital tools that helped students visualize mathematical concepts or websites that promoted mathematical conversation. Students can build the fundamental understanding of arithmetic operations they'll need as a starting point for later, more complex math problems with the aid of math applications and online resources. Supandi (2018) discovered in his study that mobile phone applications had a beneficial impact on learning outcomes as well as the learning environment both in and out of the classroom and were supported by the school administration. Learning achievement and student learning behavior improved significantly.

LEVEL OF MATHEMATICS ACHIEVEMENT OF THE RESPONDENTS IN ARITHMETIC SEQUENCE AND SERIES

This part discusses the mean performance of students in the achievement test of Arithmetic Sequence and Series. This is taken by simply getting the average of the scores of the students after checking. This has been categorized accordingly by the Department of Education’s range of scores.

Table 28 that follows displays the respondents' Math achievements. It reveals that the majority of respondents received a very satisfactory rating. There were 17 respondents, or 47.22 percent, who achieved a very satisfactory level of achievement. Nine respondents received a fairly satisfactory rating, seven

respondents received a satisfactory rating, and only two respondents received an outstanding rating. On the other hand, only one respondent received a low rating. This means that only one person failed the math achievement test, while 97 percent of those who took it passed. This also implies that respondents understood the concept correctly, as many passed the test.

Table 28
Level of mathematics achievement of the respondents in Arithmetic Sequence and Series

Descriptive Rating	Numerical Range	Frequency	Percentage
Outstanding	25 - 30	2	5.56
Very Satisfactory	19 - 24	17	47.22
Satisfactory	13 - 18	7	19.44
Fairly Satisfactory	7 - 12	9	25.00
Poor	0 - 6	1	2.78
Total		**36**	**100.00**
Mean		17.33	
Standard Deviation		6.00	

No matter how much a person learns or comprehends, there are still things that may be explored; all that is needed is information. Learning is a constant process that never comes to an end. This has been confirmed by Vidyalankar (2021), who asserts that there is a digitalization wave in education and that trends in education are shifting. Students now have a new need for online learning. The software helps children comprehend ideas by offering them

difficult challenges, brainteasers, and educational activities. Students are excited and eager to learn because of the excitement of the learning environment.

TEST OF SIGNIFICANT RELATIONSHIP BETWEEN THE PROFILE OF THE RESPONDENTS AND THEIR UTILIZATION OF MATH APPS AND WEBSITES

This section tests whether there is a meaningful connection between the respondent profiles and the use of math websites and applications. The impact of each responder profile on the use of math applications and websites will be examined in the discussions that follow.

Table 29
Test of Significant Relationship between the profile of the Respondents and their Utilization of Math Apps and Websites

Variables	x^2	p-value	Decision on Ho	Interpretation
Age	4.543	0.337	Accept Ho	Not significant
Gender	0.361	0.835	Accept Ho	Not significant
Highest Educational Attainment	2.002	0.920	Accept Ho	Not significant
Combined Income	9.990	0.441	Accept Ho	Not significant
Source of Internet	5.060	0.536	Accept Ho	Not significant
Device used	13.009	0.368	Accept Ho	Not significant

***significant if p< 0.05

Table 29 above depicts the relationship between the respondents' demographic profile and their use of math apps and websites. According to the age of the respondents and their use of math apps and websites, the p-value is 0.337, which is greater than the level of significance of 0.05, and thus the null hypothesis is accepted. This means that there was no statistically significant relationship between age and the use of math apps and websites.

About the respondents' gender and their use of math websites and apps, it was discovered that the p-value was 0.835, which is not less than the level of significance of 0.05 and supports the null hypothesis. Therefore, there was no significant relationship between gender and the use of math apps and websites.

The p-value between the respondents' parents' greatest level of education and their use of math apps and websites was found to be 0.920, which is not less than the level of significance of 0.05 and supports the null hypothesis. Therefore, there was no correlation between the parent's greatest level of education and their use of math apps and websites.

It was discovered that the p-value is 0.441, which is not less than the level of significance of 0.05 and indicates that the null hypothesis is accepted when the combined income of the parents' respondents and the use of math applications and websites are taken into account. This indicates that there was no significant relationship between the parent's total income and the use of math applications and websites.

It was discovered that the p-value between the respondents' internet connection type and their use of math applications and websites is 0.536, which is not less than the level of significance of 0.05 and supports the null hypothesis. Thus, there was no significant relationship between the source of the internet connection and the use of math websites and apps.

The p-value was found to be 0.368, which is not less than the level of significance. It indicates that the null hypothesis is accepted when considering the respondents' device and their use of math applications and websites. This suggests that there was no significant relationship between the respondents' device of choice and their use of math apps and websites. In the study of Owate, et al. (2017), on the use of e-learning resources in public secondary schools in Rivers State, it was found that various demographic independent variables, such as age, gender, availability, accessibility, and human resources, have a significant impact. In addition, accessibility and availability played a substantial role in the linkages between the use of e-learning resources. According to Kay's (2020) research, using mathematics apps for remembering, understanding, applications, and analysis-based tasks improved student learning performance significantly. The gender, ability, attitudes, and age of students had little effect on their learning success. Teacher gender and techniques, on the other hand, had a considerable impact on student learning performance.

TEST OF SIGNIFICANT RELATIONSHIP BETWEEN THE PROFILE OF THE RESPONDENTS AND THEIR MATHEMATICS ACHIEVEMENT

The correlation between the respondents' demographic characteristics and their proficiency in math in Arithmetic Sequence and Series is displayed in Table 30.

Table 30
Test of Significant Relationship in Demographic Profile vs. Math Achievement

Variables	x^2	p-value	Decision on Ho	Interpretation
Age	1.813	0.986	Accept Ho	Not significant
Gender	2.435	0.656	Accept Ho	Not significant
Highest Educational Attainment	12.776	0.386	Accept Ho	Not significant
Combined Income	34.612	0.022	Reject Ho	Significant
Source of Internet	7.174	0.846	Accept Ho	Not significant
Device used	34.638	0.074	Accept Ho	Not significant

***significant if p< 0.05

The null hypothesis is accepted since the p-value between the respondents' ages, and their arithmetic prowess is 0.986, which is not less than the level of significance of 0.05. This indicates that there was no significant relationship between age and math proficiency. The p-value between the gender of the respondents and their math achievement was 0.656, which is not less than

the level of significance of 0.05, implying that the null hypothesis is accepted. This means that there was no significant relationship between gender and math achievement.

The p-value between the respondents' parents' highest educational attainment and their math achievement was found to be 0.386, which is not less than the level of significance of 0.05, implying that the null hypothesis is accepted. This means that there was no significant relationship between the parent's highest educational attainment and the child's math achievement.

The p-value between the combined income of the parents' respondents and math achievement is 0.022, which is less than the level of significance of 0.05, so the null hypothesis is rejected. This means that there was a significant relationship between the parents' combined income and math achievement.

The p-value between the source of internet connection among respondents and math achievement was 0.846, which is not less than the level of significance, implying that the null hypothesis is accepted. This means that there was no significant relationship between the source of the internet connection and math achievement.

The p-value between the device used by the respondents and their math achievement is 0.074, which is not less than the level of significance, so the null hypothesis is accepted. This means that there was no significant relationship between the respondents' device and their math achievement. Over the past years, the effect of demographic variables and students’ performance in

mathematics has been the subject of numerous research. According to the findings of Ntibi (2021), student demographics have a crucial role in both teaching and learning, particularly in the subjects of mathematics and physics. To improve students' academic progress in schools, gender, and age should be taken into consideration. This has also been confirmed by the research of Ayebale et al. (2020), which indicated that a wide range of factors, including classroom environment, gender stereotypes, parental circumstances, and students' and teachers' attitudes, had a significant impact on students' mathematical ability.

TEST OF SIGNIFICANT RELATIONSHIP BETWEEN THE UTILIZATION OF MATHEMATICAL APPS AND WEBSITES OF THE RESPONDENT'S MATHEMATICS ACHIEVEMENT

The test of the relationship between the use of math apps and websites and math achievement in Arithmetic Sequence and Series is shown in Table 31, which follows.

Table 31
Test of Significant Relationship between the utilization of the mathematical apps and websites and mathematics achievement of the respondents

Variable	x^2	p-value	Decision on Ho	Interpretation
Utilization Level Vs. Math Achievement	10.433	0.236	Accept Ho	Not significant

***significant if p< 0.05

The p-value was discovered to be 0.236, which is not less than the level of significance, implying that the null hypothesis is accepted. This means that there is no significant relationship between using math apps and websites and math achievement in Arithmetic Sequence and Series. This finding is in contrast to the earlier research conducted by Barrientos (2021), which recommended the use of math apps to supplement independent learning to ensure that there are no gaps in the learning process. Another study by Demir and Akpinar (2018) considered that mobile learning has the potential to improve academic performance and motivation among students. These implications were also supported by Yeh et al. (2019), who revealed that the majority of research shows that mobile applications give students a convenient and personalized game-based environment to increase their mathematical achievement and engagement.

RESULTS OF THE DATA GATHERED FROM THE THREE IDENTIFIED SCHOOLS

A survey questionnaire was used to elicit responses from 82 Grade 10 students from the three participating schools - the Patronage of Mary Development School, Southwestern University-Main Campus, and Cebu Bradford School Inc. regarding each of the indicators provided by factors that impacted their academic performance. The following findings were drawn in light of the results of the data collection and statistical analysis.

PROFILE OF THE RESPONDENTS

This study provides a quantitative analysis of the influences of age, gender, parent educational level, combined family income, internet connection

sources, and student-owned devices on students' academic achievement in mathematics. It is also one of the researchers' objectives to examine their demographic profiles to determine their relationship to the extent of using math applications and websites.

Age and Gender

Individuals' exposure to technological apps varies depending on their ages and gender. As students of the twenty-first-century advance, they utilize technology more frequently than younger ones, which leads to more solidified mental models of how to use technology. Gender disparities in technology adoption, on the other hand, are less clearly demonstrated. Table 32 shows the age distribution of Grade 10 students in this study.

Table 32
Age and Gender of the Respondents

Age	Male		Female		Total	
	f	%	f	%	f	%
18	0	0.00	1	1.22	1	1.22
17	2	2.44	1	1.22	3	3.66
16	5	6.09	11	12.5	16	19.51
15	26	31.71	30	36.59	56	68.29
14	2	2.44	4	4.88	6	7.32
Total	**35**	**42.68**	**47**	**57.32**	**82**	**100.00**

The percentage breakdown of Grade 10 learners by age is shown in the table above. It shows that the ages of the respondents range from 14 years old to 18 years old. Most of the respondents have an age of 15 years old which

comprise 68.29 percent of the total population, and most of these were females. It is also revealed in the table that most of the respondents were females, with 57.32 percent or 47 respondents. Only 42.68 percent, or 35 students, were males. Furthermore, based on the data presented, the majority of respondents are female, as more females than males are enrolled in high school in the Philippines. Cruz (2019) reported that not only do females outnumber males in enrollment, but they also outperform males in academic performance. This also has implications for the educational attainment of Filipinos, which can be a barrier to achieving higher educational levels. Furthermore, this suggests that female students may have more difficulties in accessing higher levels of education than male students. In this context, interventions should also target the education system at the community level so that parents can better understand how to access higher education and ensure that their child receives an education free from gender-based barriers. Providing quality training and academic opportunities to the next generation of women cannot be over-emphasized. Finally, programs should seek to empower teachers by emphasizing and incorporating gender-sensitive topics and expectations and focusing on teachers' abilities to provide quality teaching.

Parents' Educational Attainment

Parents with greater education have high expectations for their children's achievement, and they actively push their children to have high goals for themselves as well as hold their children to high standards of success and actively push them to set high standards for themselves. It might be challenging

for students whose parents didn't go to college to decide between completing their education and living up to family expectations or duties. Table 33 presents the distribution of the respondents by their parents' highest educational attainment.

Table 33
Parents' Highest Educational Attainment

Highest Educational Attainment	f	%
College Graduate	58	70.73
College Level	13	15.85
High School Graduate	10	12.20
High School Level	1	1.22
Total	**82**	**100.00**

It is quite clear that 58 or 70.73 percent of the respondent's parents were college graduates. Parents are the primary role models for students. They have a significant influence over their children, especially during this time of pandemic, and this influences how well students perform in school. According to a U.S Education Department's National Center for Education Statistics study administered by Bird (2018), children of college-educated parents are more likely to achieve and actively participate in the class that will help them finish their degree or course. Students will perform better in class if their parents are encouraged to become active in their education. Active parents are more likely to support their children's involvement in extracurricular activities and academic interests, which will improve their self-esteem. As a result, students will benefit

from this because they will be more self-assured, have stronger communication skills, value themselves more, and have stronger self-esteem, and are less stressed. In this way, students' educational experience will be enhanced by parents and teachers cooperating more effectively.

Combined Monthly Family Income

Previous studies revealed that a family with ample resources, particularly in education, may provide more. For families with poor incomes, parents often lead busy lives with low expectations of their children and may prioritize survival over their education. Maintaining and purchasing new technology may be difficult for persons with little financial resources. Table 34 presents the respondents' combined family monthly income in this study.

Table 34
Combined Monthly Family Income of the Respondents

Combined Monthly Family Income	f	%
Above P 30, 000	28	34.15
P 25, 000 - P 30, 000	14	17.07
P 20, 000 - P25, 000	6	7.32
P 15, 001 - P 20, 000	11	13.41
P 10,001 – P15,000	5	6.10
P 10,000 and below	18	21.95
Total	**82**	**100.00**

It reveals that 18 respondents, or 21.95 percent of the population, have an income of Php 10,000 or less. Only five students believe their family income

ranges from Php 10,000 to Php 15,000 per month. With 13.41 percent of the total, 11 students believe their monthly income ranges from Php 15,001 to Php 20, 000. Six respondents have a combined income of Php 20,001 to Php 25, 000. 14 students believed that their monthly family income ranged from Php 25,001 to Php 30, 000. The total income shown in the table was more than Php 30, 0001, which gained 34.15 percent of the population or 28 respondents. A study in China by Ming et al. (2020) found that the family's income ensures basic living and educational support, such as cellphones, computers, the internet, or available technologies, which are practical steps parents can take to promote their school achievement development. Indeed, a lot of lower-income families struggle to give their children the same opportunity and level of education as wealthier families. These families frequently experience poverty, which restricts their access to high-quality, affordable education. Moreover, households with lower earnings frequently have fewer books, fewer computer resources, and less money for school supplies. According to a different study, having a poor socioeconomic status might have an impact on how families interact and cause behavioral issues that may hinder children's intellectual and academic growth. Furthermore, parents who experience financial difficulties frequently deal with anxiety, low self-esteem, and an inability to cope, which they could transmit to their children.

Internet Connectivity

The amount of time students spend online has a big impact on their academic success. Learning may become more efficient and of higher quality by

making it simpler to collaborate and transmit knowledge remotely, as well as to access resources and services. The respondents' sources of internet connectivity are displayed in Table 35.

Table 35
Source of Internet Connectivity

Source of Internet Connection	f	%
Mobile Data Only	14	17.07
Wi-Fi	63	76.83
Mobile Data and Wi-Fi	4	4.88
Pisonet	1	1.22
Total	**82**	**100.00**

Majority of respondents (76.83 percent) rely far too heavily on WiFi. This is followed by mobile data only which has 17.07 percent of the population. Moreover, 4.88 percent and 1.22 percent used mobile data and wifi and pisonet, respectively. Based on these figures, most of them have access to a reliable internet connection. With this, education continues throughout the pandemic; thus, having a stable internet connection has become a necessity for the respondents. According to Fabito et al. (2020), a strong internet connection was one of the three obstacles and difficulties students faced when learning online. With this, Hossain &Rahman (2017) emphasized the necessity for students to improve their internet use for academic purposes and further recommended that the institution provide online resources and a supportive environment for students. They also emphasized the importance of prioritizing internet access for

schools. Institutions should offer teachers and students constant internet connectivity to avoid students losing their education as a result of a brief internet outage. Educational institutions require financial support due to the rising cost of internet access and its usage. Therefore, this is where the private sector can provide internet services, and this will be supported by the government. All of these recommendations and concepts are steps in giving students, teachers, and schools access to affordable internet and educational resources.

Types of Devices Used

Students chose their preferred gadgets for various reasons, but convenience, usability, and effectiveness were all key factors. The practicality of using these devices supports students in finishing their school projects and improve their comprehension of how to do their activities. The findings of device ownership or the platforms on which the respondents accessed the websites and apps are shown in table 36 below.

It is established that the majority of respondents, about 31.71 percent of the population, exclusively utilized their smartphones to access internet resources. This also appeared in the findings of Jin and Sabio (2018), mobile device utilization has the potential to be utilized and modified for educational purposes. Additionally, 22 respondents or 26.83 percent of the population have used both smartphones and laptops in accessing math apps and websites. There were also nine respondents or 10.97 percent of the population, who have used both of their desktops and smartphones to access online materials. Only

Table 36
Types of Devices they Used

Devices	f	%
Desktop computer only	2	2.44
Smartphone only	26	31.71
Laptop only	7	8.53
Tablet Device only	1	1.22
Smartphone and Laptop	22	26.83
Smartphone, Laptop, and Tablet Devices	4	4.88
Desktop, Smartphone	9	10.97
Smartphone, Laptop, TV	1	1.22
Desktop, Smartphone, and Laptop	4	4.88
Desktop, Smartphone, Laptop, and Tablet Devices	6	7.32
Total	**82**	**100.00**

six of the respondents, or 7.32 percent of the population, however, used the four devices, such as desktops, smartphones, laptops, and tablets, to access web pages and apps related to mathematics. According to the data presented above, students have also sought to use technology that is very beneficial for their education. The study by Estira (2020) revealed that a student's degree of readiness for learning increased with the number of device types they owned. According to a related study, students' perceptions of their productivity when using mobile learning devices are positively impacted (Chase et al., 2018). These results imply that the student’s primary concerns are their educational experience and the benefits of employing technology in the classroom instead of traditional

learning environment. Additionally, they have a greater propensity to venture outside their comfort zone. As a result, emphasis is placed on how crucial it is to give the student a comfortable environment. The success of students in their academic endeavors should be supported by technology-based learning environments.

EXTENT TO WHICH THE RESPONDENTS UTILIZE MATH APPS AND WEB PAGE APPLICATIONS IN LEARNING MATHEMATICS

The introduction of mobile applications and websites has sparked a lot of interest in how they might be applied in the area of education. It makes it possible for both the teacher and the student to easily obtain the necessary course materials, monitor progress, and continue providing the resources necessary for academic success. This is in contrast to the traditional classroom setting, where a student's learning depends entirely on the teacher. By utilizing these mobile applications and websites, students can now study at their own pace, review the class material, or watch a video learning resource available online. Table 37 that follows shows the utilization of math apps and websites among respondents.

Five out of 24 statements (i.e. items 3, 10, 16, 18, and 19) which the respondents addressed as “highly utilized”. This suggests that the widespread use of these modern tools in improving academic performance, easily obtaining knowledge, learning at any time and from any location, and aiding learning are all seen as key components in accomplishing their Math activities.

Table 37
The Extent to which the respondents utilize math apps and web page applications in learning mathematics

S/N	Indicators	WM	Verbal Description
1	Math apps and websites help me get better results in my subjects.	3.18	Utilized
2	Math apps and websites help me understand the subject material more deeply.	3.13	Utilized
3	Math apps and websites make completing work in my Math subjects more convenient.	3.27	Highly Utilized
4	Math apps and websites motivate me to explore topics I may not have seen before.	3.12	Utilized
5	Math apps and websites allow me to collaborate with others easily, both on and outside of campus.	2.80	Utilized
6	I get more actively involved in my Math class using Math apps and websites.	2.90	Utilized
7	Math apps and websites help me to concentrate and think deeply about our lesson/topic.	3.07	Utilized
8	Use of Math apps and websites in class improves my engagement with the content and class	3.06	Utilized
9	Multitasking with Math apps and websites sometimes prevents me from concentrating on or doing the work that is most important.	2.84	Utilized
10	I find it useful to learn mathematics on the phone anywhere and at any time by accessing Math apps and websites.	3.27	Highly Utilized
11	The Math apps, websites, and learning activities on the phone were easy to use.	3.07	Utilized
12	Using Math apps and websites makes sophisticated concepts accessible to students.	3.09	Utilized
13	I can learn through the application independently of time and place with the help of Math apps and websites.	3.10	Utilized
14	The utilization of apps and websites increases the quality of education.	3.21	Utilized
15	Teaching Math concepts using Math apps and websites helps me evaluate my own understanding and performance.	3.13	Utilized
16	Math applications and websites are valuable tools for my study.	3.37	Highly Utilized
17	Math applications and websites can offer opportunities for communication and team-working.	3.07	Utilized
18	Math applications and websites can help me find resources related to my study.	3.26	Highly Utilized
19	Math applications and websites bring many opportunities to the learning process.	3.26	Highly Utilized
20	Math applications and websites can help me to access the course material anytime, anywhere.	3.16	Utilized
21	Math applications and websites can be an easy way to get feedback and notifications from my instructors.	3.04	Utilized
22	Math applications and websites can help me to exchange the course material with my friends.	3.05	Utilized
23	Math applications and websites can help me to manage my study.	3.16	Utilized
24	Math apps and websites help students understand math concepts better.	3.16	Utilized
	Aggregate Weighted Mean	**3.12**	**Utilized**

Legend: 3.25-4.00-Highly Utilized; 2.50– 3.24- Utilized ;1.75 – 2.49- Less Utilized ; 1.00 – 1.74– Not Utilized

The following 3 statements (i.e items 20, 23, and 24) with a higher mean of 3.16 are interpreted as “utilized”. It can be deduced that the math apps and websites served as simulations and excellent tools for assisting learners in

visualizing mathematical concepts as a starting point for more complex math concepts. Furthermore, the study of Kocakoyun & Bicen (2017) firmly attests that with the aid of mobile applications, teachers may encourage students' engagement in class activities and improve their enthusiasm and output.

Statement no. 5, on the other hand, has the lowest mean of “2.80” and is interpreted as “utilized”. This recognizes the ease of collaboration in using math apps and websites. Geer et. al (2017) reported that teachers believed that mobile learning positively contributed to student-centered learning, giving students more influence over their education than traditional teaching might have. By letting students learn at their own pace, teachers can give required one-on-one assistance and permit more advanced students to go on to more difficult courses.

LEVEL OF MATHEMATICS ACHIEVEMENT OF THE RESPONDENTS IN ARITHMETIC SEQUENCE AND SERIES

One of the primary objectives of assessment in mathematics education is to provide information that may be utilized to make judgments about or enhance the teaching of the subject matter. Teachers need to assess further what each student already understands and what, with the right help, might be within their reach. Table 38 that follows illustrates the Math achievement of the respondents.

It reflects that 43.90 percent, or the majority of survey participants, got a Very Satisfactory rating. A satisfactory level of achievement was attained by 23 students, or 28.05 percent of the total population, while 12 respondents, or 14.63 percent, received fairly satisfactory ratings. Additionally, 12 percent of the total

Table 38
Level of mathematics achievement of the respondents in Arithmetic Sequence and Series

Descriptive Rating	Numerical Range	Frequency	Percentage
Outstanding	25 - 30	10	12.20
Very Satisfactory	19 - 24	36	43.90
Satisfactory	13 - 18	23	28.05
Fairly Satisfactory	7 - 12	12	14.63
Poor	0 - 6	1	1.22
Total		82	100.00
Mean		18.79	
Standard Deviation		5.29	

students, or 10 students, succeeded to the Outstanding level. However, there was only 1.22 percent of the total respondents received an extremely low score. This demonstrates that majority of the students passed the achievement test. This suggests that participants were able to understand the subject matter because many of them were able to pass the test. Most research emphasizes using mobile applications to give students a convenient and personalized game-based learning experience will increase their aptitude and interest in mathematics (Yeh et al. 2019). With the help of these websites, anyone can explore supplementary resources for the lessons and video tutorials, interactive tests, practice exams, play games, learn arithmetic through enjoyable activities, and more which can all be accessed by students using their own devices.

TEST OF SIGNIFICANT RELATIONSHIP BETWEEN THE PROFILE OF THE RESPONDENTS AND THEIR UTILIZATION OF MATH APPS AND WEBSITES

This section provides the relationship between the respondent's demographic profiles and their utilization of math applications and websites presented in table 39 below. Whether or not each profile of the students has a relationship with the utilization of the math apps and websites, will be bared in the following discussions.

Table 39
Test of Significant Relationship between the profile of the Respondents and their Utilization of Math Apps and Websites

Variables	x^2	p-value	Decision on Ho	Interpretation
Age	7.759	0.804	Accept Ho	Not significant
Gender	3.389	0.335	Accept Ho	Not significant
Highest Educational Attainment	3.253	0.953	Accept Ho	Not significant
Combined Income	8.707	0.892	Accept Ho	Not significant
Source of Internet	8.577	0.477	Accept Ho	Not significant
Device used	23.025	0.814	Accept Ho	Not significant

*significant if p< 0.05

Between the age of the respondents and the utilization of math apps and websites, it was revealed that the p-value is 0.804, which is not less than the level of significance of 0.05, therefore, the null hypothesis is accepted. This

means that there was no significant relationship between age and the utilization of math apps and websites.

Between the gender of the respondents and the utilization of math apps and websites, it was revealed that the p-value is 0.335, which is not less than the level of significance of 0.05, therefore, the null hypothesis is accepted. This means that there was no significant relationship between gender and the utilization of math apps and websites.

Between the parent's highest educational attainment of the respondents and the utilization of math apps and websites, it was revealed that the p-value is 0.953, which is not less than the level of significance of 0.05, therefore, the null hypothesis is accepted. This means that there was no significant relationship between the parent's highest educational attainment and the utilization of math apps and websites.

Between the combined income of the respondent's parents and the utilization of math apps and websites, it was revealed that the p-value is 0.892, which is not less than the level of significance of 0.05, therefore, the null hypothesis is accepted. This means that there was no significant relationship between the combined income of the parents and the utilization of math apps and websites.

Between the source of the internet connection among respondents and the utilization of math apps and websites, it was revealed that the p-value is 0.477, which is not less than the level of significance therefore, the null

hypothesis is accepted. This means that there was no significant relationship between the source of the internet connection and the utilization of math apps and websites.

Between the device used by the respondents and the utilization of math apps and websites, it was revealed that the p-value is 0.814, which is not less than the level of significance therefore, the null hypothesis is accepted. This means that there was no significant relationship between the device used by the respondents and the utilization of math apps and websites.

It has been difficult for the Philippines to adjust to this sudden shift in the educational environment amid the pandemic. In the new normal educational environment, mobile devices like smartphones are a great help due to their variety of capabilities, thus optimizing their use as learning potential. Another study by Cleofas & Rocha (2021) found that low-income children lack access to laptops and have limited internet connections. According to Beng et al. (2020), increasing use of technology during the pandemic may have improved students' social and cognitive health. In contrast, a lack of technology and connectivity for online learning has been associated with higher stress levels in students (Baticulon et al., 2021).

TEST OF SIGNIFICANT RELATIONSHIP BETWEEN THE PROFILE OF THE RESPONDENTS AND THEIR MATHEMATICS ACHIEVEMENT

Table 40 shows the relationship between the demographic profile of the respondents and the math achievement of respondents in Arithmetic Sequence and Series.

Table 40
Test of Significant Relationship between the profile of the Respondent's and their Mathematics Achievement

Variables	x^2	p-value	Decision on Ho	Interpretation
Age	12.073	0.739	Accept Ho	Not significant
Gender	5.690	0.223	Accept Ho	Not significant
Highest Educational Attainment	16.675	0.162	Accept Ho	Not significant
Combined Income	42.060	0.003	Reject Ho	Significant
Source of Internet	16.054	0.189	Accept Ho	Not significant
Device used	53.594	0.074	Accept Ho	Not significant

*significant if p< 0.05

Between the age of the respondents and the math achievement, it was revealed that the p-value is 0.739, which is not less than the level of significance of 0.05; therefore, the null hypothesis is accepted. This means that there was no significant relationship between age and math achievement.

Between the gender of the respondents and the math achievement, it was revealed that the p-value is 0.223, which is not less than the level of significance

of 0.05 ; therefore, the null hypothesis is accepted. This means that there was no significant relationship between gender and math achievement.

Between the parent's highest educational attainment of the respondents and the math achievement, it was revealed that the p-value is 0.162, which is not less than the level of significance of 0.05, therefore, the null hypothesis is accepted. This means that there was no significant relationship between the parent's highest educational attainment and the math achievement.

Between the combined income of the parent's respondents and the math achievement, it was revealed that the p-value is 0.003, which is less than the level of significance of 0.05; therefore, the null hypothesis is rejected. This means that there was a significant relationship between the combined income of the parents and math achievement.

Between the source of the internet connection among respondents and the math achievement, it was revealed that the p-value is 0.189, which is not less than the level of significance of 0.05; therefore, the null hypothesis is accepted. This means that there was no significant relationship between the source of the internet connection and math achievement.

Between the device used by the respondents and the math achievement, it was revealed that the p-value is 0.074, which is not less than the level of significance, of 0.05; therefore, the null hypothesis is accepted. This means that there was no significant relationship between the device used by the respondents and the math achievement. Further investigation demonstrated that none of

these factors, including age, gender, parents' greatest level of education, and the type of device the students were using, affected their academic performance. However, the data concerning their parent's combined income significantly differ. Parental attitudes toward education are correlated with family socioeconomic status (SES), which has a major impact on children's academic progress (Hascoët, et al. 2021). The findings of the same study demonstrated that students' mathematics achievement was influenced by their mathematics self-concept, the socioeconomic and educational context of their families, and their parent's expectations for their academic success.

TEST OF SIGNIFICANT RELATIONSHIP BETWEEN THE UTILIZATION OF MATHEMATICAL APPS AND WEBSITES OF THE RESPONDENTS MATHEMATICS ACHIEVEMENT

Table 41 shows the test of the relationship between the utilization of math apps and websites and the math achievement in Arithmetic Sequence and Series.

Table 41
Test of Relationship between the utilization of the mathematical apps and websites and mathematics achievement of the respondents

Variable	x^2	p-value	Decision on Ho	Interpretation
Utilization Level Vs. Math Achievement	21.613	0.042	Reject Ho	Significant

*significant if p< 0.05

It was revealed that the p-value is 0.042, which is less than the level of significance ; therefore, the null hypothesis is rejected. This means that there is a significant relationship between the utilization of math apps and websites and math achievement in Arithmetic Sequence and Series. This implies that the utilization of math apps and websites influences the math achievement of the students. Additionally, it demonstrates how Math Apps considerably enhance students' gained skills and knowledge, which in turn impacts how well students perform in mathematics in this New Normal Education. This agrees with the results of the study conducted by Barrientos (2021) that Math Apps significantly affect the student’s performance in the subject. Moreover, it also is supported by the study of Cantonjos and Labo (2020) that Math Apps are very effective in improving the performance of students in a mathematics subject.

Chapter 3

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

This chapter presents the summary, findings, and conclusion of the study. This also contains the recommendations, which are based on the results and findings of the study, which aimed to improve the utilization of math apps and websites and the math achievement of students.

SUMMARY

This study aimed to determine the utilization of mathematical apps and websites and math achievement in Arithmetic Sequence and Series in three different schools, namely Cebu Bradford School Inc., Southwestern University PHINMA, and Patronage of Mary Development School. The profiles of the respondents were used to help interpret the results of the study. Respondents were asked to answer the survey questionnaire describing the utilization of mathematical apps and websites. To describe their mathematics achievement, a standard test was given about arithmetic sequence and series.

Data gathered were treated statistically using frequency count, percentage, and weighted mean to describe the characteristics inherent to the respondents. A test on the relationship between the utilization of mathematical apps and websites and the mathematical achievement of the respondents was conducted using the Pearson r and Chi-square test to arrive at an inference based on the evidence presented by the data.

FINDINGS

The following findings were arrived at based on the results of the data that were gathered and treated statistically.

Most of the respondents from all three schools were 15 years old. It was also found that most of the respondents were Female. Only in Cebu Bradford School Inc. had most of the respondents been males. Under the parent's Highest Educational Attainment, most of the respondents have parents who are college graduates. It was also found that most of the respondents' monthly family income is above 30,000 pesos; however, in the Patronage of Mary Development School (PMDS), most of the family's monthly income is 10,000 pesos or below. Most of them used Wifi as their source of internet connection, and most of the respondents from the PMDS used smartphones to do online work. Smartphones and laptops were common among the respondents from CBSI and SWU PHINMA.

The utilization of mathematical apps and websites was measured using 24 statements. The overall mean of the utilization of mathematical apps and websites was interpreted as utilized. In terms of math achievement, most of the respondents from PMDS and SWU PHINMA got a very satisfactory rating. Most of the respondents from CBSI got a satisfactory rating.

Using the test of the relationship of the identified profile variables and utilization of mathematical apps and websites, it was found that there was no significant relationship between age, parent's highest educational attainment, family combined monthly income, source of internet connection, and device

used, and the utilization of math apps and websites. There was a significant relationship between the gender and the utilization of math apps and websites in the CBSI. At the same time, there was no significant relationship between the gender and the utilization of math apps and websites with rest of the two schools, namely PMDS and SWU PHINMA. The overall data taken by adding all the respondents from all schools posed no significant relationship between all the demographic variables and the utilization of math apps and websites.

With the overall data, it was found that there was no significant relationship between age, gender, parent's highest educational attainment, source of internet connection, the device used, and math achievement. Only the combined family monthly income has a significant relationship with the math achievement based on the overall data. In Cebu Bradford School, there was a significant relationship only between the source of internet connection and the math achievement. In SWU PHINMA, there was a significant relationship between age and family combined monthly income and math achievement only. In PMDS, there was a significant relationship only between the family's combined monthly income and the math achievement.

Lastly, there was no significant relationship between the utilization of math apps and websites and the math achievement in arithmetic sequence and series among all schools. However, there was a significant relationship between the utilization of math apps and websites and math achievement in arithmetic sequence and series using the combined overall data of the three schools.

CONCLUSIONS

Based on the findings of the study, it was concluded that the utilization of math apps and websites poses an influence on the achievement of students in arithmetic sequences and series.

RECOMMENDATIONS

In light of the findings of the study, it is highly recommended that the proposed intervention plan through the use of Strategic Implementation Material (SIM) shall be adopted to improve the utilization of mathematical apps and websites and the math achievement of students in the least mastered competency/ies.

Other factors shall be looked into per school so that the data will be more reliable and valid. This may include the proportion of respondents to be considered, the mode of administering the test or survey, and the time allotted for completing the survey and test.

Lastly, administrators, curriculum planners, and teachers must create a centralized resource center, including a list of resources and guidelines which students can use to supplement their learning of specific content.

Chapter 4

OUTPUT OF THE STUDY

This chapter presents the proposed intervention plan through the Strategic Intervention Material, which is used in remedial classes to emphasize enhancing learners' least-mastered skills. Moreover, this also aims to enrich further the mathematical achievement of Grade 10- students in the identified private institutions in Cebu, namely the Patronage of Mary Development School, Southwestern University-Main Campus, and the Cebu Bradford School Inc. The corresponding SIM is based on the study's results, particularly on the competencies where students have the lowest rating.

STRATEGIC INTERVENTION MATERIAL

Rationale

As of March 11, 2020, the World Health Organization (WHO) proclaimed coronavirus (COVID-19) an international concern for public health which labeled the new global pandemic outbreak.

As a preventative step against the spread of the coronavirus disease, the majority of educational systems around the world have shifted to remote learning methods. It cannot be denied that along with these challenges of a new modality of learning, some students struggle to grasp some key concepts, which negatively affects their performance and, thus, inevitably, their ability to improve their mathematics skills.

Amidst the pandemic, no students will be left behind is still one of the Department of Education's goals. As a result, the learners' deficient performance in growing their least-mastered abilities is addressed by the competency-based strategic intervention resources. Intervention resources are currently highly valued as instruments in the Philippine educational system for improving students' subpar performance. These are strategically planned and created for teaching remediation for underachievers in the topic ; SIM, or Strategic Intervention Material is a teaching tool used in instructional methods to raise student involvement and, as a result, their level of knowledge.

It is one of the methods conducted by the Department of Education used to solve problems to improve the academic performance of learners who do poorly in mathematics. The DepEd Memo No. 117, series of 2005, entitled “Training Workshop on Strategic Intervention Materials (SIMs) for Successful Learning” , equips secondary math instructors to gear up for SIM preparation.

Objectives

With the implementation of this plan, it is expected that the following objectives will be achieved:

A. To increase the mathematics achievement of the students, especially on the least mastered competencies
B. To create an Open Educational Resource (OERs) which includes a list of online resources

C. To provide an avenue for the students to display their knowledge and strengthen them using the SIM and become competent individuals
D. To serve as a model to teachers in creating their Strategic Intervention Materials (SIMs)
E. To identify a solution to students' weak arithmetic sequence proficiency.

Scheme of Implementation

The methodologies of this proposal are carefully developed to produce a reliable, valid output that can be generalized. The objectives of this strategic intervention material will be presented to the corresponding principals, subject coordinators, and mathematics teachers of Patronage of Mary Development School, Southwestern University-Main Campus, and the Cebu Bradford School Inc. A printed copy of the proposed activities and matrix will be distributed to the respective Mathematics 10 teachers. Thus, the evaluation of the material follows.

CEBU BRADFORD SCHOOL INC.

MATHEMATICS LEARNING DEVELOPMENT PLAN

Areas of Concern	Objectives	Strategies	Persons Involved	Budget	Source of Budget	Time	Expected Outcome	Actual Accomplishment	Remarks
A. Strengthen instrumentation capabilities for student's least mastered skill/s	give students a platform to demonstrate their expertise and help them strengthen their least mastered skill using the SIM To improve teachers' proficiency in adopting and implementing SIM	Implement SIMs as part of the Remediation Program Develop and maintain, through training and workshop seminars, new expertise in making Strategic Intervention Materials (SIMs) Encourage instructors to create remediation programs in accordance to evaluation results	Administrators and Mathematics coordinators and subject teachers	P 30,000	School MOOE	One Academic Year	Objectives and associated strategies/ actions are implemented An increased competency of teachers in conducting Remediation Programs Strategic Intervention Materials (SIMs) Implementation schedule for Remediation		
B. Utilization of Math Apps and Websites	Devise an educational e-learning material and remote delivery methods to support the utilization of math apps and websites with reduced costs and increased accessibility Improve productivity and efficiency	Make use of new sources of openly available information, including from multimedia, mobile applications, web sources Conduct mobile application training/s on teachers and JHS students Bridge gap and connect IT experts to the learners by integrating mobile application development in the curriculum	IT personnel, Website or mobile application developer, Administrators, Librarians, Teachers, and JHS students	P 50,000	School MOOE	One Academic Year	Implementation of educational e-learning materials Development of educational apps that accords to the guidelines (Usability, Accessibility, Compatibility, & Cost effectiveness) School subscription to valuable educational websites Integration of mobile application development in the JHS curriculum		

SOUTHWESTERN UNIVERSITY - MAIN CAMPUS

MATHEMATICS LEARNING DEVELOPMENT PLAN

Areas of Concern	Objectives	Strategies	Persons Involved	Budget	Source of Budget	Time	Expected Outcome	Actual Accomplishment	Remarks
A. Improving Math Achievement	To increase the competency of teachers in SIM implementation and creation To increase the math achievement of students	Conduct seminars and pieces of training for teachers crafting Strategic Intervention Materials (SIMs) Encourage teachers to use the assessment scores as the basis for creating or improving remediation plans Conduct workshops on creating the SIMs for all the competencies in Math Train teachers on how to implement the SIMs Orient teachers on the conduct of the Remediation Program using the SIMs Implement SIMs as part of the Remediation Program or Enrichment Programs	Administrators and Math Teachers	P 200,000	School MOOE	One year	An increased competency of teachers in conducting Remediation or Enrichment Programs Strategic Intervention Materials (SIMs) Implementation schedule for Remediation or Enrichment Programs		
B. Utilization of Math Apps and Websites	To create Open Educational Resources (OERs)	Identification of Teachers and Related People who will be part of the team who will work on the OERs	Administrators, Librarians, Computer Experts, IT personnel, and math teachers	P 200,000	School MOOE	One semester	List of Open Educational Resources (OERs) and Apps License for Apps		

		Conduct pieces of training on creating OERs – guidelines and actual resource center Actual preparation and creation of the OERs and list of apps Creation of guidelines for using the OERs and Apps							

PATRONAGE OF MARY SCHOOL DEVELOPMENT

MATHEMATICS LEARNING DEVELOPMENT PLAN

Areas of Concern	Objectives	Strategies	Persons Involved	Budget	Source of Budget	Time	Expected Outcome	Actual Accomplishment	Remarks
A. Improving Math Achievement	To increase the competency of teachers in SIM implementation and creation To increase the math achievement of students	Conduct seminars and trainings to teachers crafting of Strategic Intervention Materials (SIMs) Encourage teachers to use the assessment scores as basis in creating remediation plans Conduct writeshop in creating the SIMs for all the competencies in Math Train teachers on how to implement the SIMs Orient teachers on the conduct of the Remediation Program using the SIMs Implement SIMs as part of the Remediation Program	Administrators and Teachers	P 50,000	School MOOE	One year	An increased competency of teachers in conducting Remediation Programs Strategic Intervention Materials (SIMs) Implementation schedule for Remediation		

B. Utilization of Math Apps and Websites	To create an Open Educational Resources (OERs)	Identification of Teachers and Related People who will be part of the team who will work on the OERs Conduct trainings on creating OERs – guidelines and actual resource center Actual preparation and creation of the OERs and list of apps Creation of guidelines in using the OERs and Apps	Administrators, Librarians, Computer Experts, IT personnel and Teachers	P 100,000	School MOOE	One semester	List of Open Educational Resources (OERs) and Apps License for Apps		

Strategic Intervention Material - Cebu Bradford School Inc.

STRATEGIC INTERVENTION MATERIAL

Guide card

Least mastered skills: Determining the nth term of an arithmetic sequence, finding the sum of an Arithmetic Sequence, and solving problems involving arithmetic sequence.

Sub-tasks:

- illustrates an arithmetic sequence
- finds the sum of the terms of a given arithmetic sequence
- solves applied problems, including finding the number of terms given the sum and other necessary information

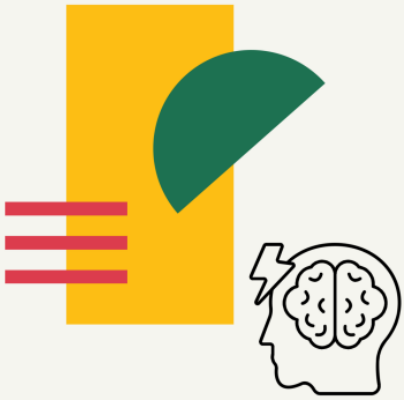
Question to Ponder!

What have you observe in the following pictures?

Overview

Brief Introduction

How are arithmetic sequences used to model and solve many mathematical ideas and real life situations?



ARITHMETIC SEQUENCE

A sequence is a set of numbers that follow a pattern where all numbers are related by the same common difference. The common difference must be an addition or subtraction constant. Each number in the sequence is a term of the sequence.

An arithmetic sequence is a list of terms separated by a fixed number i. e the common difference, d, which is the number added to each consecutive term in an arithmetic sequence.

Example

Find the next 3 terms and give the pattern.

4, 7, 10, 13, 16, ___, ___, ___...

Solution: Get the difference between two consecutive terms.

7-4=3	13-10=3
10-7=3	16-13=3

The common difference in this pattern is +3. Based on this information, you can say that the next 3 terms will be 19, 22, and 25.

Activity 1: I'll Tell You What You Are!

State whether the given is an arithmetic sequence or not.

1.) 5, 9, 12, 16, …
2.) 15, 13, 11, 9, …
3.)15, 25, 45, 85, 165,…
4.) 8.2, 8.5, 8.8, 9.1 …
5.) 1, 1/2 , 1/3 , 1/4 , 1/5 , …

Activity 2: Spot the Common Difference!

Matching Type. Match the common difference of each arithmetic sequence.

Column A	Column B
1.) 5, 4, 3, 2, 1, …	a. 6
2.) -6 , -5, -4, -3, …	b. 1/2
3.) 3, 9, 15, 21, …	c. 1
4.) -8, -3, 2, 7, …	d. -5
5.)1,3/2,2,5/2,…	e. -1

Activity 3: Mind the Gap!

Find the missing terms.

1.) 61, 54, 47, 40, _____ , _____, _____, …

2.) _____ , _____, 29 , 41, 53, 65, …
3.) _____, _____ , 233 , 283, 333, 383, …
4.) 88, 80, 72, _____ , _____ , _____, …
5.) _____ , _____ , 98, 123, 148, 173, …

GENERAL TERM OF AN ARITHMETIC SEQUENCE

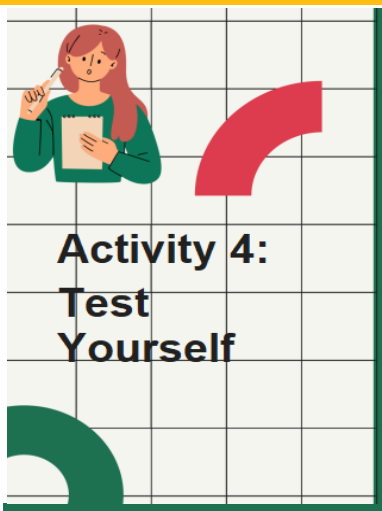
Remember!

If you want to find a term in an arithmetic sequence that is far into the pattern, there is a formula to use.

$$a_n = a_1 + (n - 1)(d)$$

Where:

a_n = the answer term you are looking for in the sequence
a_1 = the first term in the sequence
n = the ordinal number term you are looking for in the sequence
d = the common difference



Activity 4: Test Yourself

Answer the following questions.

1.) Find the common difference for the arithmetic sequence 4,8, 12, 16, …
2.) Find the common difference and the 15th term of the sequence 3, 11, 19, 27, 35, …
3.) Write the 3rd and 5th term in which the 4th term is 9 and the common difference is 2.

GENERAL TERM OF AN ARITHMETIC SEQUENCE

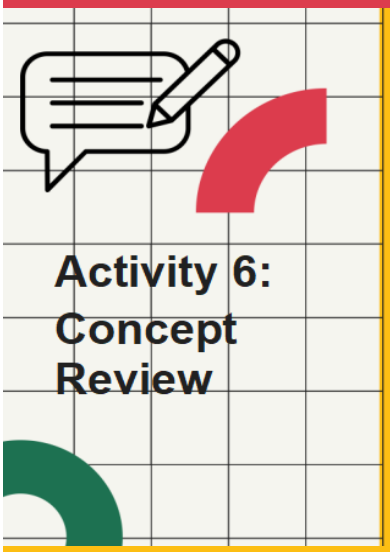
Example 1 : 23, 18, 13, 8, … find the 63rd term.

an = a1 + (n – 1)(d)		Use the formula	
an = 23	+ (63 – 1)(-5)	Substitute a1= 23	, n= 63, d=-5
an = 23	+ 62(-5)	Subtract within parenthesis	
an = 23	+ (-310)	Multiply and add	
an = -287		Simplify	

GENERAL TERM OF AN ARITHMETIC SEQUENCE

Example 2: Find the 9th term of the arithmetic sequence whose first term is 6 and whose common difference is 8.

$$an = a1 + (n - 1)(d)$$
$$an = 6 + (9 - 1)(8)$$
$$an = 6 + (8)(8)$$
$$an = 6 + (64)$$
$$An = 70$$



Activity 6: Concept Review

Find the indicated term of the following arithmetic sequence.

1.) a28 when a1 = 3 ; d= 5
2.) a50 when a1 = -7 ; d= -13
3.) a20 when a1 = 42 ; d= 32
4.) a70 when a1 = -32 ; d= 10
5.) a16 when a1 = 9 ; d= -6

SUM OF AN ARITHMETIC SEQUENCE

To find the sum of an arithmetic sequence, we have the formula:

$S_n = n2\,(a_1 + a_n)$ or $S_n = n2\,[2a_1 + (n - 1)d]$

where: S_n = sum of the arithmetic sequence

n = number of terms of an arithmetic sequence

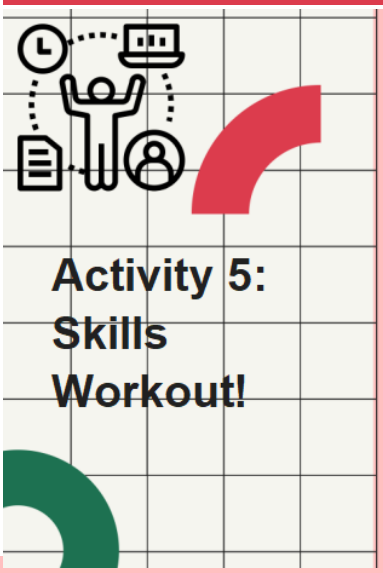
a_1 = first term of an arithmetic sequence

a_n = indicated term of an arithmetic sequence

SUM OF AN ARITHMETIC SEQUENCE

Illustrative example:

In a hardware center shop, paint in metal cans are displayed in a triangle. The 1st row is 1 can, 2nd row is 3 cans, 3rd row is 5 cans, 4th row is 7 cans, and so on. How many cans are there if there are 20 rows?



Activity 5: Skills Workout!

Find the required term of the given arithmetic sequence.

1.) 11, 13, 15, 17, … Find the 85th term

2.) 25, 22, 19, 16, … Find the 50th term

3.) a1 = -15 d = +4 Find the 71st term

4.) an = 255 d = +3 a1 = 36 Find n.

SUM OF AN ARITHMETIC SEQUENCE

Solution:

First, find the 40th term.

$a_n = a_1 + (n - 1)(d)$

$a_{40} = 2 + (40 - 1)\ 3$

$a_{40} = 2 + (39)\ 3$

$a_{40} = 2 + 117$

$a_{40} = 119$

Next, find the sum.

$S_n = \frac{n}{2}(a_1 + a_n)$

$S_n = \frac{40}{2}(2 + 199)$

$S_n = 20\ (121)$

$S_n = 2,\ 420$

SUM OF AN ARITHMETIC SEQUENCE

The sum of the first n terms of an arithmetic sequence denoted by Sn and it called the nth partial sum can be found without having to add up all the terms. In finding the total number of cans in the problem, we have the formula.

Given: n= 20 , d= 2

$$S_n = \frac{n}{2}(a_1 + a_n)$$

$$S_{10} = \frac{20}{2}(1 + 20)$$

Therefore, there are 210 cans in the display.

Activity 8: Problem Solving

Answer the following problems.

1. Rai has taken a job with initial pay of Php 35, 000 and an annual increase of P30, 000. a. What will be his salary in his 6th year? b. How much money in total will Rai have earned after 6 years?

2.) Sophia is buying a prom dress. She agrees to make a Php 1, 800 payment and increase the payment to Php 200 per week. a. What will be her payment in the 9th week? b. How much money in total will Sophia have paid after 10 weeks?

Activity 7: Do This!

Solve the following exercises.

1.) Find the sum of the first 20 terms of the arithmetic sequence: 4, 10, 16, 22, …

2.) Find the sum of the first 50 terms of the arithmetic sequence: -10, -6, -2, 2, …

3.) Find the sum of the first 60 positive even integers.

4.) Find the sum of all the integers from 1 to 100.

5. Find the sum of the first 20 terms of the arithmetic sequence: -15, -9, -3, 3, …

ENRICHMENT

Mastery Points!
Can you,

- Distinguish example of arithmetic sequence?
- Identify the common difference of an arithmetic sequence?
- Find the missing terms of an arithmetic sequence?
- Find the nth term and the sum of the following arithmetic sequence?
- Solve problems involving Arithmetic sequence?

Enrichment Remember Me?

Determine whether each sequence is arithmetic or not. If the sequence is arithmetic, give its common difference.

1.)1,4,9,16,…
2.) -21, -18, -15, -12, …
3.) 97, 86, 75, 64, …
4.) 34, 27, 20, 13, 6…
5.) -50, -44, -38, -32, -26…

Assessment 1: Missing You

Find the next 3 missing terms.

1.) 3, 7, 11, 15, _____, _____, _____ , …
2.) 1, 74, 52, 134, _____, _____, _____, …
3.) 104, 113, 122, _____, _____, _____, …
4.) 0.45, 0.38, 0.31, _____, _____, _____, …
5.) 25, 28, 51, _____, _____, _____ , …

Assessment 3: Level Up What You've Learned!

1. A baker has 400kg of flour on the first day of the month and uses no flour that day. How much will he have at closing time on the 17th day of the month, if he uses 24kg each day? Show your calculations using the formula for an of an arithmetic sequence.

Assessment 2: What I have Learned So Far

Answer the following.

1. A gardener buys a plant that is 12cm in height. Each week after that the plant grows 10cm. Note: The plant is 12cm high at the beginning of the first week.
   a. What will be the height of the plant at the beginning of the 1st, 2nd, 3rd, 4th, and 5th weeks?
   b. How long is the plant after 3 months?

2.) The ground floor of a building is 6 meters in height and each floor above it is 4 meters in height.
   1.Taking the ground floor as floor one. List the height of the building on each of the first five floors.

List of Online Resources for Additional Exploration

- https://www.calculator.net/number-sequence-calculator.html?afirstnumber=2&afactor=5&athenumber=20&ctype=1&x=35&y=13
- https://www.cuemath.com/algebra/arithmetic-sequence/
- https://www.youtube.com/watch?v=KXxJCRXMjc8&ab_channel=MathTeacherGon
- https://www.youtube.com/watch?v=BA0uxIaMtMs&ab_channel=BrianMcLogan
- https://www.youtube.com/watch?v=WgeSmqzmP7k

Reference

IMath K to 12 Curriculum Series, Habijan, E., & Insigne, L.(2020) by IMath Publishing Inc.

Answer Key

Activity 4: Test Yourself

1. d = 4
2. d = 8 ; a15 = 115
3. 3, 5, 7, 9, 11

Activity 5: Skills Workout!

1. a85= 179
2. a50 = 172
3. a71 = 265
4. n = 74

Activity 6: Concept Review

1. a28 = 138
2. a50 = -644
3. a20 = 650
4. a70 = 658
5. a16 = -81

Answer Key

Activity 1: I'll Tell You What You Are

1.	No
2.	Yes
3.	No
4.	Yes
5.	No

Activity 2: Spot the Common Difference!

1.	c
2.	e
3.	a
4.	d
5.	b

Activity 3: Mind the Gap!

1. 33, 26, 19
2. 5, 17
3. 133 , 183
4. 64, 56, 48
5. 48, 73

Answer Key

Activity 7: Do this!	Activity 8: Problem Solving	Enrichment: Remember Me?
1. S20 = 1, 220 2. S50 = 5, 900 3. S60 = 3, 660 4. S100 = 5, 050 5. S20 = 840	1. a. Php 185, 000 b. Php 660, 000 2. a. Php 3, 400 b. Php 3, 600	1. No 2. Yes; d= 3 3. Yes; d= 11 4. Yes ; d = 7 5. Yes; d= 6

Answer Key

Assessment 1: Missing You	Assessment 2: What I Have Learned So Far?	Assessment 3: Level-Up What You've Learned!
1. 19, 23, 27 2. 4, 19/4, 11/2 3. 131, 140, 149 4. 0.24, 0.17, 0.10 5. 64, 77, 90	1. a. 12, 22, 32, 42, 52, … b. 122 cm 2. a. 6, 10, 14, 18, 22	1. a17 = 400 - (17 - 1) (24) = 16 Therefore, the baker will have 16kgs of flour at closing time on the 17th day of the month.

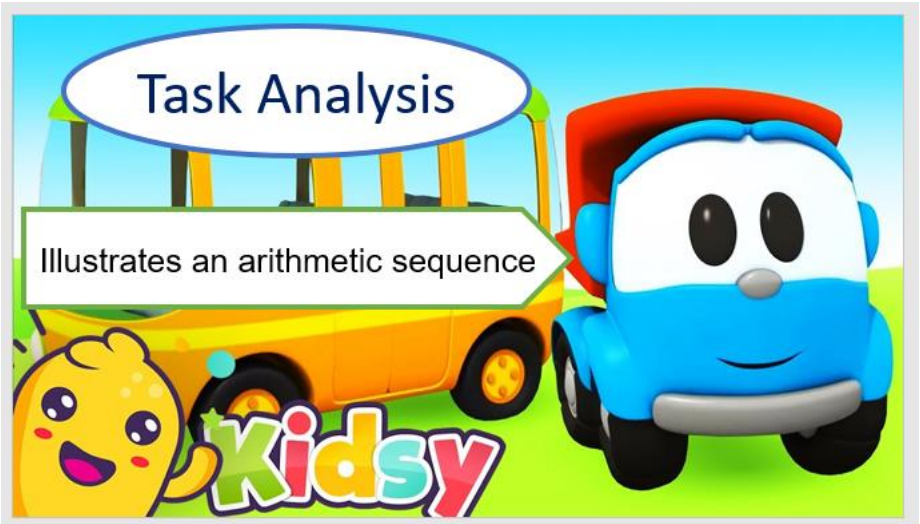
How do I perceived the Activities?

Score:

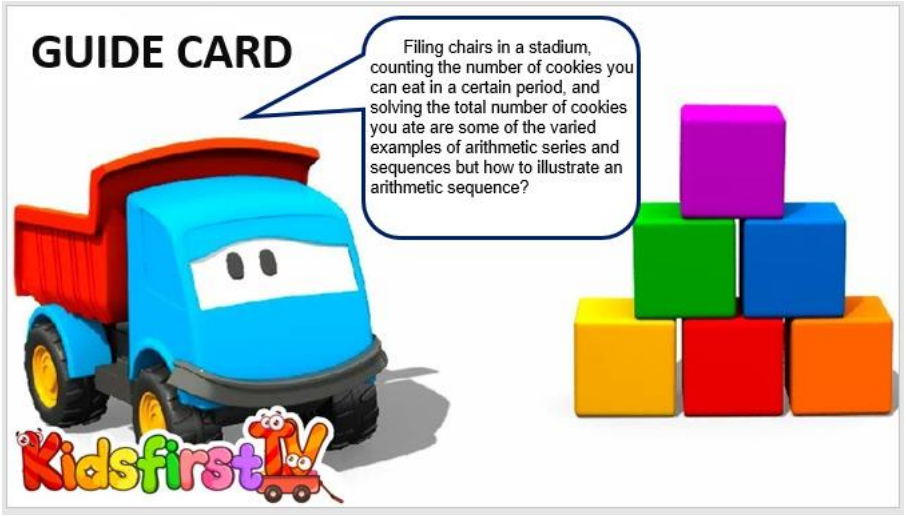
	Yes	No
I can find the sum of an Arithmetic Sequence		
I can now determine the nth term of an arithmetic sequence		
I can now solving problems involving arithmetic sequence		

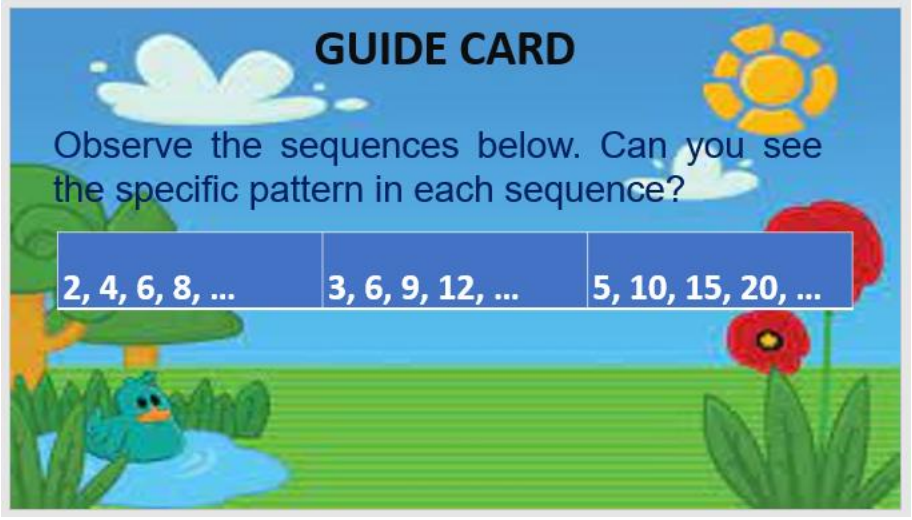
My Score Means	Score
I did great and fully understood the lesson.	38-55
I did good and partially understood the lesson. I still need to review.	19-37
I need to go back with the lesson because there are still areas I need to work on. I will not give up.	1-18

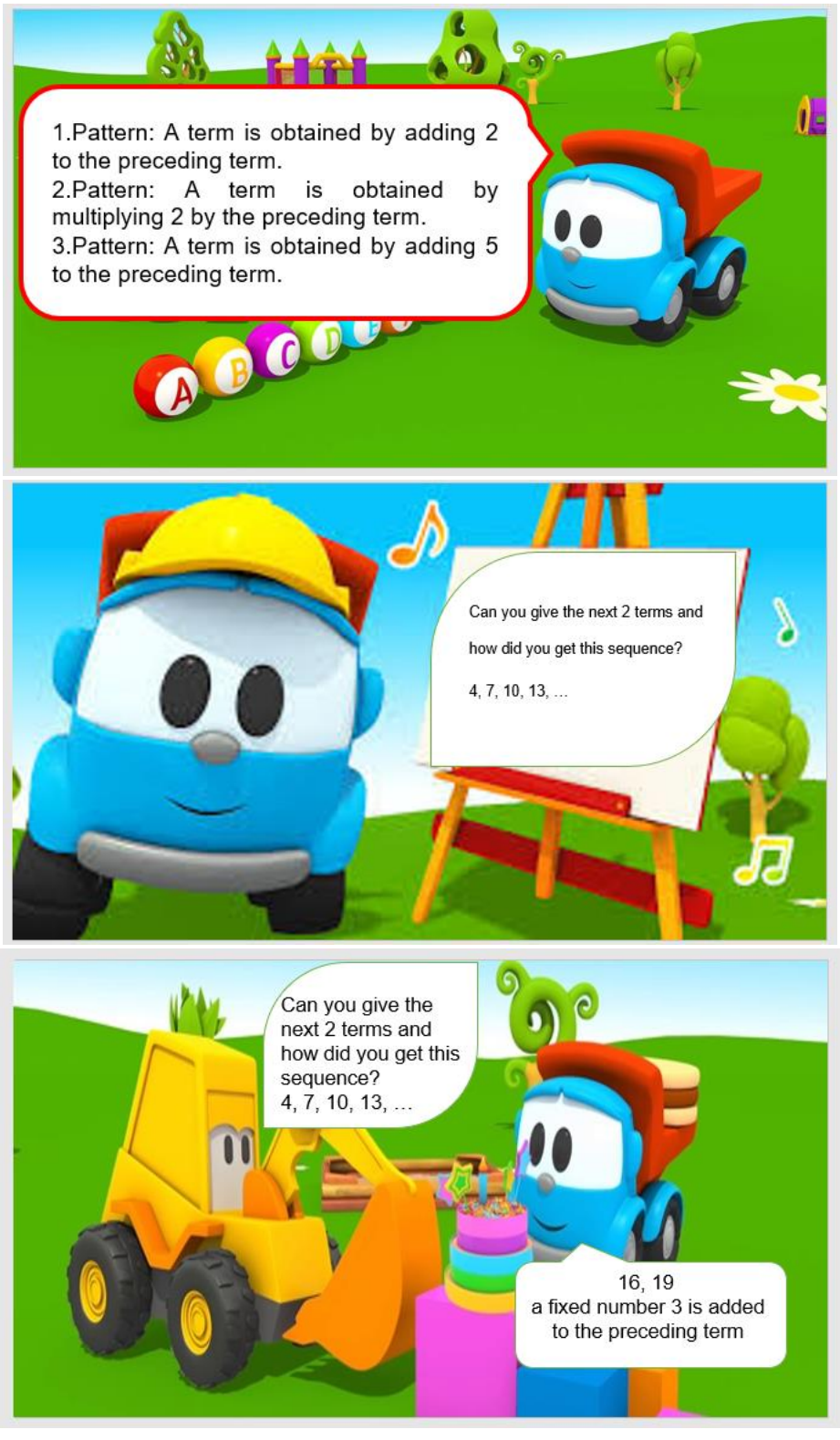
Strategic Intervention Material - Southwestern University PHINMA



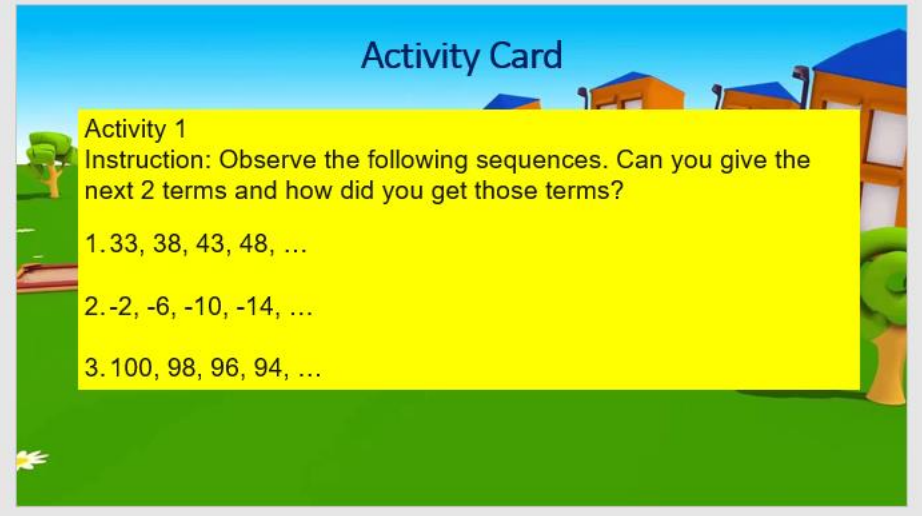

GUIDE CARD
What do you think Leo, can you give me examples of an arithmetic sequence in real life?
Hmmm... Let me try.
Kidsfirst TV

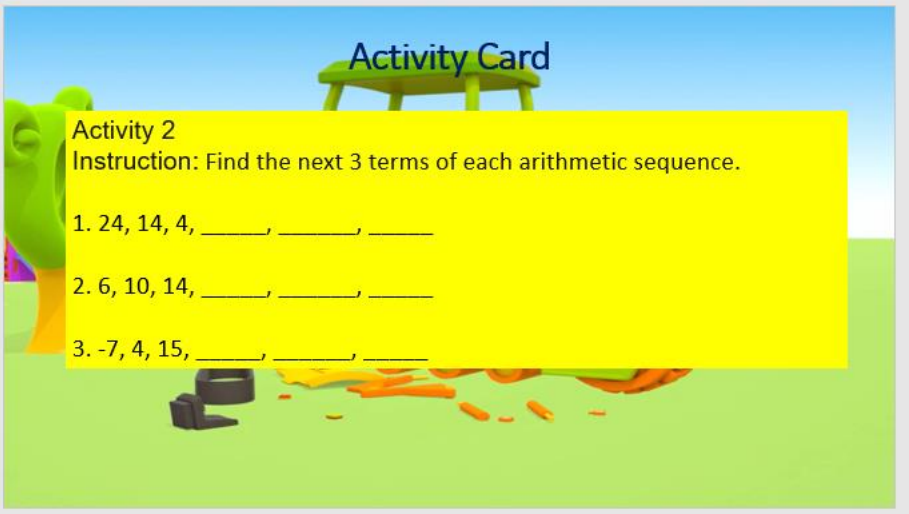

GUIDE CARD
Filing chairs in a stadium, counting the number of cookies you can eat in a certain period, and solving the total number of cookies you ate are some of the varied examples of arithmetic series and sequences but how to illustrate an arithmetic sequence?
Kidsfirst TV

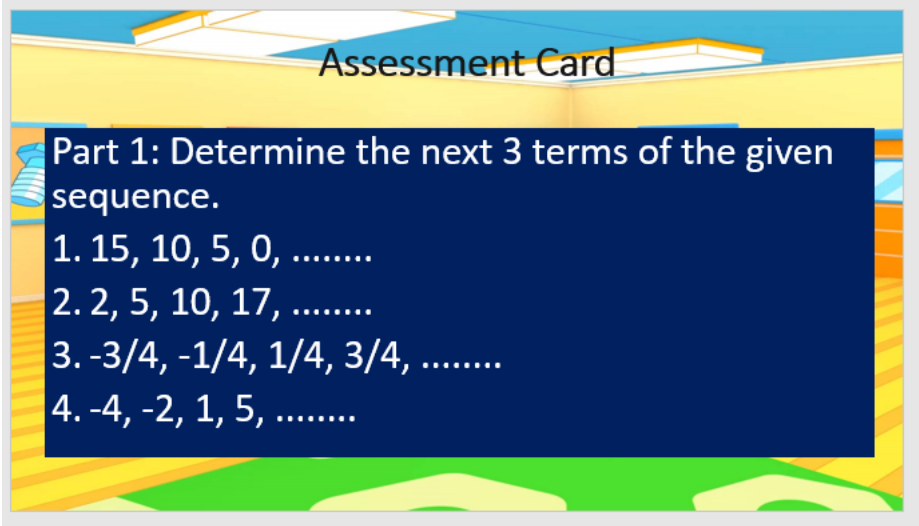

GUIDE CARD
Observe the sequences below. Can you see the specific pattern in each sequence?
2, 4, 6, 8, ...
3, 6, 9, 12, ...
5, 10, 15, 20, ...

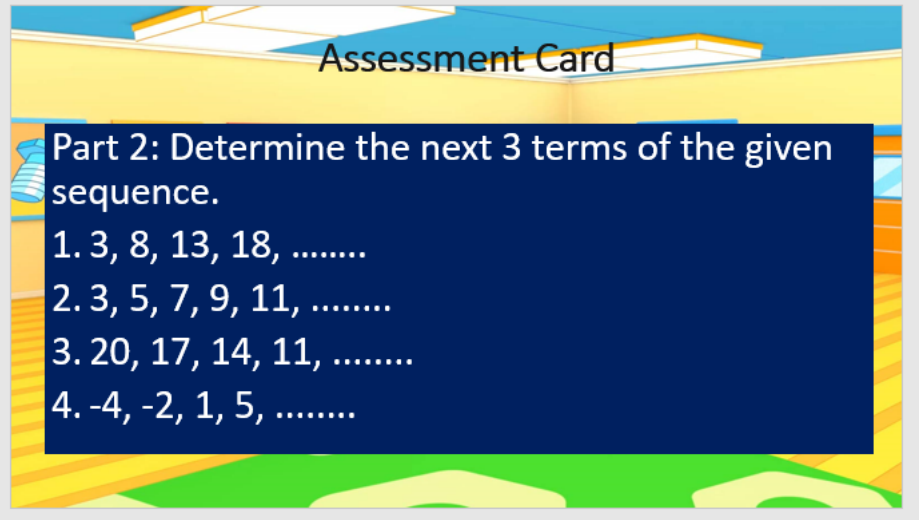

1.Pattern: A term is obtained by adding 2 to the preceding term.
2.Pattern: A term is obtained by multiplying 2 by the preceding term.
3.Pattern: A term is obtained by adding 5 to the preceding term.
Can you give the next 2 terms and how did you get this sequence?
4, 7, 10, 13, …
Can you give the next 2 terms and how did you get this sequence?
4, 7, 10, 13, …
16, 19
a fixed number 3 is added to the preceding term

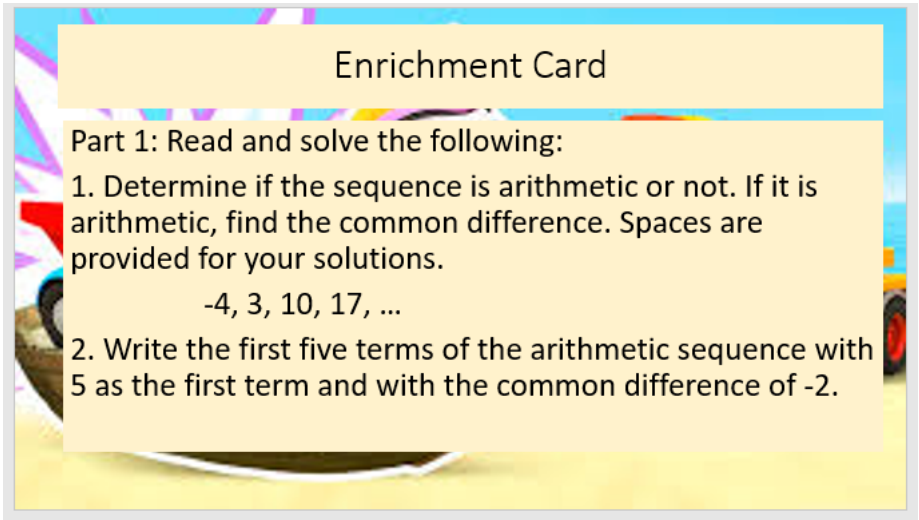

Leo
the truck
An arithmetic sequence is an ordered set of numbers with a common difference between each consecutive term or a collection of numbers following a pattern. Every term is obtained by adding a fixed number to its previous term.
A common difference is a difference between any term and its preceding term in an arithmetic sequence

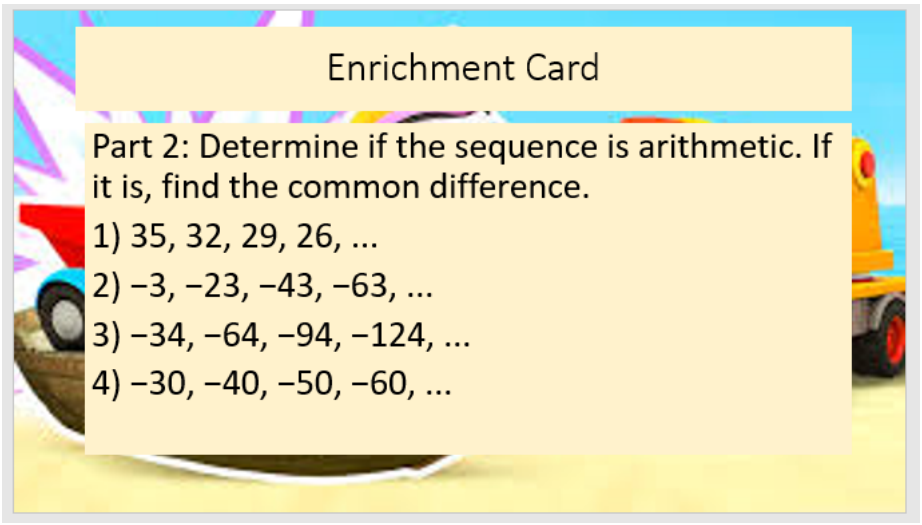

Activity Card
Activity 1
Instruction: Observe the following sequences. Can you give the next 2 terms and how did you get those terms?
1. 33, 38, 43, 48, …
2. -2, -6, -10, -14, …
3. 100, 98, 96, 94, …

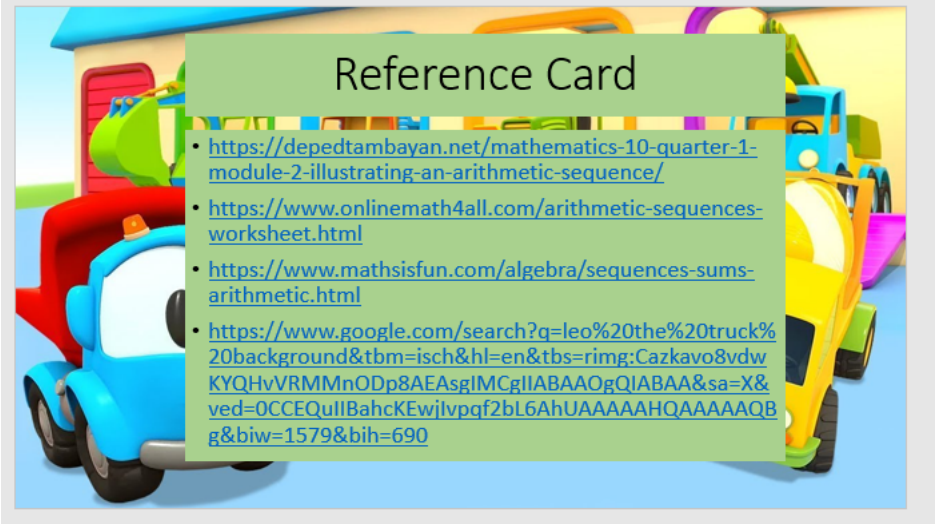

Activity Card
Activity 2
Instruction: Find the next 3 terms of each arithmetic sequence.
1. 24, 14, 4, _____, _____, _____
2. 6, 10, 14, _____, _____, _____
3. -7, 4, 15, _____, _____, _____


Assessment Card
Part 1: Determine the next 3 terms of the given sequence.
1. 15, 10, 5, 0, ...
2. 2, 5, 10, 17, ...
3. -3/4, -1/4, 1/4, 3/4, ...
4. -4, -2, 1, 5, ...

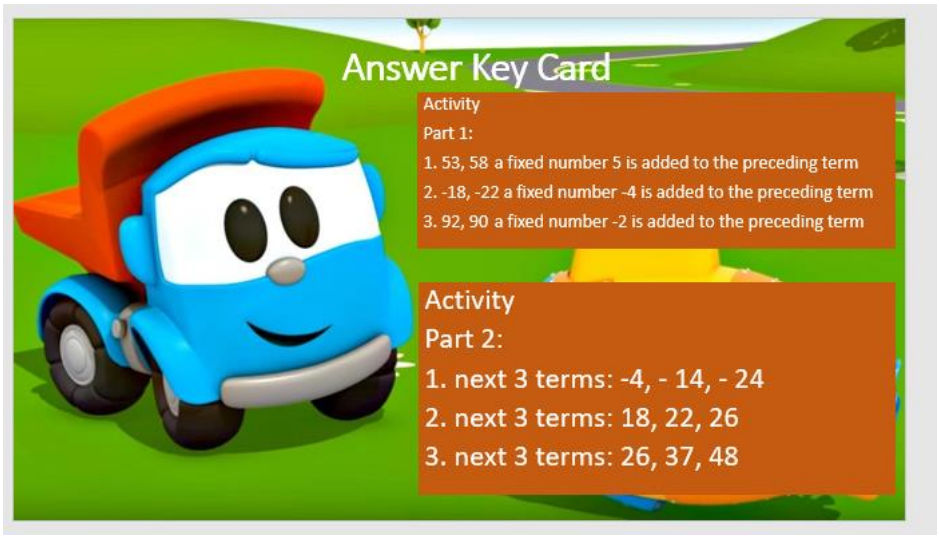

Assessment Card
Part 2: Determine the next 3 terms of the given sequence.
1. 3, 8, 13, 18, ...
2. 3, 5, 7, 9, 11, ...
3. 20, 17, 14, 11, ...
4. -4, -2, 1, 5, ...

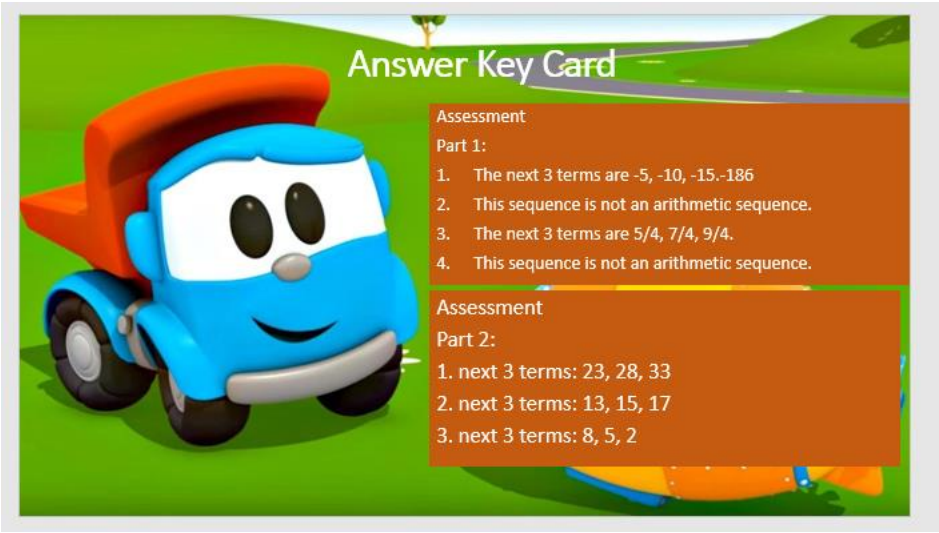

Enrichment Card
Part 1: Read and solve the following:
1. Determine if the sequence is arithmetic or not. If it is arithmetic, find the common difference. Spaces are provided for your solutions.
-4, 3, 10, 17, ...
2. Write the first five terms of the arithmetic sequence with 5 as the first term and with the common difference of -2.

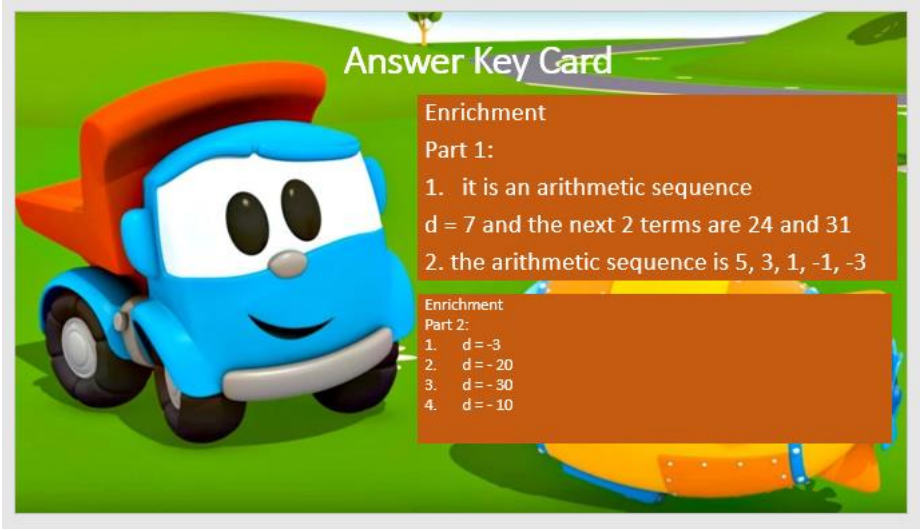

Enrichment Card
Part 2: Determine if the sequence is arithmetic. If it is, find the common difference.
1) 35, 32, 29, 26, ...
2) −3, −23, −43, −63, ...
3) −34, −64, −94, −124, ...
4) −30, −40, −50, −60, ...


Reference Card
https://depedtambayan.net/mathematics-10-quarter-1-module-2-illustrating-an-arithmetic-sequence/
https://www.onlinemath4all.com/arithmetic-sequences-worksheet.html
https://www.mathsisfun.com/algebra/sequences-sums-arithmetic.html
https://www.google.com/search?q=leo%20the%20truck%20background&tbm=isch&hl=en&tbs=rimg:Cazkavo8vdwKYQHvVRMMnODp8AEAsgIMCgIIABAAOgQIABAA&sa=X&ved=0CCEQuIIBahcKEwjlvpqf2bL6AhUAAAAAHQAAAAAQBg&biw=1579&bih=690

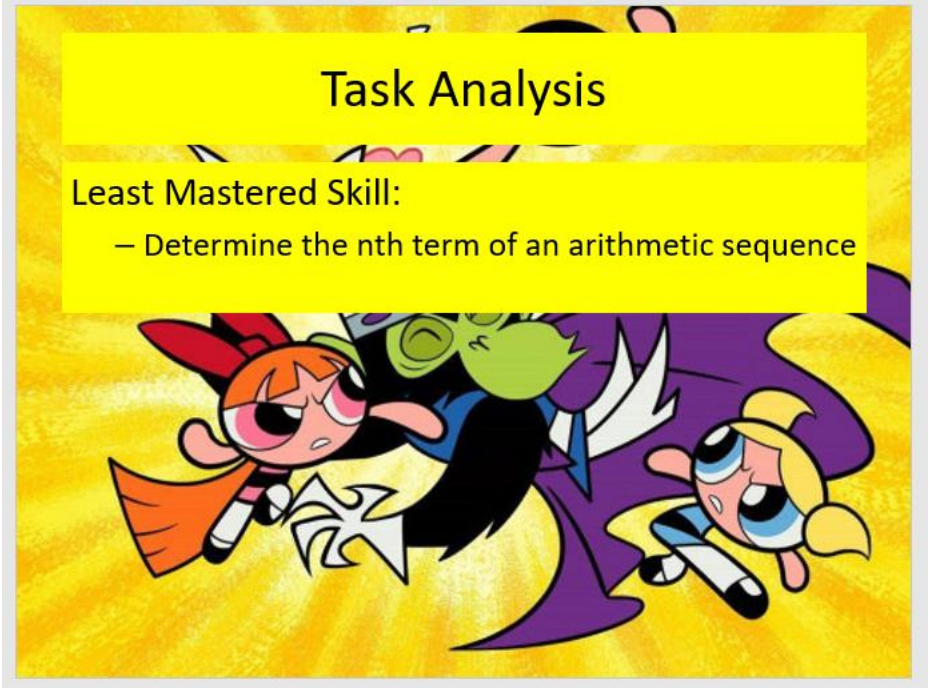

List of Online Resources for Additional Exploration
https://www.onlinemath4all.com/arithmetic-sequences-worksheet.html
https://www.mathsisfun.com/algebra/sequences-sums-arithmetic.html
https://www.youtube.com/watch?v=ffr2HmswAf0&t=11s
https://www.youtube.com/watch?v=Az0AfE4M0nI
https://www.youtube.com/watch?v=yujFBbR3U1k


Answer Key Card
Activity
Part 1:
1. 53, 58 a fixed number 5 is added to the preceding term
2. -18, -22 a fixed number -4 is added to the preceding term
3. 92, 90 a fixed number -2 is added to the preceding term
Activity
Part 2:
1. next 3 terms: -4, - 14, - 24
2. next 3 terms: 18, 22, 26
3. next 3 terms: 26, 37, 48

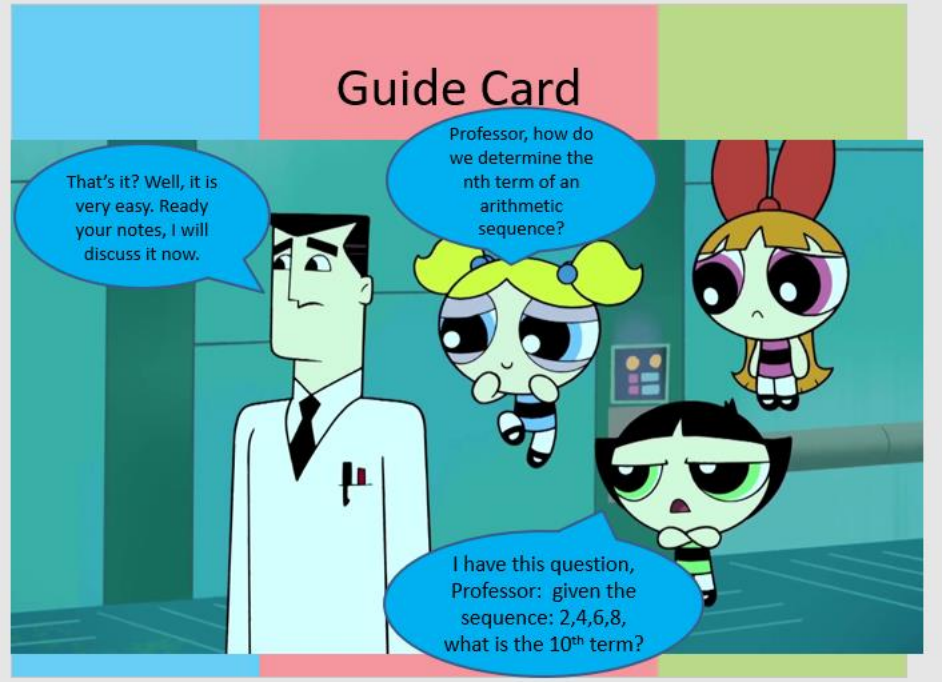

Answer Key Card
Assessment
Part 1:
1. The next 3 terms are -5, -10, -15.-186
2. This sequence is not an arithmetic sequence.
3. The next 3 terms are 5/4, 7/4, 9/4.
4. This sequence is not an arithmetic sequence.
Assessment
Part 2:
1. next 3 terms: 23, 28, 33
2. next 3 terms: 13, 15, 17
3. next 3 terms: 8, 5, 2

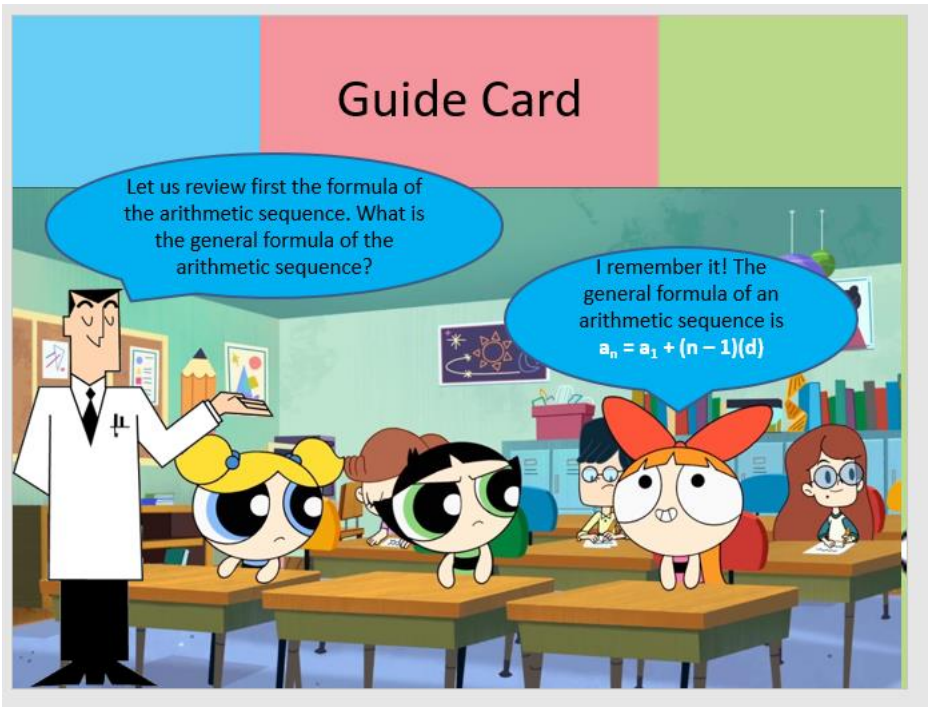

Answer Key Card
Enrichment
Part 1:
1. it is an arithmetic sequence
d = 7 and the next 2 terms are 24 and 31
2. the arithmetic sequence is 5, 3, 1, -1, -3
Enrichment
Part 2:
1. d = -3
2. d = - 20
3. d = - 30
4. d = - 10

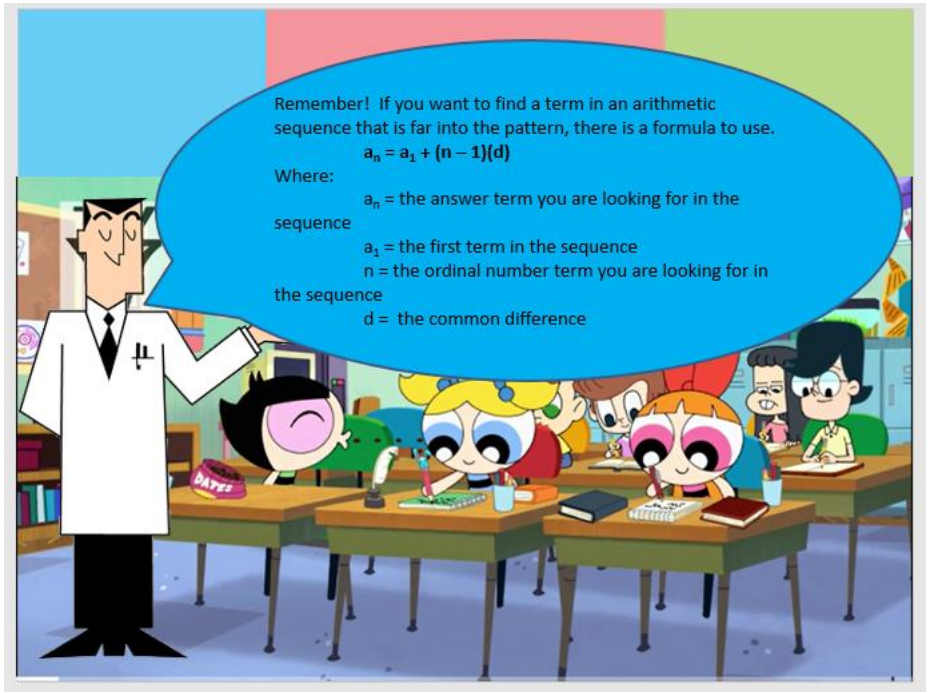
Strategic Intervention Material - Patronage of Mary Development School



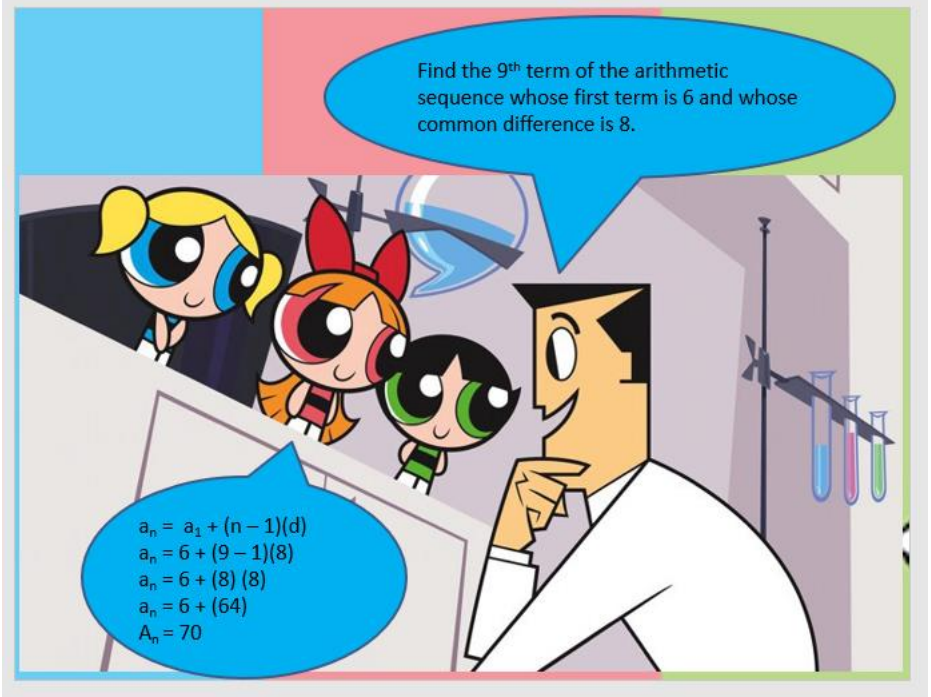

Guide Card
Hi, Friends! Are you ready for a new day of fun battle?
Our mission today is to learn how to determine the nth term of an arithmetic sequence.
Today, we are going to have another mission.

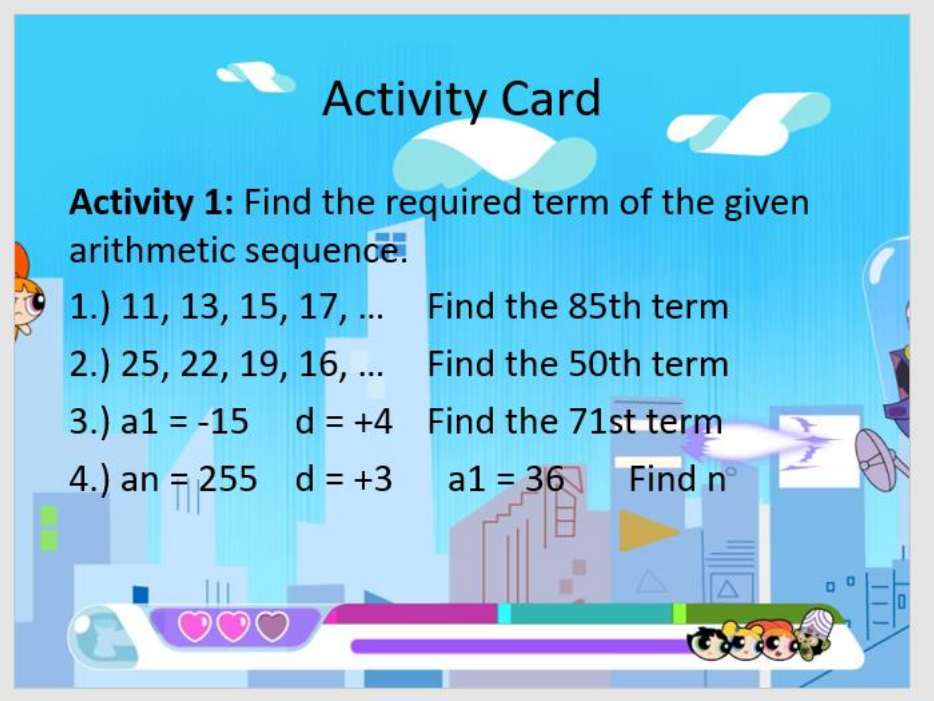

Guide Card
That's it? Well, it is very easy. Ready your notes, I will discuss it now.
Professor, how do we determine the nth term of an arithmetic sequence?
I have this question, Professor: given the sequence: 2,4,6,8, what is the 10th term?

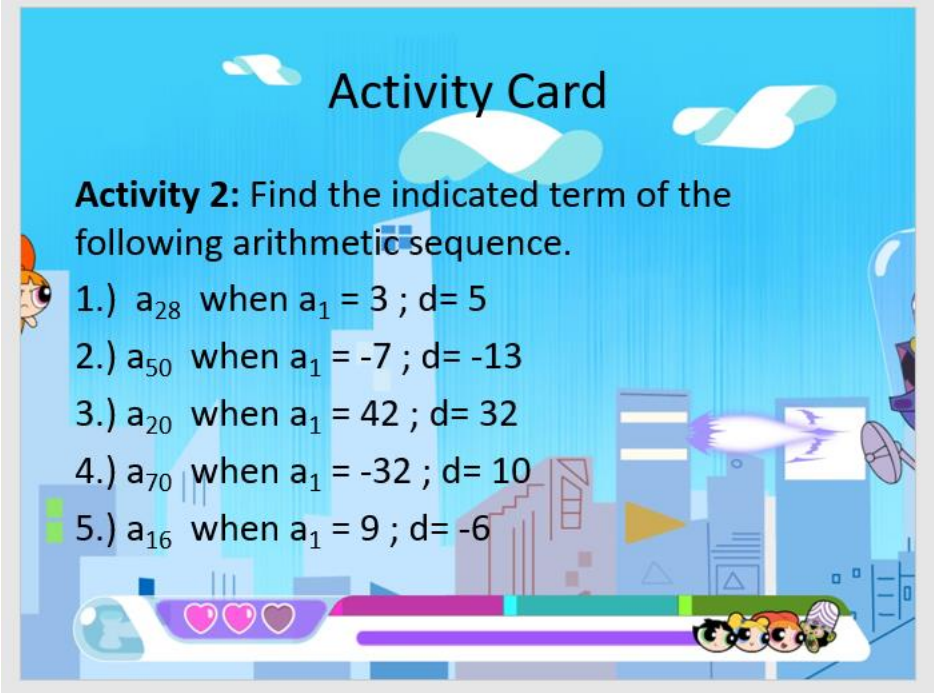

Guide Card
Let us review first the formula of the arithmetic sequence. What is the general formula of the arithmetic sequence?
I remember it! The general formula of an arithmetic sequence is $a_n = a_1 + (n - 1)(d)$

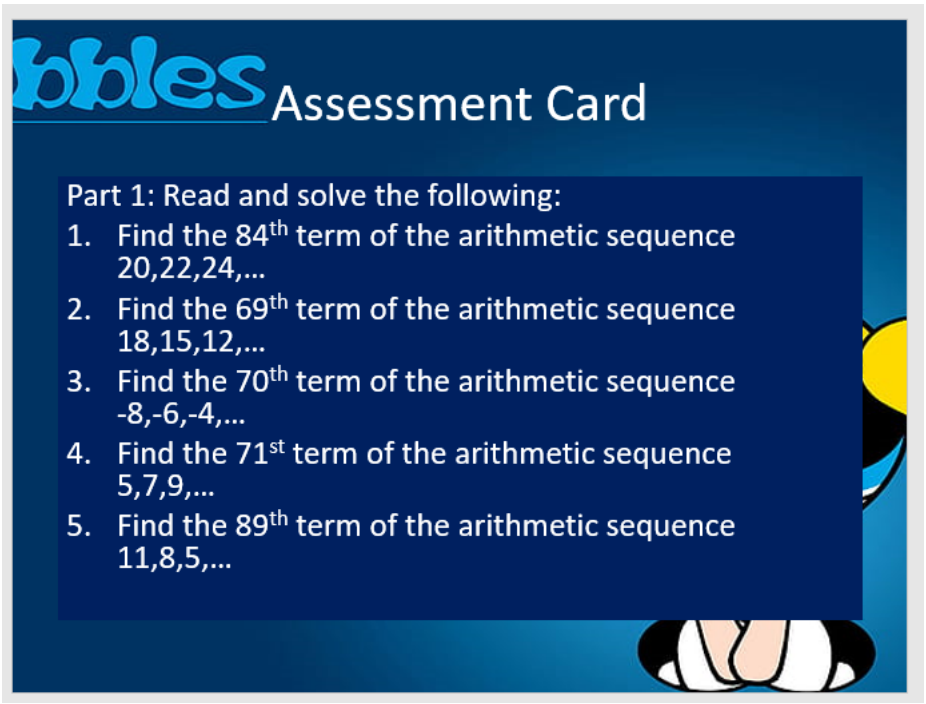

Remember! If you want to find a term in an arithmetic sequence that is far into the pattern, there is a formula to use.
$a_n = a_1 + (n - 1)(d)$
Where:
a_n = the answer term you are looking for in the sequence
a_1 = the first term in the sequence
n = the ordinal number term you are looking for in the sequence
d = the common difference


For example: Given: 23, 18, 13, 8, ... find the 63rd term.
an = a1 + (n – 1)(d) Use the formula
an = 23 + (63 – 1)(-5) Substitute a1= 23 , n= 63, d=-5
an = 23 + 62(-5) Subtract within parenthesis an =
23 + (-310) Multiply and add
an = -287 Simplify

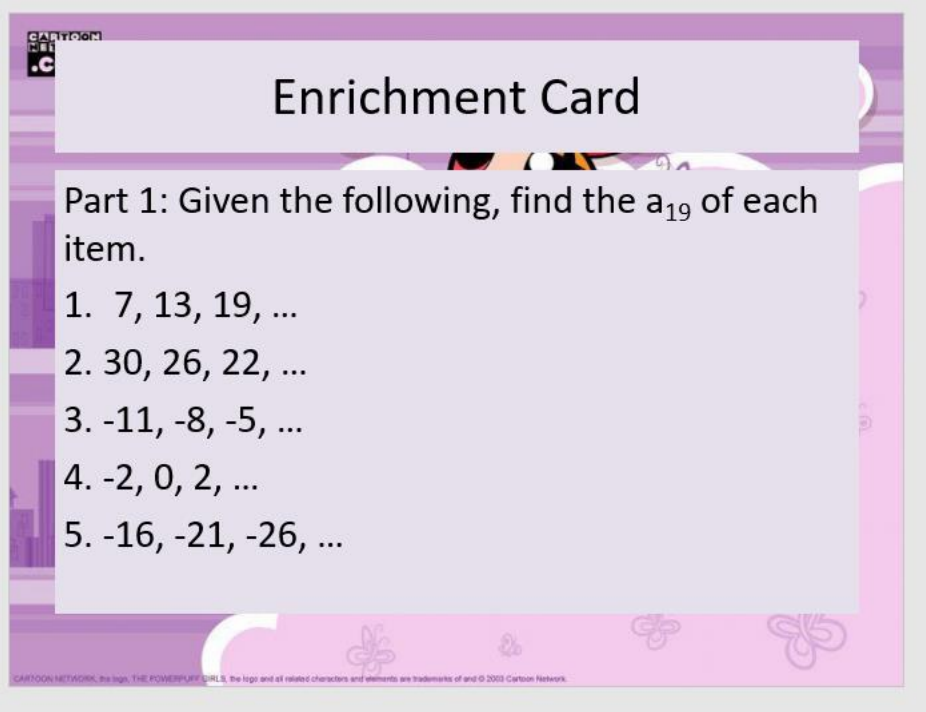

Find the 9th term of the arithmetic sequence whose first term is 6 and whose common difference is 8.
an = a1 + (n – 1)(d)
an = 6 + (9 – 1)(8)
an = 6 + (8) (8)
an = 6 + (64)
An = 70

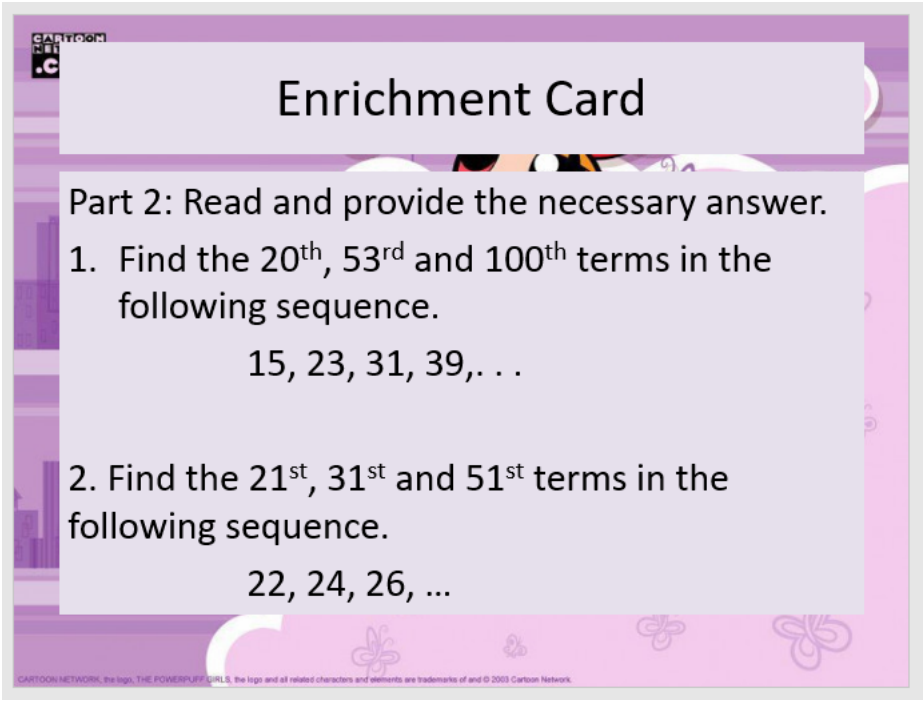

Activity Card
Activity 1: Find the required term of the given arithmetic sequence.
1.) 11, 13, 15, 17, … Find the 85th term
2.) 25, 22, 19, 16, … Find the 50th term
3.) a1 = -15 d = +4 Find the 71st term
4.) an = 255 d = +3 a1 = 36 Find n

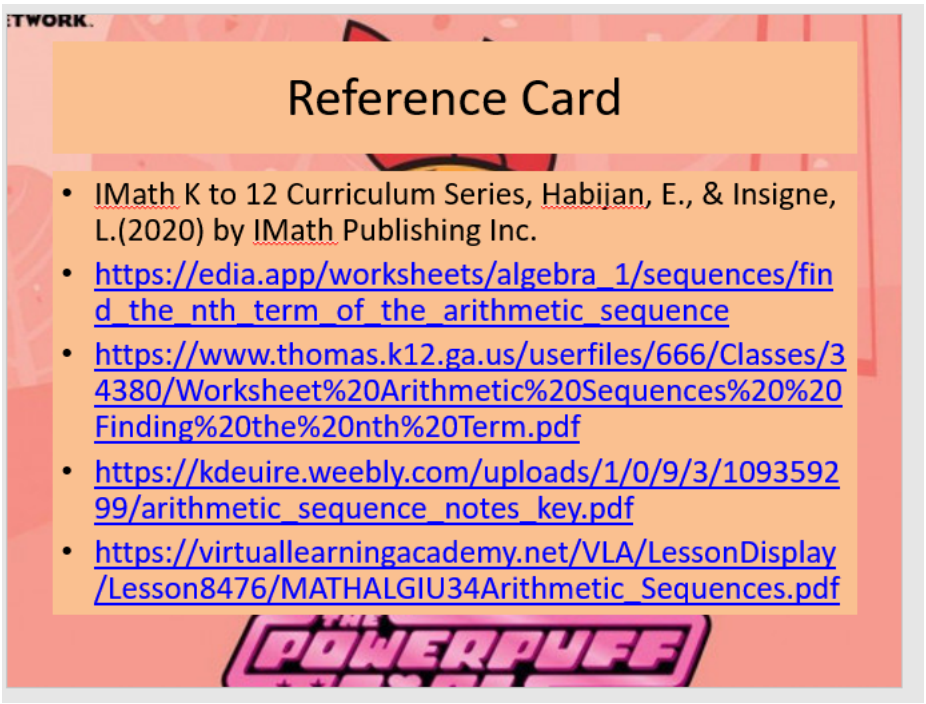

Activity Card
Activity 2: Find the indicated term of the following arithmetic sequence.
1.) a_{28} when $a_1 = 3$; d= 5
2.) a_{50} when $a_1 = -7$; d= -13
3.) a_{20} when $a_1 = 42$; d= 32
4.) a_{70} when $a_1 = -32$; d= 10
5.) a_{16} when $a_1 = 9$; d= -6

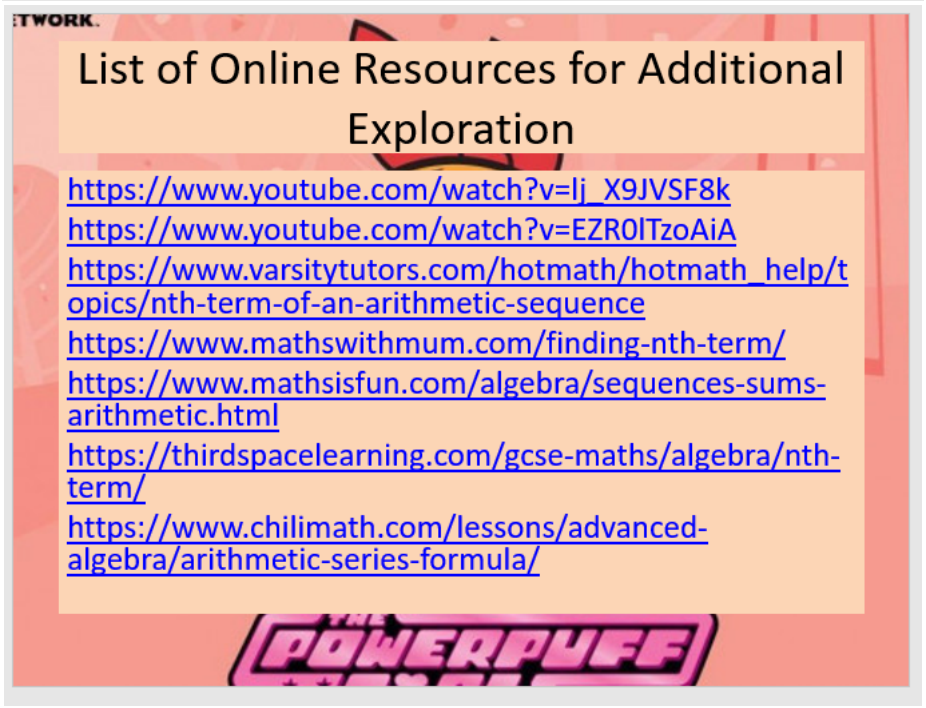

bbles Assessment Card
Part 1: Read and solve the following:
1. Find the 84th term of the arithmetic sequence 20,22,24,...
2. Find the 69th term of the arithmetic sequence 18,15,12,...
3. Find the 70th term of the arithmetic sequence -8,-6,-4,...
4. Find the 71st term of the arithmetic sequence 5,7,9,...
5. Find the 89th term of the arithmetic sequence 11,8,5,...

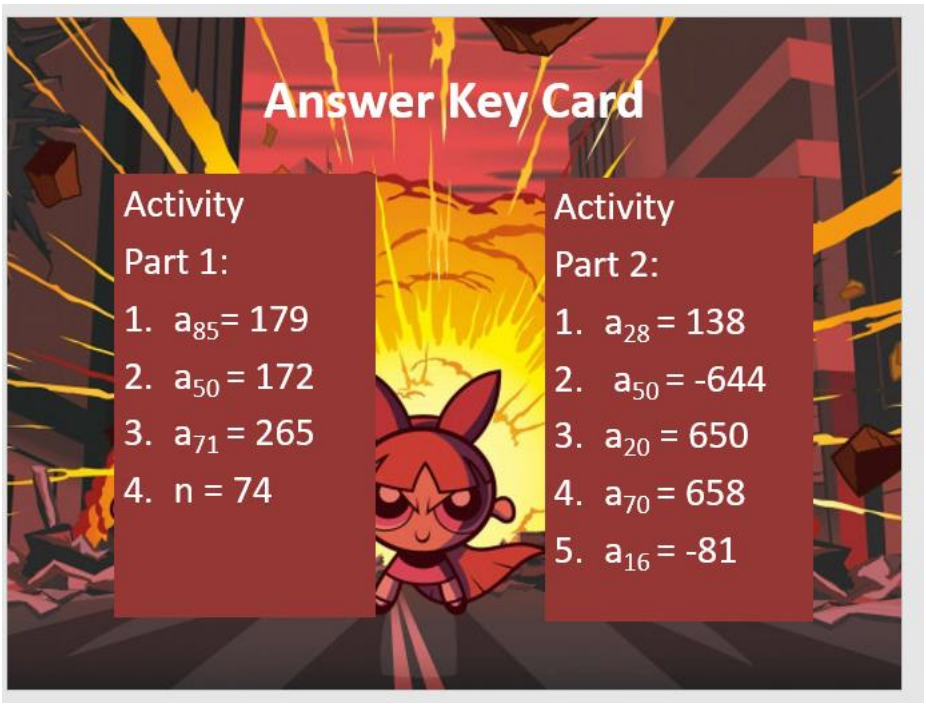

Lossom Assessment Card
Part 2:
1. -19, -15, -11, -7, ... Find a_{35}
2. -22, -19, -16, -13, ... Find a_{21}
3. 30, 35, 40, 45, ... Find a_{28}
4. -22, -12, -2, 8, ... Find a_{26}
5. 11, 18, 25, 32, ... Find a_{35}

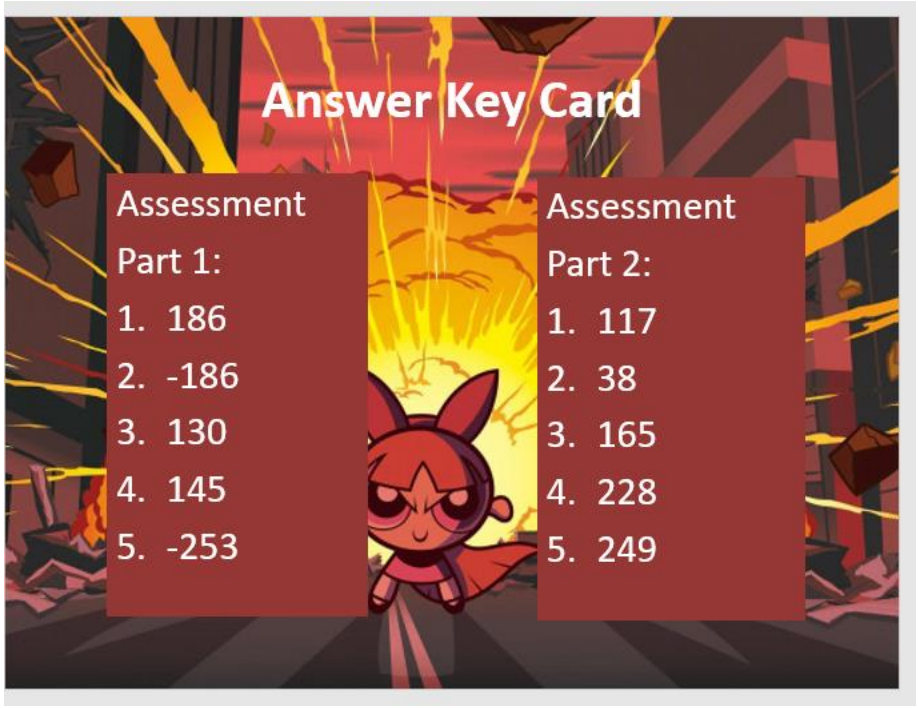

Enrichment Card
Part 1: Given the following, find the a_{19} of each item.
1. 7, 13, 19, …
2. 30, 26, 22, …
3. -11, -8, -5, …
4. -2, 0, 2, …
5. -16, -21, -26, …

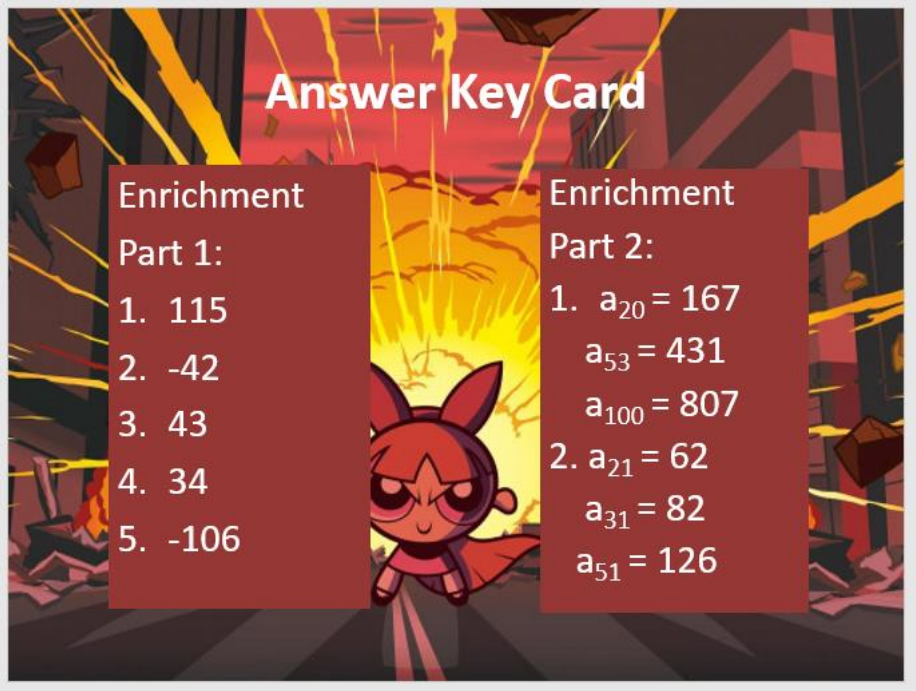

Enrichment Card
Part 2: Read and provide the necessary answer.
1. Find the 20th, 53rd and 100th terms in the following sequence.
15, 23, 31, 39,. . .
2. Find the 21st, 31st and 51st terms in the following sequence.
22, 24, 26, …


Reference Card
IMath K to 12 Curriculum Series, Habijan, E., & Insigne, L.(2020) by IMath Publishing Inc.
https://edia.app/worksheets/algebra_1/sequences/find_the_nth_term_of_the_arithmetic_sequence
https://www.thomas.k12.ga.us/userfiles/666/Classes/34380/Worksheet%20Arithmetic%20Sequences%20%20Finding%20the%20nth%20Term.pdf
https://kdeuire.weebly.com/uploads/1/0/9/3/109359299/arithmetic_sequence_notes_key.pdf
https://virtuallearningacademy.net/VLA/LessonDisplay/Lesson8476/MATHALGIU34Arithmetic_Sequences.pdf


List of Online Resources for Additional Exploration
https://www.youtube.com/watch?v=lj_X9JVSF8k
https://www.youtube.com/watch?v=EZR0lTzoAiA
https://www.varsitytutors.com/hotmath/hotmath_help/topics/nth-term-of-an-arithmetic-sequence
https://www.mathswithmum.com/finding-nth-term/
https://www.mathsisfun.com/algebra/sequences-sums-arithmetic.html
https://thirdspacelearning.com/gcse-maths/algebra/nth-term/
https://www.chilimath.com/lessons/advanced-algebra/arithmetic-series-formula/


Answer Key Card
Activity
Part 1:
1. a_{85} = 179
2. a_{50} = 172
3. a_{71} = 265
4. n = 74
Activity
Part 2:
1. a_{28} = 138
2. a_{50} = -644
3. a_{20} = 650
4. a_{70} = 658
5. a_{16} = -81


Answer Key Card
Assessment
Part 1:
1. 186
2. -186
3. 130
4. 145
5. -253
Assessment
Part 2:
1. 117
2. 38
3. 165
4. 228
5. 249


Answer Key Card
Enrichment
Part 1:
1. 115
2. -42
3. 43
4. 34
5. -106
Enrichment
Part 2:
1. $a_{20} = 167$
$a_{53} = 431$
$a_{100} = 807$
2. $a_{21} = 62$
$a_{31} = 82$
$a_{51} = 126$

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Appendix A
TRANSMITTAL LETTER TO THE PRINCIPAL

August 2, 2022

Dr. Josefina T. Arreza
Cebu Bradford School Inc.
School Principal

Dear Madam:

The undersigned are currently undertaking their research entitled “Utilization of Math Apps and Websites and Mathematical Achievement of Grade 10 Students” as partial fulfillment of the requirements of the Degree Master of Education major in Mathematics at the Cebu Technological University (Main Campus).

It is in this context that they request to gather the necessary data required for this study from the Junior High School Level particularly among the Grade 10 students in your school. This study will be conducted this first semester of the academic year 2022-2023 utilizing survey questionnaires and examination questions.

All the data gathered will be handled with utmost confidentiality.

Your favorable action and approval of this request is highly appreciated with utmost sincerity and gratitude.

Thank you.

Very truly yours,

BABEJANE ARITA — Researcher
LYNNIEL PERADILLA — Researcher
PATRICK SALINAS — Researcher

Noted by:

EMERSON D. PETEROS, Dev.Ed.D.
Adviser

Approved by:

Dr. Josefina T. Arreza
CBSI Principal

Appendix B

TRANSMITTAL LETTER TO THE RESPONDENTS

_____

_____

Dear Mr./Mrs./Ms. _____:

The undersigned are currently undertaking their research entitled “Utilization of Math Apps and Websites and Mathematical Achievement of Grade 10 Students” as partial fulfillment of the requirements of the Degree Master of Education major in Mathematics at the Cebu Technological University (Main Campus).

It is in this context that they invite you to participate in this noble undertaking. You qualified as a research respondent since you are one of the Grade 10 students. The research study will attempt to determine the relationship between the utilization of math apps and websites and the mathematical achievement in Arithmetic Sequence and Series. This study will be conducted this first semester of the academic year 2022-2023 with survey questionnaires and examination questions.

Rest assured that protocol will be observed in the data gathering and all information obtained from the respondents will be treated with the utmost confidentiality.

Your favorable response to this request is highly appreciated with utmost sincerity and gratitude.

Thank you.

Very truly yours,

BABEJANE ARITA
LYNNIEL PERADILLA
PATRICK SALINAS

Researchers

Approved by:

Dr. Josefina T. Arreza
Principal

Appendix A
TRANSMITTAL LETTER TO THE PRINCIPAL

August 2, 2022

Mr. Jerick E. Duaban
Southwestern University PHINMA
School Principal

Dear Sir:

The undersigned are currently undertaking their research entitled “Utilization of Math Apps and Websites and Mathematical Achievement of Grade 10 Students” as partial fulfillment of the requirements of the Degree Master of Education major in Mathematics at the Cebu Technological University (Main Campus).

It is in this context that they request to gather the necessary data required for this study from the Junior High School Level particularly among the Grade 10 students in your school. This study will be conducted this first semester of the academic year 2022-2023 utilizing survey questionnaires and examination questions.

All the data gathered will be handled with utmost confidentiality.

Your favorable action and approval of this request is highly appreciated with utmost sincerity and gratitude.

Thank you.

Very truly yours,

BABEJANE ARITA — Researcher
LYNNIEL PERADILLA — Researcher
PATRICK SALINAS — Researcher

Noted by:

EMERSON D. PETEROS, Dev.Ed.D.
Adviser

Approved by:

Mr. Jerick E. Duaban
School Principal

Appendix B

TRANSMITTAL LETTER TO THE RESPONDENTS

_____

_____

Dear Mr./Mrs./Ms. _____:

The undersigned are currently undertaking their research entitled “Utilization of Math Apps and Websites and Mathematical Achievement of Grade 10 Students” as partial fulfillment of the requirements of the Degree Master of Education major in Mathematics at the Cebu Technological University (Main Campus).

It is in this context that they invite you to participate in this noble undertaking. You qualified as a research respondent since you are one of the Grade 10 students. The research study will attempt to determine the relationship between the utilization of math apps and websites and the mathematical achievement in Arithmetic Sequence and Series. This study will be conducted this first semester of the academic year 2022-2023 with survey questionnaires and examination questions.

Rest assured that protocol will be observed in the data gathering and all information obtained from the respondents will be treated with utmost confidentiality.

Your favorable response to this request is highly appreciated with utmost sincerity and gratitude.

Thank you.

Very truly yours,

BABEJANE ARITA
LYNNIEL PERADILLA
PATRICK SALINAS

Researchers

Approved by:

Mr. Jerick E. Duaban
School Principal

August 2, 2022

DR. ROUEL A. LONGINOS
Patronage of Mary Development School
School Principal

Dear Dr. Longinos:

The undersigned are currently undertaking their research entitled "Utilization of Math Apps and Websites and Mathematical Achievement of Grade 10 Students" as partial fulfillment of the requirements of the Degree Master of Arts in Education major in Teaching Mathematics at the Cebu Technological University (Main Campus).

It is in this context that they request to gather the necessary data required for this study from the Junior High School Level particularly among the Grade 10 students in your school. This study will be conducted this first semester of the academic year 2022-2023 utilizing survey questionnaires and examination questions.

All the data gathered will be handled with utmost confidentiality.

Your favorable action and approval of this request is highly appreciated with utmost sincerity and gratitude.

Thank you.

Very truly yours,

BABEJANE ARITA
Researcher

LYNNIEL PERADILLA
Researcher

PATRICK SALINAS
Researcher

Noted by:

EMERSON D. PETEROS, Dev.Ed.D.
Adviser

Approved by:

ROUEL A. LONGINOS, Ed.D., Ph.D.
School Principal

Appendix C
Informed Consent

August 2022

Cebu City

To the Respondents:

Pleasant greetings to you!

We, Babejane G. Arita, Lynniel D. Peradilla and Patrick M. Salinas, the graduate students of Master of Arts in Teaching Mathematics are enrolled in OE 104 Thesis Writing for 2nd Trimester May - August 2022 and want to pursue the group thesis. Our research study is about the “Utilization of Mathematical Apps and Websites and the Mathematics Achievement of Grade 10 Students In The New Normal”.

For the completion of our master’s thesis, we would like to request a moment of your time to answer the questionnaires that we prepared for our research study. Every answer that you have will be the basis of our study. Rest assured, all the information that we gather will be held confidential.

Thank you so much for your kind consideration. God bless!

Respectfully yours,

The Researchers

Appendix D

Survey Questionnaire

All personal information will be kept confidential and used only in aggregate form. Please respond to all questions by following the instructions.

Student's Personal Information

Name:_____ Age:____ Gender: ___ M ___F

Directions: Put a checkmark (/) on the appropriate answer of your profile below.

Parent's Highest Educational Attainment:

Father	Mother
_____ College Graduate	_____ College Graduate
_____ College Level	_____ College Level
_____ High School Graduate	_____ High School Graduate
_____ High School Level	_____ High School Level
_____ Elementary Graduate	_____ Elementary Graduate
_____ Elementary Level	_____ Elementary Level
_____ No Formal Schooling	_____ No Formal Schooling

Combined Family Monthly Income:

_____ Above P30,000 _____ P 15,001 – P20,000

_____ P 25,001 – P30,000 _____ P 10,001 – P15,000

_____ P 20,001 – P25,000 _____ P 10,000 and below

What is your source of internet connection?

[ ] Mobile Data

[ ] Pisonet

[ ] Computer cafe

[ ] Wi-Fi

Others: (please specify) _____

What devices do you use to access online applications and websites? Check as many as possible.

[ ] Desktop computer [ ] Laptop

[ ] Smartphone [ ] Tablet device

UTILIZATION OF MATH APPS AND WEBSITES

Directions: The following items talk about the statements about your own perceptions in using the different mathematical applications and websites. Please check (/) the appropriate level of your agreement towards these statements as you perceived them to be true to yourself. There are no correct or incorrect responses. Please rate each statement on its truthfulness.

Legend:

4 – Strongly Agree 2 – Disagree

3 – Agree 1 – Strongly Disagree

S/N	INDICATORS	4	3	2	1
1	Math apps and websites help me get better results in my subjects.				
2	Math apps and websites help me understand the subject material more deeply.				
3	Math apps and websites make completing work in my Math subjects more convenient.				
4	Math apps and websites motivate me to explore many topics I may have not seen before.				
5	Math apps and websites allow me to collaborate with others easily, both on and outside of the campus.				
6	I get more actively involved in my Math class with the use of Math apps and websites.				
7	Math apps and websites help my ability to concentrate and think deeply about our lesson/topic.				
9.	Use of Math apps and websites in class improves my engagement with the content and class.				

10.	Multitasking with Math apps and websites sometimes prevents me from concentrating on or doing the work that is most important.				
11.	I find it useful that I can learn mathematics on a phone anywhere and at any time by accessing Math apps and websites.				
12.	The Math apps and websites and learning activities on the phone were easy to use.				
13.	Using Math apps and websites make sophisticated concepts accessible to students.				
14.	I can learn through the application independently of time and place with the help of Math apps and websites.				
15.	The utilization of apps and websites increases the quality of education.				
16.	Teaching Math concepts using Math apps and websites help me evaluate my own understanding and performance.				
17	Math applications and websites are useful tools for my study.				
18	Math applications and websites can offer opportunities for communication and team-working.				

19	Math applications and websites can help me in finding resources related to my study.				
20	Math applications and websites bring many opportunities to the learning process.				
21	Math applications and websites can help me to access the course-material anytime, anywhere.				
22	Math applications and websites can be an easy way to get feedback and notifications from my instructors.				
23	Math applications and websites can help me to exchange the course-material with my friends.				
24	Math applications and websites can help me to manage my study.				
25	Math apps and websites help the students understand the math concepts better.				

Thank you for the time and effort you have put into completing this survey questionnaire.

Appendix E
TABLE OF SPECIFICATIONS FOR GRADE TEN MATHEMATICS
(Arithmetic Sequence and Series)

Learning Competencies	No. of Days	Level of Cognition	No. of Items	% of Items	Test Placement	Index of Difficulty
generates patterns	2	Remembering	6	20%	1, 2, 3, 4, 5, 6	Easy
illustrates an arithmetic sequence	2	Understanding	4	13.33%	7, 8, 9, 17	Easy
determines arithmetic means and nth term of an arithmetic sequence	2	Understanding	6	20%	10, 11, 12, 16, 22, 27	Moderate
finds the sum of the terms of a given arithmetic sequence	2	Understanding	5	16.67%	13, 14, 24, 26, 28	Easy
solve applied problems, including finding the number of terms given the	3	Applying	2	6.67%	15, 20,	Moderate

sum and other necessary information. predicting the next term and nth term of sequences		Analyzing	2	6.67%	19, 25	Moderatel y Difficult
	3	Evaluating	5	16.67%	18, 21, 23, 29, 30	Moderatel y Difficult
TOTAL	**14**		**30**	**100%**		

Appendix F

ARITHMETIC SEQUENCE AND SERIES ACHIEVEMENT TEST

Name: _____ Section: _____ Date: _____ Score: _____

Multiple Choice. Directions: Choose the correct answer by encircling the letter of your choice.

1. What is the next number in the sequence 1, 2, 4, 8, 16, …?

   a. 18 b. 24 c. 32 d. 64

2. What is the next set of shapes in the illustration below?

a. 

b. 

c. 

d. 

3. Which of the following is a step on determining the next number in the sequence 5, 15, 45, 135, …?

   a. multiply 135 by 5 c. multiply 135 by 3

   b. Add 105 to 135 d. divide 135 by 5

4. Which of the following rules describes the sequence 3, 8, 13, 18, …?

   a. $a_n = 3n + 5$ c. $a_n = n + 5$

   b. $a_n = 5n - 2$ d. an = $\frac{3n - 23n - 2}{5 \quad 5}$

5. What will be the next shape?

a.  c. 

b.  d. 

6. What is the next term of the sequence 16, 12, 8, 4, …?

a. -12 c. -4

b. -8 d. 0

7. Which term of the arithmetic sequence 3, 8, 13, 18, … is 48?

a. 9^{th} term c. 11^{th} term

b. 10^{th} term d. 12^{th} term

8. The first term of an arithmetic sequence is 2 while the 3^{rd} term is 8. What is the common difference of the sequence?

a. 5 c. 3

b. 4 d. 2

9. Find the missing term of the sequence: -1, 4, 9, _____, 19, 24.

a. 12 c. 14

b. 13 d. 16

10. If three arithmetic means are inserted between 12 and 48, what is the third arithmetic mean?

a. 21 c. 30

b. 25 d. 39

11. What is the 10^{th} term of the sequence defined by $a_n = 5n - 4$?

a. 46 c. 54

b. 49 d. 64

12. The first term of an arithmetic sequence is -5 and the common difference is 3, find the 20^{th} term.

a. 52 c. 57

b. 55 d. 62

13. Which of the following is the sum of the terms of the arithmetic sequence 2+ 4 + 6 + 8 + 10?

a. 20 c. 40

b. 30 d. 50

14. The sum of the terms of the arithmetic sequence is 21. Which of the following represents the sequence?

a. 2, 3, 4, 5, 6, 7 c. 3, 4, 5, 6, 7, 8

b. 1, 2, 3, 4, 5, 6, 7 d. 1, 2, 3, 4, 5, 6

15. Ryan plants 38 tree seedlings on Saturday. On Sunday he finished planting 50 tree seedlings and added the same amount everyday the other day. How many seedlings did he planted on Wednesday?

a. 79 c. 86

b. 96 d. 87

16. If five arithmetic means are inserted between 9 and 45 what is the 2nd arithmetic mean?

a. 21 c. 27

b. 33 d. 39

17. Which of the following is an example of an arithmetic sequence?

a. 2/5, 2/7, 2/9, 2/11,… c. 1, 2, 4, 8, 16,…

b. 3, 1, - 1, - 3, - 5, - 7,… d. 54, 18, 6, 2,…

18. Find the 9th term of the arithmetic sequence with a1 = 10 and d = $-\frac{11}{22}$.

a. 4 c. 5

b. 6 d. 7

19. I was advised by my physician to walk each day in the morning as my daily exercise. On my first day, I walked 40m. On the second and third day, I walked 60m and 80m, respectively, and so on. Which of the following is the distance I walked on the 10th day if I continue the pattern in my daily walk?

a. 180 m c. 220 m

b. 200 m d. 240 m

20. Ellen earns P200 on the first day of work and additional P50 on every succeeding day. How much is his salary on the fourth day?

a. P300 b. P350 c. P400 d. 450

21. Find the first five terms of the sequence an = 4 + 5n.

a. 4, 8, 12, 16, 20 c. 9, 14, 19, 24, 29

b. 25, 20, 15, 10, 5 d. 4, 6, 8, 12, 14

22. The general term for the arithmetic sequence 9, 15, 21, 27, 33,... is given as

a. an = 9 + (n-1)d c. an = 9 + nd

b. an = n + 9d d. an = 9d + n

23. What number is added every after each number to obtain the succeeding numbers in the sequence 72, 60, 48, 36,….?

a. 12 c. 24

b. -12 d. -24

24. What is the sum of all odd integers between 8 and 100?

a. 2034 c. 2484

b. 2215 d. 2745

25. During a free-fall, a skydiver jumps 16 feet, 48 feet, and 60 feet on the first, second, and third fall, respectively. If he continues to jump at this pattern, how many feet will he have jumped during the tenth fall?

a. 144 c. 132

b. 156 d. 140

26. Which of the following is the sum of all the multiples of 3 from 15 to 90?

a. 1365 b. 1375 c. 1385 d. 1395

27. The general term for the arithmetic sequence 11,18, 25, 32,... is given as .

a. an = 4n - 7

c. an = 7n + 4

b. a n = 4n + 7

d. an = 7n –4

28. Find the sum of the first 10 terms of an arithmetic sequence 5, 8, 11, 14, ….

a.185 b. 190 c. 195 d. 200

29. Find the first five terms of the sequence a n = 3n - 11

a. 8, 11, 14, 17,20

c. 3, 6, 9, 12, 15

b. - 8, - 5, - 2, 1, 4

d. 11, 22, 33, 44, 55

30. Which of the following sequences follows the general term an=3n-5?

a. 3, 6, 9, 12, 15,…

c. -2, 1, 4, 7, 11,…

b. 5, 10, 15, 20, 25,…

d. 5, 8, 11, 14, 17,…

CURRICULUM VITAE

BABEJANE G. ARITA

Centro Jugan, Consolacion, Cebu

Mobile: 09238611446

Email Address: babejanearita27@gmail.com

PERSONAL INFORMATION

DATE OF BIRTH	: April 27, 1999
PLACE OF BIRTH	: Consolacion, Cebu
CITIZENSHIP	: Filipino
GENDER	: Female
STATUS	: Single
FATHER	: Pablo C. Arita
MOTHER	: Helen G. Arita

ACADEMIC BACKGROUND

GRADUATE STUDIES Master of Arts in Education
Major in Teaching Mathematics
Cebu Technological University
Main Campus, Cebu City
September 2020 - present

COLLEGE Bachelor in Secondary Education
Major in Mathematics
Cebu Technological University
Main Campus, Cebu City
2018-2019

HIGH SCHOOL Jugan National High School
Jugan, Consolacion, Cebu
2014 - 2015

ELEMENTARY Jugan Elementary School
Jugan, Consolacion, Cebu
2010 - 2011

PROFESSIONAL CAREER SERVICE ELIGIBILITY

Licensure Examination for Teachers
September 27, 2021 - Passed

TEACHING EXPERIENCE

Senior High School Teacher

Cebu Bradford School Inc.

340-P Ascension St. Sambag 2 Urgello, Cebu City

August 2021 – present

Part-time High School Mathematics Tutor

Tutoring Club Cebu

Unit 221 Gov. M Cuenco Ave., Cebu City Philippines

November 3, 2021 - May 11, 2022

Junior High School Teacher

Little Angels Montessori School

Hernan Cortes St., Banilad, Mandaue City

June 2019 – March 2020

SEMINARS ATTENDED

“Adaptive (Flexible) Teaching of SHS Core Subjects Towards Optimal Learning”

2022 INSET for Senior High School Teachers

August 4-6, 2022

“Engaging Students to be Reflective and Self-Directed Learners In Their Achievement of the K-12 Learning Outcomes In The New Normal”

2022 INSET for Junior High School Teachers

June 6-8, 2022

University of the Philippines - Cebu Teaching and Learning Resource Center **“Research Ethics for Teachers and Students”**

October 13, 2021

Holy Trinity University webinar **“Research Writing Webinar Workshop”**

February 20 & March 6, 2021

National Council of Teachers of Mathematics webinar **“More Ideas from the Classroom on Using Children’s Literature to Make Real-World Mathematics Connections”**

January 12, 2021

Philippine Normal University **“Global Education and Teaching in the Non-Contact Era”** via zoom

December 12, 2020

SUCTEA International Research Conference and Curriculum Workshop with the theme **“Nurturing Globally Competent Filipino Teachers Through the Enhanced Curricula”**

September 12 -14, 2018

Cebu Technological University - Main Campus O**rganizational Leadership Seminar**

December 6, 2017

CURRICULUM VITAE

LYNNIEL D. PERADILLA

Block 22 Lot 18, Grand Terrace Heights, Casili, Consolacion, Cebu

Mobile: 0967- 204-9332

Email Address: lynnielperadilla@gmail.com

PERSONAL INFORMATION

DATE OF BIRTH	: February 01, 1988
PLACE OF BIRTH	: Calauan, Laguna
CITIZENSHIP	: Filipino
GENDER	: Female
STATUS	: Single
FATHER	: Nandrito S. Peradilla
MOTHER	: Analyn D. Peradilla

ACADEMIC BACKGROUND

GRADUATE STUDIES Master of Arts in Education

Major in Teaching Mathematics

Cebu Technological University

Main Campus, Cebu City

September 2018 - present

COLLEGE Bachelor of Science

Major in Mathematics

Cebu Normal University

Jones Avenue, Cebu City

2008 - 2009

HIGH SCHOOL **University of Cebu - Main Campus**

Urgello St., Cebu City

2004 - 2005

ELEMENTARY Maasin Elementary School

Maasin, Candelaria, Quezon

2000 -2001

PROFESSIONAL CAREER SERVICE ELIGIBILITY

Licensure Examination for Teachers

September 2010 - Passed

TEACHING EXPERIENCE

Senior High School Teacher

Southwestern University - PHINMA
Urgello St., Cebu City

June 2017 – present

Junior High School Teacher

St. Paul College Foundation Inc.

Ramos St., Cebu City

2015 - 2017

Part-time Elementary Mathematics Tutor

2014 - 2015

Junior High School Teacher

NuestraSeñora De Las Nieves, Inc.

Himamaylan City, Negros Occidental

2009 - 2014

SEMINARS ATTENDED

Lider 4: Fighting Forward: Teachers vs. Fake News
INSET for SHS Teachers - General Mathematics, Region VII
Ensuring Student Success Program
April 2022 Student Success Program SUMMIT
Breaking Barriers to Effective Communication
Teach Like a Champion Seminar on Teaching Techniques
Active Learning: Student Engagement Seminar

CURRICULUM VITAE

PATRICK M. SALINAS

Aspire Homes, Sitio Pailub, Sambag 2, Cebu City
Mobile: 09683171402
Email Address: salinaspatrick90@gmail.com

PERSONAL INFORMATION

DATE OF BIRTH : November 18, 1991
PLACE OF BIRTH : Binangonan, Rizal
CITIZENSHIP : Filipino
GENDER : Male
STATUS : Single
FATHER : Petronilo B. Salinas
MOTHER : Elisa M. Salinas

ACADEMIC BACKGROUND

GRADUATE STUDIES Master of Arts in Education

Major in Administration and Supervision
Cebu Technological University
Main Campus, Cebu City

April 2016

Doctor of Education
Educational Management
Southwestern University
Urgello St., Cebu City
April 2020

COLLEGE Bachelor in Secondary Education
Major in Mathematics
Southwestern University
Urgello St., Cebu City
2011 - 2012

HIGH SCHOOL Ramon E. Bacaltos National High School
Former Name: Simala NHS
Sibonga, Cebu
2007 - 2008

ELEMENTARY Simala Elementary School
Sibonga, Cebu
2003 - 2004

PROFESSIONAL CAREER SERVICE ELIGIBILITY

Licensure Examination for Teachers

September 2012- Passed

TEACHING EXPERIENCE

Faculty, School of Education

Southwestern University PHINMA

June 2012 to present

SEMINARS ATTENDED

2nd Integrated STEM Leadership Summit in Asia: Reimagining Integrated STEM Education
Module Writing in Mathematics
Student Engagement
Asking the Right Questions in Math and Teaching and Learning Math thru the Use of Technology
K to 12 Curriculum - Mathematics
Teach like a Champion Strategies
Word Indoor and Outdoor Program for Children and Adults with Intellectual and Physical
Disabilities
Instructional Leadership in the Context of Flexible Modalities of Teaching
Home-Based Learning Unwired: No Gadgets, No Internet
Remote STEM Teaching for Diverse Learners
Feedback and Assessment
Breaking Barriers in Effective Communication
Classroom Management
Understanding by Design
K to 12: Its Trends, Issues and Challenges
Google Educator Groups
Using the Standards for Effective Teaching and Learning
Effective Supervision of Teaching Science to the Standards
Resource Person, Good Study Habits
Resource Person, Assessment in the New Normal of Teaching