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Everyday Physics: A Storybook for Underachievers in Grade 7 Physics

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Abstract

The Everyday Physics Storybook with Reading, Reflecting, Displaying and Doing (R2D2) Model as its structure, aims to aid the difficulty in problem solving of the grade 7 underachievers in Physics. The said difficulty of the grade 7 underachievers in Physics was addressed by the developed storybook in this action research. The participants of the study were chosen by purposive sampling to make sure that all participants were identified as underachievers. The developed EPS was utilized by twenty-five (25) identified grade 7 underachievers in Physics coming from the five (5) handled sections of the teacher-researcher. A pretest was conducted before the implementation and utilization of the EPS and followed by a posttest administered afterwards. The paired sample t-test was used to determine the significant difference between the pretest and posttest scores. The scores were tabulated and analyzed using Microsoft Excel Data Analysis to determine if there is a significant difference between the pretest and posttest scores of the grade 7 underachievers. The EPS was content validated by experts and grade 7 underachievers using adapted worksheet evaluation tools. The computed mean scores were used to interpret the evaluation of grade 7 underachievers toward the content and physical properties of the EPS. The significant difference of the results of pretest and posttest scores showed that the use of EPS was effective in aiding grade 7 underachievers' difficulty in Physics. The researcher recommends the use of the same remediation material to other fields of specialization, specifically in Mathematics, to improve learners' academic proficiency.

Keywords: Storybook; R2D2 Model; Purposive sampling; Remediation material; Grade 7 Underachievers

1. Introduction

Department of Education reopened the school year 2021-2022 on September 13 in light of the Philippines' battle against the Corona Virus Disease (COVID-19) pandemic. Furthermore, blended learning, a learning delivery that combines face-to-face with any or a mix of online distance learning, modular distance learning and TV/Radio-based instruction, will still be implemented. This means that teachers will have the following options: offering lessons online, through modular or printed materials, television or radio. Blended learning will enable the schools to limit face-to-face learning, ensure social distancing and decrease the volume of people outside the home at any given time (DepEd via TEACHERPH, 2020).

One among the salient features of the K to 12 Basic Education Curriculum is ensuring integrated and seamless learning or the spiral progression. Concepts and skills in Life Sciences, Physics, Chemistry and Earth Sciences are presented with increasing levels of complexity from one grade level to another in spiral progression. The third quarter of Grade 7 Science under the sequence of domain/strands per quarter involves force, motion and energy which are disciplines to be studied in Physics.

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Hewitt (2015) stated that Physics is more than a part of the physical sciences, it's about the nature of basic things such as motion, forces, energy, matter, heat, sound, light, and the structure of atoms. (p.5) Furthermore, she added that physics is the most basic science, an understanding of science begins with an understanding of physics.

Studying physics can help learners answer many questions about how and why our world works, taking some real-life situations and examining them with the use of equations, a task often referred to as problem solving (Hickman, 2002), this is given significance in the curriculum grade-level standard for grade 7 Physics that gives the learners the competence in describing the motion of objects in terms of distance and speed and represent this in tables, graphs, charts and equations. They can describe the motion of an object in terms of distance or displacement, speed or velocity and acceleration. They can differentiate quantities in terms of magnitude and direction (K to 12 Science Curriculum Guide, 2016). Specifically, the curriculum demands grade 7 learners to describe motion in terms of distance, speed and acceleration and represent using motion diagrams, charts, graphs and equations.

Richert (1991) defines underachievement as a discrepancy between potential (what a child ought to be able to do) and actual performance (what a child is really demonstrating). Meanwhile, according to Dr. Diane Heacox, there are six underachiever profiles a student can take: 'the rebel', 'the conformist', 'the stressed learner', 'the struggling students', 'the victim' and 'the bored students' (Lucie Renard – bookwidgets.com, 2019)

In a study conducted by Erinosho in Nigeria (2013), findings showed three major sources of difficulty in learning physics as related: nature of subject specifically the dilemma of solving problems alone, teaching/teacher factors and curriculum/assessment. This is somewhat evident in the seventh grade which showed poor understanding of specific topics in the curriculum such as problem solving that involves computations.

Table 1 Ranking of Difficulty of Underachievers

Rank of Difficulty	Learning Difficulties of the Underachievers
1	The underachievers cannot able to solve word problems due to poor mathematical skills.
2	The underachievers cannot able to understand and comprehend word problems.
3	The underachievers have hard time to recognize formulas and steps of solving word problems.
4	The underachievers have hard time in reading word problems particularly.

According to the four grade 7 Science teachers, the main reason why the underachievers' achievement in learning Physics concepts particularly in solving word problems was they have difficulty in analyzing word problems due to poor reading comprehension (Rank 1 in Ranking of Difficulty), which in turn affects their basic mathematical skills such as conversion, formula derivation and computation. This is clearly shown in the performance of the underachievers from their previous grade in the subject.

Albert Einstein (1879-1955) said, "If you want your children to be intelligent, read them fairy tales. If you want them to be more intelligent, read them more fairy tales." Furthermore, Furner (2018) studies the use of literature in teaching mathematics which shows that using such literature in the teaching of mathematics may help to lower math anxiety and pique students interest and confidence in math and the STEM fields. In line with this, a remediation material will be developed to help underachievers in acquiring the required competencies in Physics for grade 7 learners. This study will respond to the difficulties of underachievers in measurement and computation in Physics through sample word problem activities brought by the Everyday Physics Storybook. This remediation material is aligned with the Read, Reflect, Display and Do (R2D2) Model proposed by Curt Bonk and Ke Zhang in 2006, which works on four components: (1) Reading; (2) Reflecting; (3) Displaying; and (4) Doing.

Figure 1 shows the four components of the R2D2 Model – Reading, Reflecting, Displaying and Doing. It is a problem-solving wheel that represents phases of learning – from reading and exploration, to reflective writing, to visualization of the content learned, to attempts to try it out. The model starts on the reading phase for verbal and auditory learners which involves problem orientation and knowledge acquisition. The arrow shows readiness for the next phases. The reflecting phase for reflective and observational learners which involves problem clarification and knowledge construction. The displaying phase for visual learners which involves solution seeking analysis and knowledge representation. Lastly, the doing phase for hands-on learners which involves solution evaluation and knowledge transfer. This model will be integrated in the development of the said remediation material by applying its various components to help underachievers overcome their problem solving difficulties in Physics.

From the literatures and studies that will prove the difficulty in learning Physics the same with the observed learning hindrances of grade 7 learners by the researcher and Science teachers, underachievers must be taken into account thus require intervention to cope up with the problem. The dilemmas that involve problem solving in Physics of the underachievers must be addressed by the development and utilization of Everyday Physics storybook aligned with the MELCs in the K to 12 Science Curriculum for grade 7 learners.

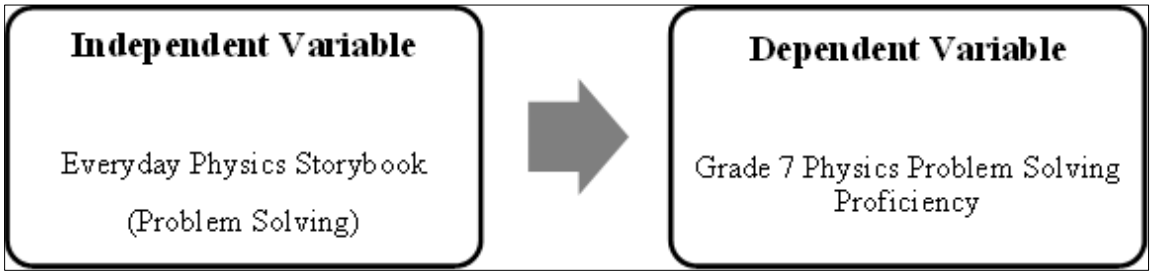

Figure 1 IV-DV Conceptual Framework

Figure 1 shows the conceptual framework of this action research. In the framework, the developed storybook was the independent variable, the arrow shows the process involved that will lead to the Grade 7 underachievers' Physics Proficiency in Problem Solving, the dependent variable. It is presumed that the developed storybook would be a great help to break the difficulties of the underachievers in problem solving in Physics.

1.1. Research Questions

This action research aims to develop a storybook about everyday physics application that will help grade 7 underachievers who are having difficulties in understanding physics concepts improve their achievement. Moreover, everyday physics will give emphasis in enhancing the measurement and computation skills of learners through simple word problem activities. Specifically, it will answer the following:

- What remediation material must be developed that will help grade 7 underachievers improve their achievement in Physics?
- Is there a significant difference in the pretest and posttest scores of grade 7 underachievers?
- How did Everyday Physics helped underachievers improve their academic achievement?

1.2. Hypothesis

The null hypothesis will be tested at 0.05 level of significance.

- There is no significant difference between the pretest and posttest of the experimental group.

1.3. Scope and Limitations

This action research will focus on the development of Everyday Physics storybook and look into its effectiveness featuring easy-to-comprehend-word-problems in aiding the difficulties of the underachievers in grade 7 Physics. The content and face validation of the storybook will be done by the schools' division Education Program Supervisor (EPS) in Science and grade 7 teachers who were currently teaching Science in the seventh grade. The study will not cover the authentic assessment as well as the students' attitude towards the subject matter. The Everyday Physics Storybook will be administered to identified Science underachievers in grade 7 of Parada National High School, Santa Maria, Bulacan after the entire third grading period as remediation material. The table below shows the competencies which require computation/ problem solving skills, thus will be covered by Everyday Physics Storybook for Grade 7 Underachievers. This will be based on enclosure no. 1 to Division Memorandum No. 026, s. 2022 or the adjusted school calendar of school year 2021-2022.

Table 2 Everyday Physics Storybook Curriculum Map

Lesson and Code	EPS Objectives	Date
I. Motion in One Dimension Weeks 1 & 2 *S7FE-IIIa-1*	Describe motion in terms of distance and displacement Calculate the distance and displacement of an object Describe motion in terms of speed and velocity Calculate the speed and velocity of an object Describe motion in terms of acceleration Calculate the acceleration of an object	February 21-March 4, 2022
II. The Characteristics of Light Week 5 *S7LT-IIId-7*	Calculate the speed of light based on frequency and wavelength.	March 21-25, 2022

2. Method

2.1. Type of Research

The Quasi-Experimental Design, an empirical interventional study used to estimate the causal impact of an intervention on a target population without random assignment, will be utilized in this action research. With this method, the data will be collected with one-group pretest-posttest design to determine the achievement of grade 7 underachievers in Physics after the utilization of the EPS, with the following conditions:

- Administration of pretest to the group.
- Administration of treatment to the group.
- Administration of posttest to the group.

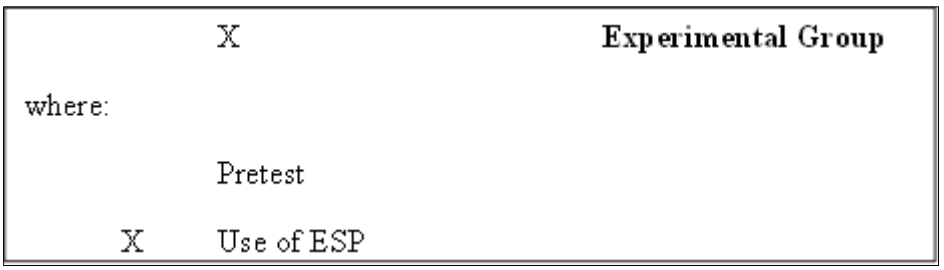

Figure 2 Illustration of the Quasi-Experimental One-Group Pretest-Posttest Design

2.2. Participants

The participants of this study will be composed of 25 grade 7 underachievers of Parada National High School located in Barangay Parada, Santa Maria, Bulacan from five different sections handled by the researcher. The learners which were sectioned based on zoning scheme would be an ease in monitoring and distribution of Self Learning Modules (SLMs) and can be used in giving the Everyday Physics Storybook. The zone of each section were the following: (1) Almond, (2) Eucalyptus, (3) Ipil – Brgy. San Vicente/Muzon; (4) Lauan – Brgy. Tumana and (5) Talisay – Brgy. San Vicente (Old Borland/Gulod/New Borland). The participants will be selected based from the following criteria: (1) previous grade in Science and Mathematics (2) to-be-remediated underachievers as prescribed and identified by their previous Science and Mathematics teachers; and (3) learners having poor basic computation skills. The participants' age ranges from 12-14 years old and were heterogeneous in terms of sex, attitude and socio-economic status.

2.3. Sampling Method

Purposive sampling will be employed in selecting the research participants. Purposive sampling technique is a non-probability sampling technique where participants were selected on the judgment of the researcher based on given criteria (Robinson, 2014). The 25 underachievers among the five sections handled by the researcher will be purposively selected based from the aforementioned criteria.

2.4. Proposed Intervention

In this study, an Everyday Physics Storybook will be developed incorporating the ADDIE model to aid the dilemma in learning concepts in Physics. This storybook will serve as a remediation material to improve grade 7 underachievers proficiency level in Physics in the third quarter, academic year 2020-2021. The developed Everyday Physics Storybook (EPS) will be content validated by the Science Education Program Supervisor and Science Head Teacher, and a Master Teacher majored in Physics. The suggestions and recommendations of the expert validators will be implemented to the EPS. The edited EPS will be pilot tested to five randomly selected grade 7 learners residing near the school for pilot testing. The students will try to answer the problem sets in the storybook, write comments and accomplish an evaluation to assess the EPS. This is done to ensure that the difficulty and structure of the EPS is suitable to grade 7 learners.

The researcher teaches five grade 7 sections which were based on zoning scheme for the ease of monitoring and distribution of Self Learning Modules. After the third quarter, the students who are underachievers will be identified and will serve as the experimental group. The Everyday Physics Storybook (EPS) will help the students to attain the Most Essential Learning Competencies (MELCs) in Science 7 given by the Department of Education, EPS Objectives and improve learning skills with the use of reading, reflecting, displaying, doing model. The intervention material will be validated by three head teachers in public junior high schools in Santa Maria, Bulacan. The structure of the Everyday Physics followed the R2D2 Model. The storybook is composed of the following parts for each EPS objective:

Table 3 R2D2 Model Implementation in Everyday Physics Storybook

R2D2 Model	Everyday Physics Storybook	Description
Reading Phase	Reading Time!	In this part of the storybook, the storybook objectives, title of the story and the whole story itself will be presented to the underachievers.
Reflecting Phase	Let Us Identify!	In this part of the storybook, the lesson that was involved in the story they've read will be identified and related by the underachievers.
Displaying Phase	Apply It!	In this part of the storybook, the underachievers are tasked to apply the performance standards of the lesson.
Doing Phase	Sum It Up!	In this part of the storybook, the lesson from the story they've read will be generalized and a word problem will be asked to solve by the underachievers which will serve as formative assessment.

2.5. Instruments

The researcher will develop a Table of Specification (TOS) containing the competencies indicated in the Most Essential Learning Competencies for grade 7 Physics. A forty-item multiple choice pretest and posttest will be made based on the TOS. The discrimination and difficulty indices of each item will be identified using an item analysis. The grade 7 underachievers will evaluate the ESP after they've used it. The ESP Evaluation and Validation Checklist will be used by the participants to evaluate how the worksheet made learning Physics easy by its objectives, content, activities and appearance.

2.6. Data Collection Procedure

The data will be collected through a three-phased procedure.

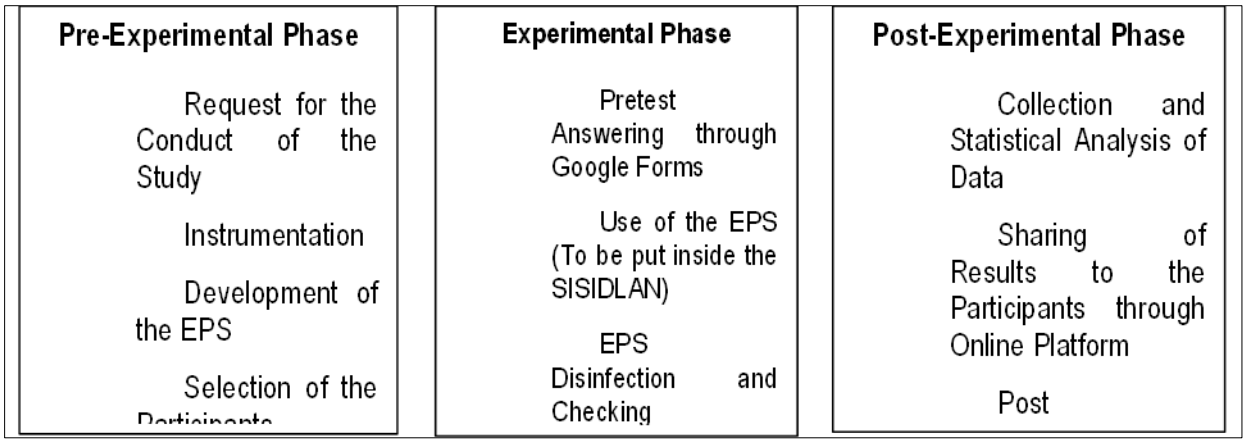

Figure 3 The Proposed New Normal Intervention Procedure

The pretest will be administered to the participants of the study through Google Forms at the start of fourth grading period. The participants will be given a corresponding code individually to keep their identity confidential. The e-test papers will bear the codes of the participants and no name nor anything that will divulge the identity of the participants. Everyday Physics Storybook will be given to the underachievers based on the number of weeks in the MELCs and it will be put inside their *Sipi ng mga Inayos at Sininop na Individual Daly Lessons na Angkop sa New Normal* (SISIDLAN). The EPS will be retrieved and checked after the disinfection of the SISIDLAN. After the intervention, the posttest will be administered via Google forms. The results will be encoded using Data Analyzing Software for statistical treatment. A simple survey about the student's attitude towards the Everyday Physics Storybook will be administered to the experimental group. Student's feedback and experiences will be noted by the researcher. The results of the study will be shared virtually via online platform such as Messenger Rooms, Google Meet and Zoom. The transmittal and retrieval of the pretest, posttest and EPS will follow the guidelines implemented by the Inter-Agency Task Force (IATF) such as wearing face mask and face shield, proper sanitation of the materials and observing/practicing social distancing to avoid contracting COVID-19.

3. Results and discussion

The results of the pretest and posttest administered to the participants will be gathered and treated with utmost confidentiality. To ensure the confidentiality and veracity of the results, the following procedures will be followed by the researcher:(1) the sealed envelopes containing the results of the assessment will be opened after the experimental phase; (2) the achievement test's answer sheets will be checked manually by the researcher; and (3) the result analysis will be aided by Data Analysis Software. The difference in the results of the pretest and posttest of the experimental group will be determined by the use of Z-Test. Chen (2020) defines Z-test as a statistical test used to determine whether two population means are different when the variances are known and sample size is large. It will be used in this study to determine whether the means of the results of the achievement test of the control and experimental groups will be significantly different in hypothesis testing. In addition, Z Test is the statistical hypothesis which is used in order to determine that whether the two samples means calculated are different in case the standard deviation is available and sample is large whereas the T test is used in order to determine a how averages of different data sets differs from each other in case standard deviation or the variance is not known. These are under the assumption that the data gathered are normally distributed, otherwise, non-parametric tests will be used.

3.1. Work Plan

Table 4 Workplan for the implementation of the study

Objectives	Strategy/Activity	Target Time and Date	Person/s Involved	Expected Outcome
To conduct an online orientation among Grade 7 underachievers and	The researcher shall conduct online orientation using google meet among Grade 7 underachievers and their parents about the objectives	1 day	School Head Researcher Grade 7 Underachievers	Oriented and well-informed participants of the study through online platform

their parents about the study. To request parental and students' consent allowing the student to be one of the participants in the study	and significance of the study. Their contribution and participation will be explained to them in detailed. Letters will be given to the parents requesting permission and support to the conduct of the study. The consent includes the assurance that all data gathered in the study will be treated with utmost confidentiality.	(March 7, 2022)	Parents	Parental Consent Assent Letters
To prepare and develop Everyday Physics Storybook based on MELCs.	The researcher shall prepare and develop Everyday Physics Storybook based on the MELC's	6 days (March 8-13, 2022)	Researcher	Developed Everyday Physics Storybook
To validate the Everyday Physics Storybook by the experts.	The researcher shall give the EPS to concern experts for validation.	1 day (March 14, 2022)	Science Experts Researcher	Validated Intervention Materials
To administer a pretest in Science via BAG KO among Grade 7 learners based on the most essential learning competencies stated in the curriculum guide	The Science teachers shall administer the teacher-made 50 item Pre-test in Physics among Grade 7 underachievers based on the most essential learning competencies in the curriculum guide.	1 day (March 7, 2022)	Researcher Science Teachers Grade 7 students	Pretest
To analyze and interpret the heterogeneity of the scores in the pretest using statistical tools	The teachers will check the answers of the students and conduct an item analysis to interpret the heterogeneity of the scores in the pretest using the Independent Sample Z-Test.	1 day (March 21, 2022)	Researcher Science Teachers	Results of the Item Analysis Interpretation of the Pretest Score
To submit a report on the result of the pretest, the least mastered competencies, and the most mastered competencies in Physics from the Grade 7 underachievers	The researcher shall submit a report on the result of the pretest of the students including the least mastered competencies and most mastered competencies in Physics of Grade 7 underachievers	1 day (March 22, 2022)	Researcher Science Teachers	Report on the Least Mastered Competencies and Most Mastered Competencies in Science of Grade 7 underachievers.
To implement the study To utilize EPS to Grade 7 underachievers	The researcher will conduct the study. The developed intervention materials will be used by the participants.	25 days (March 22-April 15, 2022)	Teacher-Researcher Selected Grade 7 student-participants	EPS
To observe and keep track of the	The researcher will keep weekly observation of the implementation of the	5 days	Researcher	Class Record EPS

development of the study To record the academic performance of the students	intervention and academic records of the participants. The teaching and learning process during the implementation of the intervention will be observed and evaluated.	(April 18-21, 2022)	Science Teachers Participants of the Study School Principal	
To administer the posttest to the participants.	The researcher will administer the posttest to the participants.	1 day (April 18, 2022)	Science Teachers Research Participants	Posttest
The researcher will administer the EPS Learner's Evaluation and Validation Tool	The learners will validate the intervention material based on their experience.	1 day (April 18, 2022)	Research participants Researcher	EPS Validation Tool
To analyze and interpret the gathered data in the study using valid statistical and data analysis tools.	The researcher will analyze the data using MS Excel Application and Thematic Analysis.	2 days (April 18-19, 2022)	Researcher Statistician	Analyzed and Interpreted Data
To formulate findings, trends, and recommendations developed from the results of the study. To submit a hardbound copy of the study to the Division office	The researcher will formulate findings, conclusion, and recommendations developed form the results of the study.	4 days (April 25-29, 2022)	Researcher School Head SDRC	Complete Action research Manuscript in hardbound copies

3.2. Plan for Dissemination and Utilization

After the conduct of this study, the results will be presented to the concerned faculty members and student-participants. The participants will reflect on their experiences and learnings during their involvement upon utilization of the storybook and will be shared with their teachers and classmates and even to their parents. The result of the study will be shared virtually using online learning platforms such as Messenger Rooms, Google Meet and Zoom. A copy of the research will be submitted to DepEd Division of Bulacan and will be deposited to the school's Learning Resource Management and Development (LRMD) Center.

4. Conclusion

The developed Everyday Physics Storybook (EPS), structured with the Reading, Reflecting, Displaying, and Doing (R2D2) model, demonstrably improved the problem-solving abilities of grade 7 underachievers in Physics. The statistically significant difference between pretest and posttest scores confirms the effectiveness of the EPS as a remediation tool. Expert and student evaluations further validated the content and physical properties of the EPS, indicating its suitability and acceptance. Therefore, the implementation of the EPS is a viable and effective strategy to address the challenges faced by underachieving students in Physics. Furthermore, the successful application of the R2D2 model within the EPS suggests its potential applicability to other subject areas, such as Mathematics, for enhancing student academic proficiency.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors of this article declare that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

Statement of ethical approval

The study will follow the ethical guidelines for educational research. The researcher will write a letter of request and endorsement to the school principal. Upon her approval, a letter of request to proceed, addressed to the Schools Division Superintendent (SDS) will be written, together with the research proposal. This study will be implemented once the endorsement of the SDS is secured and the following procedure will be done: (1) the participants will be given letter of consent of the parents by putting it inside their SISIDLAN prior to the conduct of the study; (2) the protection of the privacy of the research of the research has to be ensured by keeping it confidential; (3) the data will be collected by putting all the materials in the participants' SISIDLAN; (4) only the researcher and authorized persons will be given access to the data; (5) the responses of the participants will be properly coded and no information about the participants will be disclosed; (6) all collected data will be analyzed using a data analysis software; (7) reasonable requests for a copy or terms of data handling, transfer and destruction by the participants will be respected; (8) data transfer through the flash drive or any portable digital storage device will be avoided to further keep the data collected safe; (9) raw data in digital format will be destroyed once acceptable data processing and analysis are attained by the researcher; and (10) data safety will also be observed on hard copy data sources by providing an envelope with seals to ensure safety during transfer. All the protocols and procedure will be observed by the researcher to ensure that no respondents or participants will be endangered due to inappropriate handling of the collected data.

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