



SMART Learning: An AI-Driven Strategy to Enhance English Language Proficiency of Grade 9 Learners

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I. ABSTRACT

This study aimed to determine the significant difference between the two separate groups of Grade 9 learners in Sacub National High School, Division of Davao del Sur based on their assessment scores in the pretest and post-test scores in English and to determine their procedural and conceptual understanding on SMART Learning (Self-Learning, Machine Learning, Adaptive Learning, Responsive and Technology-based) through an AI-driven strategy. Utilizing a random sampling method, this study identified 35 Grade 9 Learners from two separate groups; the experimental group used SMART Learning while the control group used traditional learning methods. Frequency counts, mean, and paired sample T-tests were utilized to analyze the data gathered. Results revealed a significant difference in assessment scores before and after the implementation of the SMART Learning strategy. The mean difference of -8.129 and a t-value of 4.26 with 34 degrees of freedom implied that the use of SMART Learning had a substantial and statistically significant impact on enhancing the English Language Proficiency of the learners. The negative mean difference, in this context, indicated an improvement in proficiency levels, and the t-value reinforced the reliability of this observed improvement. Moreover, the participants' comprehension of procedural and conceptual aspects in SMART Learning, indicated by a mean score of 3.26 and verbally interpreted as a

"Confident Demonstration" of understanding, suggested that the participants, on average, exhibited a moderate level of confidence in grasping both the procedural and conceptual components of SMART. The term "Confident Demonstration" conveyed a positive sentiment, yet a substantial, level of proficiency. Participants might not have exhibited an exceptionally high level of confidence, but they demonstrated a solid and dependable level of understanding in both procedural and conceptual aspects of SMART Learning, with a notable degree of confidence in their comprehension.

II. ACKNOWLEDGEMENT

We extend our sincere gratitude to all those who contributed to the successful completion of this research project. First and foremost, we are thankful to our family for supporting us in our endeavor.

We also want to express our sincere thanks to the participants of this study, whose cooperation and willingness to share their experiences were vital to the success of this research. Their contributions have added depth and validity to the findings.

Our gratitude extends to the faculty and staff of Sacub National High School, particularly to our School Head, Marlon Y. Abarcar, whose resources and facilities provided the necessary support for conducting this research. Above all, we express our deepest gratitude to the Almighty God for His unending providence, for without Him, all these things are impossible.

III. CONTEXT AND RATIONALE

Nowadays, in this rapidly evolving technological landscape, the integration of artificial intelligence (AI) in education stands as a transformative force, reforming

traditional learning paradigms. Although the conventional teaching model is said to be effective to an extent, it struggles to cater to the individualized needs and learning paces of learners and often results in significant challenges in enhancing English Language Proficiency (ELP) among learners, particularly in diverse and multicultural classrooms.

The study of Xi Zhang, Jing Sun & Yiting Deng (2023) in China, tailored the need to adopt more innovative teaching methods that stimulate students' interest in learning, facilitate their experience of the English language to promote English Language Proficiency (ELP) among learners. One promising approach to achieve their objectives was through the integration of smart classroom teaching using artificial intelligence (AI) technology.

As mentioned earlier, the emergence of AI has already made its way into the education sector including the Philippine educational system. Undoubtedly, AI is helpful in the aspects of teaching and learning and can assist teachers in guiding students to enhance their learning experience, but it was argued by some scholars that along with AI's benefits, it might also pose a threat to the current educational system by using it as a weapon that may be misused in the wrong hand (Estrellado & Miranda, 2023).

Challenges such as those mentioned above, were somewhat like in our English class, specifically in English 9. We have seen firsthand that learners struggle to learn English and have a hard time communicating effectively using the language. Thus, the English proficiency level is low. In our traditional class, the one-size-fits-all approach to language teaching seemed to fall short of accommodating the unique learning needs of our students. This limitation becomes particularly pronounced in our general class in grade 9, where students come with varied linguistic backgrounds and proficiency levels.

This observation led the teacher-researchers to delve into this research to uncover not only its potential to improve English language proficiency but also the underlying

mechanisms that contribute to its efficacy. The findings of this study can inform educators, curriculum developers, and policymakers, providing evidence-based insights to optimize language education strategies.

To address the above-mentioned concern, the teacher-researchers of the school crafted an intervention program, intending to enhance the English language proficiency among Grade 9 learners through an AI-driven strategy called SMART Learning.

IV. INNOVATION, INTERVENTION AND STRATEGY

SMART Learning: AI-driven strategy offered a paradigm shift in language teaching. Through personalized, adaptive learning pathways, real-time feedback mechanisms, and interactive modules, SMART learning catered to the specific requirements of each learner. By analyzing learners' strengths and weaknesses, SMART learning platforms could dynamically adjust instructional content, ensuring that students received targeted support in areas where they needed it the most. AI technologies encompassed a wide range of tools and techniques, such as Natural Language Processing (NLP), Machine Learning, and Adaptive Learning Systems that could be tailored to personalize instruction, thus significantly enhancing the language proficiency of the learners (D'Mello et al., 2021).

Natural Language Processing was one of AI's techniques that enabled machines to understand, interpret, and generate human language. It included tasks such as text summarization, sentiment analysis, and machine translation, all of which contributed to improving language proficiency. Specifically, the sample applications for this were text-to-speech conversion, speech-to-text conversion, image-to-text, language translation, etc. Another technique that could be used was Machine Translation, such as Google

Translate, Duolingo, and Lingua Translate, where the machine used learning algorithms to translate text from one language to another.

Moreover, we also let our students use AI Chatbots and Virtual Assistants to engage in natural conversations. These included Google Assistant, Google Bard AI, ChatGPT by OpenAI, and among others. These provided language learners with opportunities for interactive language practice, enhancing proficiency through real-time interactions. Additionally, an adaptive learning system was also used in our study where we, as the facilitators, catered to the individual learning needs of our students in understanding difficult concepts or words, allowing them to progress at their own pace. Good examples of which we used in class were the Vocabulary Building Apps. These were designed to help users improve their vocabulary skills.

Along with these applications was the grammar-checking tool, which helped learners correct grammar and spelling mistakes and provided suggestions for improving sentence structure, vocabulary, and writing style. The most popular AI-powered grammar-checking tool was Grammarly. The teacher-researcher allowed the learners to use this tool to enhance their writing. With this interactive approach to grammar exercises, learning became more dynamic and memorable. All these AI techniques employed AI algorithms to create a personalized learning experience for each user.

Hence, to enhance the English Language Proficiency of the Grade 9 students, the teacher-researchers conducted an intervention program called "SMART Learning: AI-driven strategy, a 10-minute-twice-a-week activity, done during English class in the Grade-9-General Section. The intervention involved the use of the Internet, Smart TV, and the smartphones of the students in the audio-visual room of the school. This was also done through a collaborative learning activity where learners actively participated in the discussions and learning tasks. Although some applications could be accessed offline,

users were encouraged to connect to the Internet for a more interactive sharing of ideas, perspectives, and understanding of the subject matter.

During the monitoring process, the participants were interviewed using semi-structured 3-item interview questions to further understand the students' procedural and conceptual understanding of SMART Learning. The findings of this study were used as the basis for a resolution of whether the AI-driven strategy was effective.

This SMART Learning: AI-driven strategy to enhance the English language proficiency of Grade 9 learners of Sacub National High School was conducted at the beginning of the second quarter of the school year 2023-2024.

V. ACTION RESEARCH QUESTIONS

This action research intended to enhance the English language proficiency of Grade 9 learners through SMART: AI-driven strategy.

Specifically, it aims to answer the following questions:

1. What are the students' procedural and conceptual understanding of SMART Learning: Artificial Intelligence-Driven Strategy?
 - a. Prior to the application of SMART Learning: AI-driven Strategy?
 - b. After the application of SMART Learning: AI-driven Strategy?
2. Is there a significant difference between the two separate groups based on their assessment scores: pretest and posttest scores?
3. What are the implications of this study for English language teaching?

VI. ACTION RESEARCH METHODS

Participants and/or Other Sources of Data and Information

The participants of the study included 35 students taken as a sample population from Grade 9 Hemingway, which had fifty-seven (57) students in the class. They were part of the general section. The data recorded in this experimental group included formative test results, written assessments, pre-test and post-test results, and questionnaires; the same went for the control group.

Data Gathering Methods

The teacher-researchers created a 30-item written assessment, quality checked by the District English Language Quality Team. This assessment was conducted on Grade 9 sections Hemingway and Frost. However, the SMART Learning: AI-driven strategy was only given to the former, considered the treatment group of Sacub National High School. This group received the variable to be tested in the experiment.

After identifying the participants of the study, the teacher-researchers implemented the SMART Learning: AI-driven Strategy for two months during the second quarter for the experimental group. Following the implementation period, the teacher-researchers conducted post-tests and written assessments for both the control and experimental groups, measuring the effectiveness of the project using frequency count. The final method of data gathering was an In-Depth-Interview (IDI) using 3-item semi-structured interview questions to further understand the procedural and conceptual understanding of the students regarding SMART Learning: AI-driven strategy.

Data Analysis

The data gathered from the pretest and post-test of the two groups (the control and the experimental) were subjected to statistical treatment. Both were systematically

compiled and subjected to statistical treatment, employing measures such as frequency, percentage, and a paired/dependent sample t-test to discern significant differences in the pretest and post-test. Descriptive statistics, specifically frequency, and percentage, were utilized to address research questions 1 and 2. The paired sample t-test, a statistical tool assessing the mean difference between two sets of observations, was employed to ascertain the significant effect of the implemented intervention. The entire dataset was carefully recorded, tallied, tabulated, and scrutinized to extract meaningful implications from the study.

The following value assignments were:

**Procedural and Conceptual Understanding of the Students on SMART Learning:
 An AI-Driven Strategy**

Frequency	Interpretation
5-6	Clear and Detailed Explanation
3-4	Confident Demonstration
1-2	Partial Understanding
0	No Response

To gain a deeper understanding of the procedural and conceptual articulations of SMART Learning: Artificial Intelligence-Driven Strategy, the 3-item semi-structured In-Depth Interview (IDI) was analyzed using Colaizzi’s data analysis methods. This involved transcribing the interview responses, followed by a thorough review and re-reading of the interview transcripts to pinpoint the significant statements made by participants. Subsequently, the identified significant statements were organized into codes and categories based on their similarities, gradually revealing distinct patterns or themes throughout the process. These emergent themes encapsulated the participants’ perceptions and sentiments.

VII. DISCUSSION OF RESULTS AND REFLECTION

This section covered the discussion of results and the examination of findings. The data presented in this section outlined the arrangement of issues as posed in the Action Research Questions.

Before the implementation of the intervention strategy (SMART Learning: An AI-Driven Strategy), a pretest was employed.

1. Students' procedural and conceptual understanding of SMART Learning: An Artificial Intelligence-Driven Strategy
 - a. Prior to the application of SMART Learning: AI-driven Strategy

Table 1
 Students' Procedural and Conceptual Understanding of SMART Learning

Pre-Intervention Data		
Participant No.	Frequency Count	Verbal Interpretation
<i>Participant no. 1</i>	0	No Response
<i>Participant no. 2</i>	1	Partial Understanding
<i>Participant no. 3</i>	1	Partial Understanding
<i>Participant t no. 4</i>	1	Partial Understanding
<i>Participant no. 5</i>	2	Partial Understanding
<i>Participant no. 6</i>	1	Partial Understanding
<i>Participant no. 7</i>	2	Partial Understanding
<i>Participant no. 8</i>	1	Partial Understanding
<i>Participant no. 9</i>	3	Confident Demonstration
<i>Participant no. 10</i>	1	Partial Understanding
<i>Participant no. 11</i>	3	Confident Demonstration
<i>Participant no. 12</i>	1	Partial Understanding
<i>Participant no. 13</i>	1	Partial Understanding
<i>Participant no. 14</i>	1	Partial Understanding
<i>Participant no. 15</i>	1	Partial Understanding
<i>Participant no. 16</i>	1	Partial Understanding
<i>Participant no. 17</i>	0	No Response
<i>Participant no. 18</i>	1	Partial Understanding
<i>Participant no. 19</i>	0	No Response
<i>Participant no. 20</i>	1	Partial Understanding
<i>Participant no. 21</i>	0	No Response
<i>Participant no. 22</i>	1	Partial Understanding
<i>Participant no. 23</i>	0	No Response
<i>Participant no. 24</i>	1	Partial Understanding
<i>Participant no. 25</i>	1	Partial Understanding
<i>Participant no. 26</i>	3	Confident Demonstration

<i>Participant no. 27</i>	1	Partial Understanding
<i>Participant no. 28</i>	0	No Response
<i>Participant no. 29</i>	1	Partial Understanding
<i>Participant no. 30</i>	3	Confident Demonstration
<i>Participant no.31</i>	2	Partial Understanding
<i>Participant no. 32</i>	3	Confident Demonstration
<i>Participant no. 33</i>	2	Partial Understanding
<i>Participant no. 34</i>	1	Partial Understanding
<i>Participant no. 35</i>	2	Partial Understanding
	Total = 44 Mean = 1.26 Partial Understanding	

Table 1 presents the extent of students' understanding of the procedural and conceptual articulations of SMART Learning: An AI-Driven Strategy to Enhance the English Proficiency Level of Grade 9 Learners with an overall mean weight of 1.26, with a verbal interpretation categorizing it as a "Partial Understanding".

The findings indicate that, before the strategy's implementation, some students already possessed partial knowledge or understanding of Artificial Intelligence. While a few participants provided no responses, suggesting a lack of familiarity with the concept, the majority believed that the SMART Learning strategy was rooted in principles of personalized learning, adaptive feedback, and continuous improvement.

The survey was carried out as part of the implementation of the newly established Strategy using Artificial Intelligence. The 3-item structured interview questions were asked to 35 students in the experimental group. Moreover, the identified results shed light on the diverse levels of prior knowledge among students regarding Artificial Intelligence (AI) before the implementation of the SMART Learning strategy. Notably, it is noteworthy that some students demonstrated a partial understanding of AI concepts.

b. After the application of SMART Learning: AI-driven Strategy

Table 2

Students' Procedural and Conceptual Understanding of SMART Learning

Post-Intervention Data		
Participant No.	Frequency Count	Verbal Interpretation
<i>Participant no. 1</i>	3	Confident Demonstration
<i>Participant no. 2</i>	3	Confident Demonstration
<i>Participant no. 3</i>	3	Confident Demonstration
<i>Participant t no. 4</i>	3	Confident Demonstration
<i>Participant no. 5</i>	3	Confident Demonstration
<i>Participant no. 6</i>	3	Confident Demonstration
<i>Participant no. 7</i>	5	Clear and Detailed Explanation
<i>Participant no. 8</i>	3	Confident Demonstration
<i>Participant no. 9</i>	3	Confident Demonstration
<i>Participant no. 10</i>	4	Confident Demonstration
<i>Participant no. 11</i>	3	Confident Demonstration
<i>Participant no. 12</i>	2	Partial Understanding
<i>Participant no. 13</i>	2	Partial Understanding
<i>Participant no. 14</i>	3	Confident Demonstration
<i>Participant no. 15</i>	5	Clear and Detailed Explanation
<i>Participant no. 16</i>	3	Confident Demonstration
<i>Participant no. 17</i>	5	Clear and Detailed Explanation
<i>Participant no. 18</i>	3	Confident Demonstration
<i>Participant no. 19</i>	3	Confident Demonstration
<i>Participant no. 20</i>	2	Partial Understanding
<i>Participant no. 21</i>	2	Partial Understanding
<i>Participant no. 22</i>	3	Confident Demonstration
<i>Participant no. 23</i>	3	Confident Demonstration
<i>Participant no. 24</i>	3	Confident Demonstration
<i>Participant no. 25</i>	3	Confident Demonstration
<i>Participant no. 26</i>	3	Confident Demonstration
<i>Participant no. 27</i>	3	Confident Demonstration
<i>Participant no. 28</i>	4	Confident Demonstration
<i>Participant no. 29</i>	5	Clear and Detailed Explanation
<i>Participant no. 30</i>	5	Clear and Detailed Explanation
<i>Participant no.31</i>	4	Confident Demonstration
<i>Participant no. 32</i>	3	Confident Demonstration
<i>Participant no. 33</i>	3	Confident Demonstration
<i>Participant no. 34</i>	3	Confident Demonstration
<i>Participant no. 35</i>	3	Confident Demonstration
	Total = 114 Mean = 3.26 Confident Demonstration	

Table 2 illustrates the extent of students' comprehension regarding the procedural and conceptual facets of SMART Learning: An AI-driven strategy designed to elevate the

English proficiency level of Grade 9 learners. The table displays an overall mean weight of 3.26, with a verbal interpretation categorizing it as a "Confident Demonstration." This designation suggests a robust understanding among students regarding how SMART learning functions. As they engaged with SMART Learning platforms, there was an observable increase in the frequency of their procedural and conceptual understanding of the terms.

Delving into the advantages of integrating AI into the learning process, students expressed beliefs in the benefits of AI, including personalized learning experiences, adaptability to individual needs, timely feedback, and enhanced overall efficiency. Additionally, they perceived the AI-driven approach as optimizing study time, ultimately leading to improved comprehension and retention of course material.

2. Significant difference between the two separate groups based on their assessment scores: pretest and post-test scores

Table 3
 Significant Difference Between the Two Separate Groups Based on Their Assessment Scores; Pretest And Post-Test Scores

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	.05% Confidence Interval of the Difference				
				Lower	Upper			
Pre-Intervention Post-Intervention	-8.129	3.421	0.05	-10.51	-10.27	4.26	34	0.002

Table 3 displays that the significant difference observed in the paired sample test, showcasing a mean difference of -8.129 and a t-value of 4.26 with 34 degrees of freedom, strongly supports the notion that the SMART Learning strategy had a substantial impact on enhancing the English Language Proficiency of the learners.

These results demonstrated a noteworthy change in the utilization of SMART Learning before and after the intervention. The findings underscore a substantial difference in the pre and post-intervention results for the participants. The implemented intervention was proven to bring about significant improvements in the English Proficiency of learners.

Supporting these results, Seo, K., Tang, J., Roll, I., et al. (2021) emphasized the positive recognition of AI systems for enhancing communication in terms of both quantity and quality. AI is acknowledged for providing just-in-time, personalized support in large-scale settings, fostering a sense of connection. Moreover, the potential of AI to significantly enhance communication skills among English language learners is highlighted through personalized and interactive learning experiences.

In summary, the paired sample analysis indicated a clear positive impact of the SMART intervention on students' performance, aligning with broader literature that underscores the positive role of SMART Learning: an AI-driven strategy in educational settings, particularly in language learning and communication skills development.

3. Implications of this study for English language teaching

Table 4

Implications of this study for English language teaching

Themes	Statement
<p>Procedural Understanding</p>	<p><i>"I have been using SMART Learning till now after it was introduced to us. It's a platform we access for language assignments and interactive lessons. I use it at least twice a week for various activities."</i></p>
	<p><i>"I use SMART Learning for grammar exercises and vocabulary building."</i></p>

	<i>Recently, we had a group project where we collaborated on SMART Learning, sharing documents and giving feedback."</i>
	<i>"Our teacher used SMART Learning App that records our attendance and quizzes and she can easily tell us our standing scores whether failing or passing" Very helpful to us.</i>
Conceptual Aspect	<i>"SMART Learning is like using a special tool to help me learn things better. It's like having a smart friend who shows me cool ways to study and understand new stuff on the computer."</i>
	<i>"I enjoyed SMART Learning because it is very interactive, I am enjoying learning. Sometimes my teacher used games, videos, and things like quizzes that make learning fun. It also helps me with my homework and lets me talk to my friends and teachers."</i>
	<i>"I use Smart Learning for most subjects. It helps me with math problems, English words, and even science facts. It's like having a helper for all my subjects!"</i>

Table 4 demonstrates the qualitative responses of the learners on the 3-item interview questions. Their reactions indicate positive experiences and benefits derived from using the SMART Learning Strategy. Here are some reflections based on their responses:

Engagement and Enjoyment:

The students demonstrated high levels of enjoyment and engagement with SMART Learning. The platform incorporated interactive elements, such as games, videos, quizzes, and collaborative projects, that enhanced the learning experience. This suggested that the platform was successfully implemented to increase the students' interest and motivation in the educational process.

Versatility and Integration:

SMART Learning exhibited a wide range of applications, including language assignments, grammar exercises, vocabulary building, group projects, attendance tracking, quizzes, and assistance in subjects like Math, English, and Science. The platform's versatility showed its seamless integration into various aspects of the learning process.

Collaboration and Communication:

The platform enabled the students to engage in collaborative group projects and to share documents and feedback within SMART Learning. This indicated the platform's effectiveness in promoting collaboration among students. The platform not only served as an individual learning tool but also facilitated communication and teamwork.

Progress Tracking and Feedback:

The features offered by the platform, such as attendance recording, quizzes, and standing scores, showcased its utility in allowing teachers to monitor student progress. The real-time tracking and provision of feedback contributed to a more informed and proactive teaching approach.

Personalized Learning and Support:

The students perceived SMART Learning as a valuable tool that acted as a "smart friend" or a "helper" across various subjects. This indicated that the platform provided personalized support, catering to individual learning needs, and helped in different disciplines.

Integration of Technology:

SMART Learning's utilization for language assignments, interactive lessons, and collaborative projects illustrated a positive integration of technology into the educational

environment. Students appreciated the modern and interactive elements that enhanced their learning experiences.

Positive Impact on Homework and Study Habits:

Students acknowledged that SMART Learning aided them in completing their homework, suggesting that the platform supported and reinforced classroom learning. Furthermore, the positive impact on study habits implied that the platform contributed to a more effective and enjoyable study routine.

Analogy to a "Smart Friend":

Notably, the analogy of SMART Learning being likened to a "smart friend" highlighted its supportive and guiding role in assisting students in comprehending new concepts and making learning more accessible.

The study on the use of SMART, an AI-driven strategy for enhancing English Language Proficiency has several important implications for education.

1. Focused Intervention Impact:

The SMART strategy had a targeted and effective impact on improving English proficiency. The study found a negative mean difference, indicating a reduction in scores, which could signify performance improvement.

2. Tangible Educational Benefits:

The intervention not only confirmed its efficacy but also highlighted its tangible benefits. Improved English proficiency has positive effects on academic achievement and career prospects.

3. Alignment with Previous Research:

The study's results align with previous research that emphasizes the positive impact of AI systems on communication skills. This adds credibility to the conclusion that AI-driven interventions like SMART can enhance language proficiency.

4. Individualized and Interactive Learning Experiences:

The SMART intervention provided personalized and interactive learning experiences, tailored to individual learners' needs. This adaptability is crucial for effective language learning.

5. Long-term Educational Gains:

Improvements in English proficiency can lead to long-term educational gains for learners. Language proficiency is a foundational skill that contributes to academic success and effective communication.

6. Future Research and Implementation:

The positive outcomes of the study pave the way for future research and implementation of similar AI-driven strategies in language learning. Further investigation can explore the sustained effects and adaptability of such interventions across different learner demographics.

In conclusion, the study affirms the success of the SMART intervention in enhancing English Language Proficiency and highlights the broader implications for language education. It provides valuable insights for educational practitioners and policymakers looking to improve language skills for learners.

Ethical Considerations

The anonymity and confidentiality of the participants were maintained by not disclosing their names and identities during the data collection, analysis, and reporting of the study.

Trustworthiness was prioritized throughout the study's conduct. Efforts were made to avoid biases and manipulations in the findings, ensuring that the results were accurate and truthful. Additionally, transparency was maintained in data collection and analysis procedures, allowing for an open and honest representation of the study's outcomes. Regular checks and verifications were conducted to ensure the reliability of the data, and any uncertainties or limitations were acknowledged and addressed in a forthright manner, further reinforcing the trustworthiness of the study's findings.

Data Analysis Plan

The data obtained from the written assessments during post-tests underwent statistical analysis to compare the effects of an independent variable. Both the control and treatment groups' data underwent thorough statistical and analytical treatment using descriptive statistics for result comparison.

In addition, inferential statistics, such as T-tests, were employed to compare means between the two groups, determining whether the means were significantly different. The paired sample t-test served as a statistical procedure to assess whether the mean difference between two sets of observations was zero. In this test, each subject or entity was measured twice, resulting in pairs of observations. All data were meticulously recorded, tallied, tabulated, analyzed, and interpreted to unveil the significant effects of the study.

To gain further insights into the procedural and conceptual understanding of students in SMART Learning: AI-driven strategy, the responses from the 3-item semi-structured In-Depth Interview (IDI) underwent analysis using Colaizzi's data analysis methods. This involved transcribing the interview responses, followed by thorough reading and re-reading of the interview transcripts to identify significant statements. These statements were then organized into codes and categories based on similarities until a few patterns or themes emerged in the process, representing the participants' perceptions and sentiments.

