DEVELOPMENT AND VALIDATION OF C.L.A.S.S. MOBILE APPLICATION IN GENERAL MATHEMATICS

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Abstract

This study aims to address the challenges posed by the pandemic by offering various learning approaches, including the New Normal, Module-based, Blended, and In-face modalities by crafting a Contextualized Localized Application for Senior High School (CLASS) centered around General Mathematics. The development process of this study encompassed five distinct phases, guided by the ADDIE Model. An assessment of the application's educational robustness yielded a perfect score of 100%, encompassing its attributes of integrity, learner-centric focus, usability, and accessibility. Findings from the study revealed that the contents within the CLASS mobile application were perceived as of exceptionally high quality (Mean = 3.95; Standard Deviation = 0.04). As for the application's performance, it garnered a notably high overall rating (Mean = 3.85; Standard Deviation = 0.19) across dimensions such as design, accessibility, accuracy, usability, reliability, functionality, and efficiency. The consistency of evaluators' responses indicated a uniform level of agreement, highlighting a relatively homogeneous perception. A pivotal recommendation from this study is to carry out a quasi-experimental research design, aiming to assess the efficacy of the application's contents and performance in enhancing students' grasp of general mathematics concepts. Furthermore, educators can employ the application to identify inherent challenges in its application and validate its effectiveness. Subsequent reevaluation is also advised to align the application more intricately with the Philippine context and infuse it with creativity and relevance. The development of this application has the potential to enhance the teaching and learning process, fostering a more adept, coherent, engaging, and meaningful educational experience.

Keywords*:* *development and validation; general mathematics; mobile application; quality-assurance.*

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This undertaking has been gratifying, and this is due to the invitation of the Schools Division Research Committee (SDRC), headed by Dr. Ma. Colleen L. Emoricha, CESO-VI, the Assistant Schools Division Superintendent, and Dr. Ma. Liza R. Tabilon, CESO-V, the Schools Division Superintendent, is calling for the advancement of sound educational practices and evidence-based policy development through the Basic Education Research Fund (BERF).

Above all, praise and glory be to the Divine Providence, the Almighty God, Jesus Christ, for all the grace, blessings, and strength.

Context and Rationale

An occurrence of perplexing pneumonia marked by symptoms such as fever, dry cough, fatigue, and intermittent gastrointestinal issues emerged within the confines of a damp seafood market, specifically the Huanan Seafood Wholesale Market situated in Wuhan, Hubei, China. The inaugural outbreak, which transpired in December 2019, predominantly affected approximately 66% of the market's personnel (Wu, Chen, and Chan 2020, 217-220). Schools were among the sectors that swiftly underwent a shutdown, with the suspension of all activities. The imposition of lockdown measures in response to the COVID-19 pandemic profoundly impacted numerous educational institutions, higher learning establishments, and a multitude of students (Rajhans et al. 2020, 1-23).

In a proactive approach, educational administrators opted to embrace the altered educational landscape, characterized by the "new normal." The Department of Education (DepEd) acted by introducing the Learning Continuity Plan (LCP) during the preceding academic year, 2020-2021, with classes commencing on October 5, 2020 (DEPED 2020, 1). Meanwhile, the Commission on Higher Education (CHED) extended academic flexibility to higher education institutions (HEIs), enabling the implementation of distance learning, e-learning, and other innovative teaching methods for students. The demand for educational institutions to fortify their curriculum strategies and tailor them to better meet the diverse learning needs of students, transcending the confines of traditional classrooms, has grown substantially (Toquero 2020, 1).

Moreover, as per DepEd Order No. 34., series of 2022, classes will start on August 22, 2022 (DepEd 2020,1). As DepEd eyes for the opening classes, blended learning modality will be adapted, primarily face-to-face classes will be conducted as stated by Undersecretary Diosdado San Antonio (Sevillano 2022, 1).

With quality education as the main thrust as schools open, DepEd bridges the gap in education through limited face-to-face classes and implementing blended learning modality while the country is still on a national emergency. In this regard, learning mathematics is also one of the foci of the department to produce quality and globally competitive graduates under The Enhanced K to 12 Curriculum.

From a global perspective, the 2018 results of the Programme for International Student Assessment (PISA), administered by the Organization for Economic Co-operation and Development (OECD), involved the testing of nearly 60,000 15-year-old students across 79 countries. The findings revealed that a quarter of the students required assistance to accomplish even the most basic reading tasks. These results positioned the Philippines at the lowest rank for reading comprehension and second to last for science and mathematics proficiency among the 79 nations surveyed, as reported in a global assessment (CNN Philippines 2019, 1).

Considering the mathematical performance of students within the Philippine context, the National Achievement Test (NAT) disclosed regional performance outcomes using Mean Percentage Scores (MPS) for Grades 6, 10, and 12. However, the students' performance in mathematics only attained a score of 36.66%, which unmistakably falls below the satisfactory threshold.

Mastery of mathematics is not an instantaneous achievement. Gaining proficiency in this subject demands dedication and a proper mindset. The mathematics taught in schools today is the culmination of centuries of discoveries, innovations, and experiments conducted by mathematicians. The process of learning mathematics necessitates patience and a positive work ethic (MATHTED 2011). Furthermore, it's evident that students require guidance and time to grasp and assimilate mathematical

concepts. Therefore, educators should approach teaching with patience rather than expecting immediate results from their students (Putnam et al. 1992, 213-228).

Figure 1: The Conceptual Framework of Mathematics Education

The underpinning principles of the Philippine mathematics framework are firmly rooted in several key theories, including experiential and situated learning, reflective learning, constructivism, cooperative learning, discovery, and inquiry-based learning. These theories serve as the foundational support for the goals set by the Department of Education.

Of notable significance, Kolb and Kolb emphasize the importance of experiential learning, wherein learners transform their ideas based on their firsthand experiences. Knowledge is derived from the amalgamation of apprehending and transforming these experiences (Kolb and Kolb 2011).

Numerous studies have pinpointed instances where both students and educators encounter challenges in establishing a coherent and synchronized comprehension of mathematics. Moreover, research has unveiled that students require assistance in reasoning through fundamental mathematical concepts. The study's findings conjecture that solid foundational understandings within this subject area are pivotal for constructing effective and meaningful problem-solving methodologies (Markel 2000, 75).

The effectiveness of teaching mathematics can be significantly enhanced through the availability, adequacy, and strategic design of instructional and intervention materials tailored to students' personality types, learning preferences, and stress coping mechanisms. Therefore, educators must possess a comprehensive understanding of their learners to devise personalized instructional resources that cater to the students' requirements for grasping the subject matter (Dacumos 2016, 1).

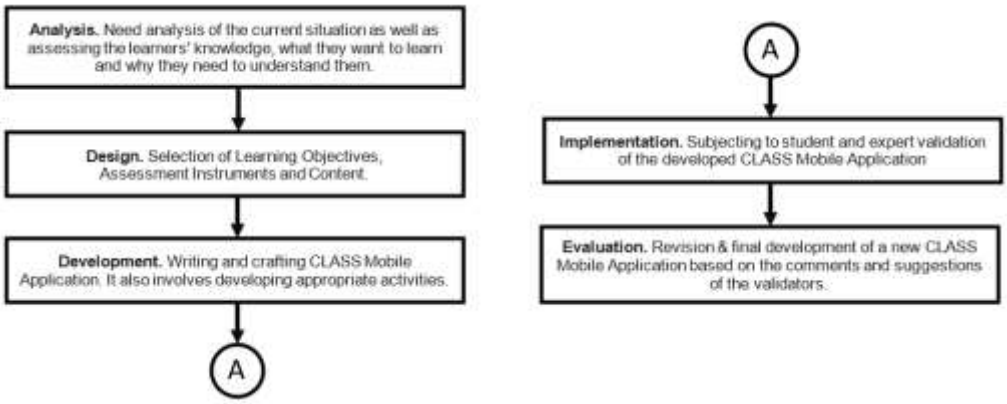
The model adapted and used for instructional materials for developing instructional materials could be the solution to distant learning for schools with multiple modalities—blended learning models of instructional materials that have

evolved to be practical for learning instructional activity (Kristanto, Mustaji and Mariono 2017, 10-17).

Guided by these foundational principles, the researcher found inspiration to conceive a mobile application named the Contextualized-Localized Application for Senior High School (CLASS) Mobile Application. This application was designed with the aim of enhancing the mathematical proficiency of Senior High School students at Pagadian City National High School. The mobile app encompassed carefully tailored video lessons that were contextualized and localized. These resources were intended to complement the teaching and learning journey, facilitating students' comprehension of the lesson's intricate concepts. The creation of the CLASS mobile application marked a significant step, prompting the involvement of various experts for validation. This validation process encompassed assessing the application's suitability for integration within the classroom setting, as well as scrutinizing the accuracy and relevance of the learning content. The outcomes of this research endeavor could potentially offer valuable insights geared toward elevating the academic performance of students in senior high school mathematics subjects. The projected impact of this accomplishment extends toward the enhancement of the teaching and learning process. The envisioned outcome involves a more proficient, well-structured, pertinent, engaging, and purposeful approach to education, fostering an environment conducive to both effective instruction and meaningful learning experiences. The research was delimited primarily to the development and validation of the CLASS mobile application only. Qualitatively, the contents of the information gathered were used for the improvement of the CLASS mobile application in terms of its software development and as well as the contents of the video lessons presented in the application.

Drawing guidance from the conceptual framework of Mathematics Education in the Philippines, the application was designed to immerse students in an experiential and situated learning approach. The mobile app encompassed contextualized and localized video lessons, supplementing the teaching-learning process, and facilitating students' comprehension of the lesson's intricacies. The study's focal point was the Most Essential Learning Competency (MELC) labeled as "solves problems involving exponential functions, equations, and inequalities" (M11GM-Ig-2), specifically addressing Week 7 of Quarter 1.

Figure 2: Development Chart of the CLASS Mobile Application using the Analysis, Design, Development, Implementation and Evaluation (ADDIE) Model



In crafting the learning material, the instructional model of choice was the ADDIE (Analysis-Design-Development-Implementation-Evaluation) model, depicted in Figure 2.

Among the array of instructional design models available, the ADDIE model was deemed most suitable for this study. Its adoption ensured that the development of the CLASS mobile application would effectively enhance learners' knowledge and skills pertinent to the content within this module (Peterson 2003, 227-241). However, it's important to note that the ADDIE model doesn't strictly mandate a linear progression of its steps.

Employing the ADDIE model serves as a strategic blueprint for designing educational content. This model not only influenced the course design but also informed the creation of assignments and other instructional materials. Implementing this model as a foundation guarantees that instructions for the instructional materials will elevate the overall learning journey for students (Davis 2013, 205).

Action Research Questions

The primary objective of this research was to create and verify an instructional resource called the CLASS Mobile Application. This learning tool was aimed at aiding Grade 11 students at Pagadian City National High School, located in Danlugan, Pagadian City, Zamboanga del Sur, in effectively addressing practical problems that encompassed exponential functions, equations, and inequalities.

Specifically, the sought to answer the following queries:

1. What is the extent of the educational soundness of the CLASS mobile application in terms of:
   1.1. Integrity;
   1.2. Learner Focus;
   1.3. Usability; and
   1.4. Accessibility?
2. What is the extent of the quality of the CLASS Mobile Application content in terms of:
   2.1. Content Quality;
   2.2. Instructional Quality;
   2.3. Technical Quality; and
   2.4. Other Findings?
3. What is the extent of the validity of the CLASS Mobile Application in terms of:
   3.1. Design;
   3.2. Accessibility;
   3.3. Accuracy;
   3.4. Usability; and
   3.5. Functionality;
4. What are the comments/ suggestions/ recommendations made by expert validators on the developed CLASS Mobile Application?
5. What changes or improvements can be made to make CLASS Mobile Application more useful to learners?

Innovation, Intervention, and Strategy

Under the guidance of the Mathematics Education Framework in the Philippines, the researcher developed a mobile application known as the Contextualized-Localized Application for Senior High School (CLASS) Mobile Application. This application was designed with the intent of bolstering the mathematical capabilities of Senior High School students, aiming to elevate their performance in this subject. The application's design aimed to immerse students in an experiential and situated learning approach,

aligning with the principles of the conceptual framework. Through this application, students could engage with contextualized and localized video lessons, providing supplementary resources to enrich the teaching-learning process. This, in turn, facilitated the students' comprehensive understanding of the presented lesson concepts. Since the mobile application is localized, the videos incorporated in the application were facilitated by the subject teacher and/or a mathematics teacher of the same institution. This will let the students feel as if the teacher is still teaching them, even in the comfort of their homes. This will also allow students to immerse themselves both at a cognitive level and a practical level.

CLASS Mobile is an android-based mobile application. CLASS will be distributed to students via Android Package (APK) through Bluetooth or Wireless Local Area Network (WLAN). Upon running the application, it allows students to browse a subject and select a particular topic. Upon selecting the topic, the application will now show the video lessons. Instead of showing the whole discussion, the researcher made video shorts per subtopic so that students may only select topics they focus on, are interested in, and are left behind without going over the whole video for the lesson. The video comprises a discussion and demonstration on how to solve and contains other examples to train students' mastery of the topic. The researcher purposely selected mobile-based applications since they can significantly improve students' academic achievement and performance (Ulfa, Sugiyarto and Ikhsan 2017, 1-6).

Experiential learning occurs when a learner engages in a specific activity (Dewey 2012, 108). Subsequently, the learner reflects on the activity, discerns crucial points, and leverages these insights for future undertakings. Within the context of mathematics learning, students must partake in designated learning activities orchestrated by their teachers to effectively acquire knowledge (Bernardo 1998, 78-106). Active engagement is essential for students to optimize their learning potential.

Aligned with the framework proposed by Jean Lave and Etienne Wenger (1991), a study conducted by Gawande and Al-Senaidi (2015, 207-213) titled "Situated Learning: Learning in a Contextual Environment" suggests that students learn not only through active participation in classroom activities and teacher-led lectures but also via self-paced learning endeavors.

By merging these two theories – experiential learning and situated learning – learners can systematically cultivate critical thinking and problem-solving skills, alongside additional markers outlined within the Mathematics Education framework of the Philippines (MATHTED 2011).

Action Research Methods

Research Design

The research followed a descriptive-developmental approach, focusing on crafting an instructional resource in the form of the CLASS Mobile Application. The primary aim was to facilitate learning, ensuring educational quality, accessibility, and relevance, while enhancing students' understanding and application of concepts and skills within the Senior High School (SHS) context.

Descriptive research is a method primarily concerned with portraying the current state and intricate details of a given situation or condition. It delves into describing the nature of a scenario as it exists during the study's timeframe and seeks to understand the reasons behind a specific phenomenon (Fraenkel, Wallen, and Hyun 2011). The main objective of descriptive research is to capture a comprehensive snapshot of

individuals, events, or circumstances. In this research model, it's crucial for the researcher to possess a clear understanding or visualization of the phenomena under scrutiny even before data collection commences.

The researcher aimed to collect firsthand data from respondents, utilizing this information to formulate logical and well-founded conclusions and recommendations for the study. The descriptive approach offers efficiency and practicality, particularly from a financial standpoint. Its flexibility is another advantage, as the method can encompass qualitative, quantitative, or a combination of both data types, granting the researcher a broader array of options when selecting data collection tools.

Descriptive research involves a deliberate and systematic process of collecting, analyzing, categorizing, and organizing existing conditions, practices, beliefs, trends, procedures, and cause-and-effect relationships, and subsequently drawing accurate and meaningful interpretations from this data, whether with or without the aid of statistical methods. This approach will be employed to ascertain the validity of the CLASS Mobile Application.

Developmental research, on the other hand, strives to generate knowledge that emerges from data systematically derived from practical applications. It's a pragmatic form of research that serves to test theories that have been proposed and validated primarily through established practices and traditions. Additionally, developmental research serves to establish fresh techniques, procedures, and tools through methodical analyses of specific instances, supported by qualitative discoveries. Consequently, developmental research can assume the role of generating conclusions or statements that have broad applicability, or it can produce context-specific insights aimed at addressing problems (Richey and Klein 2005, 23).

Participants and/or other Sources of Data and Information

The participants of this study were three (3) expert validators who validated the content of the CLASS Mobile Application. The content-expert validators consisted of a Master Teacher in Mathematics, a Head Teacher in Mathematics, and a Supervisor in Learning Resource Management and Development. They are all master's degree holders with a specialization in Mathematics and have been teaching in the secondary schools of Pagadian City. All of them taught Mathematics for at least three years and have attended related training on the subject.

Another three (3) expert evaluators also evaluated the performance of the developed CLASS Mobile Application. The evaluators were DepEd Pagadian City Division Information Technology Officer (ITO), DepEd Pagadian City Division Programmer, and DepEd Regional Information Technology Officer (RITO). They are all practitioners in the ICT field and have attended several ICT Trainings.

Research Instrument

Data collection encompassed both qualitative and quantitative elements. In terms of qualitative research, interviews were organized and arranged. Participants were provided with the opportunity to articulate their perspectives, emotions, and viewpoints regarding their experiences with the CLASS mobile application as a tool for learning senior high school mathematics. For the assessment of the contents within the CLASS mobile application, the initial tool employed was the LRMDS Educational Soundness General Evaluation. This

tool's purpose was to ascertain whether the learning material met the stipulated requisites outlined by the Department of Education. Specifically, an evaluation tool derived from the LRMDS manual, intended for the evaluation and review of new non-print materials, was utilized in this context.

Below is the range used in the interpretation of data gathered.

Responses	Range	Interpretation
4	3.26 - 4.00	Very Satisfactory
3	2.51 – 3.25	Satisfactory
2	1.76 – 2.50	Poor
1	1.00 – 1.75	Not Satisfactory

Another tool to rate the performance and functionality of the CLASS mobile application was a functionality survey adapted from the criteria given by the Institute of Electrical and Electronics Engineers (IEEE) for Software Test Document (STD).

A video lesson guide for Grade 11 students was to explore utilizing the CLASS mobile application. The Most Essential Learning Competency (MELC) covered is "solving problems involving exponential functions, equations, and inequalities." ((M11GM-Ig-2) in Week 7 of Quarter 1.

Data Gathering Procedure

The process of gathering data for the study encompassed a series of meticulously executed activities aimed at acquiring essential information. Initially, a formal letter was dispatched to the Schools Division Superintendent, seeking permission to conduct the study within their jurisdiction. In a preliminary stage, the researcher introduced the purpose and significance of the study to the participants, ensuring they were well-informed.

To address ethical considerations, participants were provided with an informed consent form to complete. This step ensured that participants were fully aware of the research's intent and their voluntary participation, and that their involvement was conducted with the utmost confidentiality. Importantly, no coercion was applied to secure their participation.

For content validation, evaluators employed an evaluation and review methodology designed for developing new non-print materials, derived from the LRMDS framework. Additionally, evaluators of the CLASS Mobile application utilized a functionality survey tool. This tool gauged the functionality of the application and was adapted from the Institute of Electrical and Electronics Engineers (IEEE) standards typically utilized for Software Test Documents (STD).

Data Analysis

The amassed data underwent analysis through descriptive and inferential statistical methods. To gauge the status and variability of the experimental and control groups, statistical measures like mean, percentage, and standard deviation were employed. Microsoft Excel was utilized for organizing the data and performing the necessary descriptive statistical calculations. The hypothetical mean range classification was adopted as follows: 1.00–1.75 – Very Low; 1.76–2.5 – Low; 2.6–3.25 – High; and 3.26–4.00 – Very High.

In addition to quantitative analysis, the study employed a qualitative research design guided by the principles and methodologies of a case study. This approach sought to delve into how the application's implementation with teachers and students could influence the teaching and learning process. To comprehensively analyze and present this qualitative data, content analysis techniques were applied. This involved scrutinizing data obtained from face-to-face interviews, focus group discussions, and essay writing and subsequently categorizing and evaluating it to identify patterns, discern meanings, and formulate conclusions. The resultant patterns and meaningful themes were elucidated and substantiated by incorporating relevant social theories.

Results and Discussion

Validation of the Educational Soundness of CLASS Mobile Application. Prior to subjecting the CLASS mobile application to content validation, it underwent a comprehensive LRMDS educational soundness general evaluation. The primary objective of this evaluation was to assess the learning material's suitability for reproduction, redevelopment, or inclusion within the LRMDS catalog of quality-assured learning resources. The validators' ratings distinctly indicate the educational soundness and validity of the CLASS mobile application's content. The evaluation outcomes, particularly concerning integrity, learner focus, usability, and accessibility, are illustrated in Table 1.

Table 1: Validation of the Educational Soundness of CLASS Mobile Application.

Qualities	CLASS Mobile Application	
	YES	NO
1. Integrity	*100%*	*0*
2. Learner Focus	*100%*	*0*
3. Usability	*100%*	*0*
4. Accessibility	*100%*	*0*

Validation of the contents of CLASS mobile application. Table 2 presents the validation outcomes provided by expert validators for the contents of the CLASS mobile application. This validation process serves to determine the materials' appropriateness for educational use and to ensure their accuracy and freedom from errors. The validation criteria encompassed multiple facets, including content quality, instructional quality, technical quality, accuracy, and currency of information. The results of this validation effort revealed that the contents of the CLASS mobile application achieved a remarkably high rating, denoted as "Very High" (Mean = 3.95; Standard Deviation = 0.04). Notably, the relatively consistent range of deviations underscores the homogeneity of responses among the expert validators, indicating a high level of consensus.

Of particular significance, the content quality of the CLASS mobile application obtained the highest score, with an exceptional assessment of "Very High" (Mean = 4.0; Standard Deviation = 0.00), along with the other criteria. This noteworthy achievement signifies that the CLASS mobile application's contents are devoid of conceptual, factual, grammatical, typographical, and computational errors, thereby upholding a standard of excellence ("Very High" with Mean = 4.0; Standard Deviation = 0.00).

In the educational realm, meticulous topic selection, well-planned execution of chosen topics, and effective delivery during the teaching and learning process play

pivotal roles. Among these, content emerges as a cornerstone. The tasks, intricacies, and substance embedded in the material contribute to a design practice that fosters understanding. Absent such thoughtful design, students might struggle to perceive and engage with the subject matter (Sendurur, Ersoy, and Çetin 2018, 1-16).

Table 2: Validation of the Contents of CLASS Mobile Application

INDICATORS		MEAN	SD	INTERPRETATION
Factor A:	*Content Quality*	4.00	0.00	Very High
Factor B:	*Instructional Quality*	3.83	0.23	Very High
Factor C:	*Technical Quality*	3.97	0.04	Very High
Factor D:	*Other Findings*	4.0	0.00	Very High
	OVERALL	**3.95**	**0.07**	**Very High**

Scale: 1.00–1.75 – Very Low; 1.76–2.5 – Low; 2.6–3.25 High; and 3.26–4.00 – Very High

Validation of the performance of CLASS mobile application. Table 3 shows the results of expert-validators validation of the CLASS mobile application in terms of performance anchoring its basis with the corresponding criteria. The overall application performance of the CLASS mobile application was very high (M = 3.85; SD = 0.19). Taking into consideration the range of the deviations, it is evident to be more homogeneous. It means that the responses of the expert validators towards the application's performance terms of the criteria are very similar.

Interestingly, all application performance criteria posted are interpreted as Very High. On the other hand, accessibility was posted to be the lowest among all criteria (M = 3.5; SD = 0.54), but still, the performance interpreted was Very High. With a significant response from validators, the table showed commendable results regarding the mobile applications' performance.

It is also evident that the application's design garnered the highest rating (M = 4; SD= 0.54), which means that all the evaluators agreed that the application's design is very attractive. Teachers should possess a comprehensive understanding of the learning materials at hand, including their strengths, weaknesses, attributes, and constraints. The incorporation of well-crafted instructional resources, coupled with the utilization of visual aids, significantly enhances engagement and the overall learning experience (Samuel 2009, 61).

Table 3. Validation of the Performance of CLASS Mobile Application.

CRITERIA	MEAN	SD	INTERPRETATION
Design	*4.0*	*0.00*	*Very High*
Accessibility	*3.5*	*0.54*	*Very High*
Accuracy	*3.9*	*0.12*	*Very High*
Useability	*3.7*	*0.23*	*Very High*
Reliability	3.9	0.12	Very High
Functionality	*3.9*	*0.23*	*Very High*
Efficiency	*3.9*	*0.12*	*Very High*
OVERALL	***3.85***	***0.19***	***VERY HIGH***

Scale: 1.00–1.75 – Very Low; 1.76–2.5 – Low; 2.6–3.25 High; and 3.26–4.00 – Very High

Conclusions and Recommendations

The study aimed to conceive and validate the CLASS Mobile Application, designed to address practical real-life problems involving exponential functions, equations, and inequalities within the General Mathematics curriculum for Grade 11 students at Pagadian City National High School within the framework of the Senior High School Curriculum. The researcher followed the ADDIE Model (Analysis, Design, Development, Implementation, and Evaluation) as a guiding principle, resulting in the creation of a mobile application intended to complement the teaching and learning processes. Upon meticulous validation by expert validators, the developed mobile application was deemed suitable for its intended purpose. This validation encompassed both the application's contents and its overall performance. The results of this validation effort were notably positive, achieving an acceptance level that is apparent in all aspects, including integrity, learner focus, usability, and accessibility, with a perfect score of 100%. The core objective of this evaluation was to ascertain whether the learning material is fit for reproduction, redevelopment, or inclusion within the catalog of quality-assured learning materials under the LRMDS (Learning Resources Management and Development System). Based on the validation, it is evident and shows the validity of the educational soundness of the contents of the CLASS mobile application. It also revealed that the contents of the CLASS mobile application disclosed as Very High (M = 3.95; SD = 0.04). Considering the range of the deviations, it is evident to be more homogeneous. It means that the responses of the expert validators towards the contents of the CLASS mobile application are very similar. On other aspects, the overall application performance of the CLASS mobile application was very high (M = 3.85; SD = 0.19). It is also evident that the application's design garnered the highest rating (M = 4; SD= 0.54), which entails that all the evaluators agreed that the application's design is very attractive. Though accessibility was posted to be the lowest among all criteria (M = 3.5; SD = 0.54), the performance was still very high. The combined data's overall standard deviation was modest. This suggests that validators' evaluations of the material are more uniform and consistent. The contents in the mobile application were deemed content-wise, and its structure and design encourage independent learning and promote interest and engagement. The contents featured within the mobile application were meticulously tailored to align with the Most Essential Learning Competencies (MELCs) specified for the Senior High School curriculum. This alignment was carried out while simultaneously addressing the unique challenges posed by the COVID-19 situation and embracing the educational continuity objectives set forth by the department. Additionally, the CLASS mobile application demonstrated exceptional performance across various dimensions, with an impressive overall performance rating (Mean = 3.85; Standard Deviation = 0.19). This evaluation encompassed several aspects such as design, accessibility, accuracy, usability, reliability, functionality, and efficiency. Based on these results, it's apparent that the integration of the CLASS mobile application would significantly enhance the teaching and learning processes, rendering them more skillful, coherent, pertinent, engaging, and profound.

Drawing from the study's findings and conclusions, the following suggestions and recommendations have been derived through data analysis:

1. Enhance the readability of formulas through the video lesson content.
2. Incorporate a wider variety of examples, ranging in difficulty from easy to challenging.
3. Consider adding features like an introductory "About" section on the landing page, introducing the application's purpose. Explore integrating React

features, implementing practice quizzes in lessons' concluding sections, assigning practice problems, and including a lock feature for lessons not yet needed.

4. Conduct a pre-test-post-test quasi-experimental study to gauge the effectiveness of the CLASS mobile application in improving students' grasp of general mathematics concepts.
5. Encourage other Senior High School teachers to utilize the developed CLASS mobile application in their classes to identify potential usage issues and further validate its efficacy.
6. Invite experts to conduct a more comprehensive review of the concepts and principles embedded within the mobile application's contents.
7. The CLASS mobile application could serve as a model for creating contextualized-localized video lessons for other core subjects within the Senior High School curriculum.
8. When implementing, distribute the mobile application via the Android Package Kit (APK) format, as Android utilizes this to distribute and install apps.
9. To expand the application's acceptability analysis, involve a broader student and expert population in further assessment.
10. Consider a follow-up study to verify the contents' alignment with the required competencies for General Mathematics within the Senior High School Curriculum.
11. Provide SHS mathematics teachers with comprehensive professional training and workshops focused on learning material development principles.
12. Share the development and validation process of the CLASS Mobile Application during School Learning Action Cell sessions.
13. Broaden the source of teacher-made learning materials, extending beyond the central office to regional contributors.
14. Encourage school administrators to actively initiate, develop, and validate learning materials across various aspects of senior high school mathematics within the education system.

The findings derived from this research underscore the significant potential of the CLASS Mobile Application to greatly augment students' academic accomplishments and involvement in the learning journey. This outcome also presents educators with the opportunity to consider incorporating this approach not only within the Mathematics domain but also across other subjects within the Senior High School Curriculum. The process of developing, preparing, and validating content, coupled with the integration of available technology, contributes substantially to kindling students' curiosity and active engagement. Of noteworthy importance, interest holds a compelling role as a motivational factor in the learning process. It invigorates the educational experience, sparks individual curiosity, facilitates problem-based learning, and heightens the sense of utility. Nurturing interest directly contributes to fostering a more engaged, motivated, enjoyable, and enriching learning environment, all of which are pivotal for student academic achievements (Harackiewicz, Smith, and Priniski 2016, 220-227). As part of the recommendations put forth by this study, it's advised to fortify and institutionalize the utilization of CLASS Mobile Applications and similar learning platforms at both the school and division levels. This can be achieved by organizing seminar workshops targeting all teaching staff, ensuring widespread adoption and proficiency.

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Republic of the Philippines
Department of Education
Region IX, Zamboanga Peninsula
Division of Pagadian City
Pagadian City

Action Plan for C.L.A.S.S. Mobile application in general mathematics
School Year 2023 – 2024

Subject Focus	Program Description	Objectives	Strategies/ Activities	Time Frame	Persons Involved	Sources of Fund	Expected Outcome
Mathematics	Implement CLASS Mobile Application in Teaching Mathematics	Enhance the teaching-learning process for students to become active constructors of learning.	Construct and implement video lessons intended for class and supplementary class activities.	Whole Year	Proponent/ Teachers/ Students	Personal	At least 75% Mastery Level in NAT and in Math subject; at least 75% (Very Satisfactory) GPA in Math
Mathematics	School-Level Seminar – Workshop on Creating Video Lessons	Enhance teachers' pedagogical strategies and proficiency in teaching mathematics in the K to 12 Curriculum.	Intensive In-service Training on creating video lessons and conducting demonstration or lesson implementation for critiquing & polishing.	Oct. 26-27, 2023	Proponent/ Head Teachers/ PCNHS Math Teachers/ Students	MOOE/ Math Club	Comprehensive, MELCs Based Lesson Plans, Teaching Guides, Learning Material; Collaborating and Mentoring PCNHS Math Teachers
Mathematics	Division-Level Seminar – Workshop on	Enhance teachers' pedagogical strategies and	Intensive In-service Training on creating video lessons	Oct. 18-20, 2023	Proponent/	SEF/ MOOE/ CID	Comprehensive, MELCs Based Lesson Plans, Teaching

	Creating Video Lessons	proficiency in teaching science in the K to 12 Curriculum.	and conducting demonstration or lesson implementation for critiquing & polishing.				Guides, Learning Material; Collaborating and Mentoring Pagadian City Division Math Teachers

Appendix A

Financial Report

The table below shows the cost estimates that will be expended before, during, and after the conduct of this action research.

General Descriptions	Quantity	Unit	Unit Price	Total Estimated Costs
Short Bond paper sub 20	1	ream	275	275
Ink for printer	4	bottles	299	1,200
Snacks for Validators	3	pcs	150	450
Total				1,925

Appendix B

Informed Consent Form

Title of the Study:

Development and Validation of C.L.A.S.S. Mobile Application in General Mathematics

Principal Investigator:
CHRISTIAN FRIX J. DECHAVEZ

I agree to participate in this study, I understand that the focus of the study the development and validation of C.L.A.S.S. Mobile Application in General Mathematics for Senior High School students of Pagadian City National High School.

1. **Confidentiality:** I understand that the information provided by this study, may be used for research purposes, and including publications in research journal. All personal information, however, will be coded, and at no time will my personal identity be revealed.

2. **Voluntary participation:** The nature and purpose of the study has been explained to me. I understand that participation in this study is voluntary, and refusal to participate will involve no penalty or victimization. I may terminate my participation at any time I choose, without penalty. I understand that I may withdraw from participation at any time I choose, without penalty. I understand that I may withdraw from participation at any point in the study with no penalty whatsoever.

3. **Termination of Participation:** My participation in this research may be terminated without my consent if the investigator believes that any part of the study may put me at undue risk. My participation may also be terminated if I do not adhere to the study protocol.

4. **Persons to contact with questions:** I understand that the principal investigator in this study is: **Mr. Christian Frix J. Dechavez (Contact Number: 09955059359**). I also take note of the contact persons as indicated in the information leaflet that accompanied this letter which I will file for safekeeping and later reference.

5. **Consent to participation:** I certify that I have read all of the above and received satisfactory answers to any questions that I may have had. I therefore willingly give my consent to participate in the study. (I will be provided with a copy of this signed informed consent)

_____ _____

Participant's Signature Date

Appendix C

Evaluation and Review for Development of New Non-Print Materials

(Source: DepEd- Guidelines and Processes for LRMDS Development and Production, 2009)

Factor A. Content Quality	**V S 4**	**S/NA 3**	**Poor 2**	**Not Satisfactory 1**
1. Content is consistent with topics/skills found in the DepED Learning Competencies for the subject and grade/year level it was intended.				
2. Concepts developed contribute to enrichment, reinforcement, or mastery of the identified learning objectives .				
3. Content is accurate.				
4. Content is up-to-date				
5. Content is logically developed and organized				
6. Content is free from cultural, gender, racial, or ethnic bias				
7. Content stimulates and promotes critical thinking				
8. Content is relevant to real-life situations				
9. Language (including vocabulary) is appropriate to the target user level				
10. Content promotes positive values that support formative growth.				
Total Points				
Note: Resource must score **at least 30 points** out of a maximum **40 points** to pass this criterion. Please put a check ***(*** √) mark on the appropriate box		**Passed**		
		Failed		

Factor B. Instructional Quality	**V S 4**	**S/NA 3**	**Poor 2**	**Not Satisfactory 1**
1. Purpose of the material is well defined				
2. Material achieves its defined purpose.				

3. Learning objectives are clearly stated and measurable.				
4. Level of difficulty is appropriate for the intended target user				
5. Graphics / colors / sounds are used for appropriate instructional reasons.				
6. Material is enjoyable, stimulating, challenging, and engaging				
7. Material effectively stimulates creativity of target user.				
8. Feedback on target user's responses is effectively employed				
9. Target user can control the rate and sequence of presentation and review.				
10. Instruction is integrated with target user's previous experience.				
Total Points				
Note: Resource must score **at least 30 points** out of a maximum **40 points** to pass this criterion. Please put a check mark ***(*** √) on the appropriate box		**Passed**		
		Failed		

Factor C. Technical Quality	**V S** **4**	**S/NA** **3**	**Poor** **2**	**Not Satisfactory** **1**
1. Audio enhances understanding of the concept.				
2. Speech and narration (correct pacing, intonation, and pronunciation) is clear and can be easily understood.				
3. There is complete synchronization of audio with the visuals, if any				
4. Music and sound effects are appropriate and effective for instructional purposes.				
5. Screen displays (text) are uncluttered, easy to read, and aesthetically pleasing.				
6. Visual presentations (non-text) are clear and easy to interpret				

7. Visuals sustain interest and do not distract user's attention.				
8. Visuals provide accurate representation of the concept discussed				
9. The user support materials (if any) are effective.				
10. The design allows the target user to navigate freely through the material.				
11. The material can easily and independently be used.				
Technical Evaluation: Complete Section G. Interoperability: Technical format Checklist for conformance If not already completed prior to this review.				
12. The material will run using minimum system requirements.				
13. The program is free from technical problems.				
Total Points				
Note: Resource must score **at least 39 points** out of a maximum **52 points** to pass this criterion. Please put a check mark ***(*** √) on the appropriate box		**Passed**		
		Failed		

Factor D. Other Findings **Note down observations about the information contained in the material, where the following errors are found:**	**Not present** **4**	**Present but very minor & must be fixed** **3**	**Present & requires major redevelopment** **2**	**Do not evaluate further** **1**
1. Conceptual errors				
2. Factual errors				
3. Grammatical and / or typographical errors				
4. Other errors (i.e., computational errors, obsolete information, errors in the visuals, etc.)				
Total Points				
		Passed		

Note: Resource must score **at least 16 points** out of a maximum **16 points** to **pass** this criterion. Please put a check ***(*** √) mark on the appropriate box		**Failed. All issues must be documented in the Comments section.**

Other Comments

Recommendation

Evaluator(s):

Date:

Appendix D

LRMDS Educational Soundness General Evaluation

(Source: DepEd- Guidelines and Processes for LRMDS Development and Production, 2009)

Title of Resource:

Location of Resource:

Current Format:

Copyright:

Mandatory (*)

Qualities of the Learning Resource, Teaching Resource, Professional Development Material	Yes/No/Not applicable (NA) Comments	Refer to Educational Soundness Specification v1.0
1. *Content is accurate and reflects the ways in which knowledge is conceptualized within the domain.	If any inaccuracy is identified this should be clearly described and referenced.	Integrity
2. Supports learners' deepening of knowledge within the content domain.		Integrity
3. Presents controversial issues with balance and fairness and in accordance with the DepED curriculum policies, where these apply.		Integrity
4. Uses language and symbols of the content domain and its ways of representation, and supports learners in developing and using them.		Integrity
5. *The following are used correctly and appropriately: - terms and expressions - symbols and notations - diagrammatic representation - graphical representation	If any inaccuracy or inappropriate use is identified this should be clearly described and referenced.	Integrity
6. Assists the learner with identifying and differentiating between different points of view and perspectives presented		Integrity

7. Uses content in ways that are real to life/authentic for learners/users: - are not over simplified or trivialized - makes sense to learners within their imaginary or real world - are realistic within the relevant context - enhances learners' social capital – their knowledge of how the world works and how to make a way in it		Learner Focus
8. Reflects the profile of the target learner/user for the curriculum or training area.		Learner Focus
9. Presents the same idea to learners/users in multiple/multi-directional modes - visual text (e.g. pictures, diagrams) - verbal (written) text - symbolic representations - oral (spoken) text - both static and dynamic images		Learner Focus
10. Learning objectives are made explicit to learners/users.		Learner Focus
11. The target learners/users are clearly identified (academic level/technical ability/demographics addressed).		Learner Focus
12. Content is structured to scaffold learning.		Learner Focus
13. Provides an opportunity for learners/users to obtain feedback either within or outside the resource.		Learner Focus
14. Pre-requisite knowledge/skills are clearly identified and their connections to prior and future		Learner Focus

learning are established.		
15. Is easy to use (time and effort to use it is reasonable) and the language is appropriate for the intended learner/user.		Usability
16. Clear instructions for use are provided (i.e., purpose, processes, intended outcomes are explicit).		Usability
17. Learning and information design is intuitive (i.e., the user knows what to do and how to do it).		Usability
18 The learning resource can be accessed by learners/users in deprived, depressed and underserved areas and communities.		Accessibility
19. The resource may not require teacher/facilitator intervention to be used effectively in varied learning environments and learning sequences (i.e.it may include instructions, terms, material in English/Filipino/local dialect as maybe necessary).		Accessibility
20. The learning resource connects to learners' personal/local knowledge and experience a. linguistic and cultural experience b. local (community/geographic) conditions c. individual and family circumstances- including, gender, abilities, economic conditions d. interest and degree of engagement (in particular addresses differently able learners)		Accessibility
21. *Resource does not confront or embarrass learners in any or all of the following ways: - require learner to expose personal data which may embarrass them - invade learners' privacy - unfavourably compare learners' learning performance with learners' identity	If any one of the following is evident then the material is not appropriate.	Accessibility

- unfavourably or stereotypically compare family or community characteristics with learners' identity - unnecessarily or indiscriminately confront cultural beliefs or practices		
22.. Equivalent or alternative access to information is available for learners' with diverse needs - identical content or activity is presented in different modalities - different activities that achieve the same learning outcome are available		Accessibility

Result of Evaluation of the Resource

Check all that apply (√)

	1. Recommend reproduction and distribution in current format. Resource acceptable as is.	If recommended for reproduction review, resource using the IPR Guidelines. If NOT recommended for reproduction and submit completed evaluation to LRMDS Manager for records. If recommended for modification, outline and suggest what needs to be done in the Comments section and indicate required further Evaluations below. If recommended for digitization, outline and suggest what needs to be done. Complete Comments Section and indicate required Evaluations below.
	2. Resource requires modification before being reproduced. (Must undergo full Educational Quality Evaluation)	
	3. Do not reproduce. Resource does not meet specifications.	

Comments:

Always include the criteria number from the checklist that your comment/s refers to unless it is very general. Also indicate the page, screen or location of the issue being raised within the resource.

If possible attach a photocopy, or screen capture of the issue.

Check all that apply (√)
☐ Recommend full Educational Quality Evaluation
☐ Recommend full Educational Quality and Technical Evaluation
☐ Recommend Accessibility Evaluation
☐ Not recommended for further evaluation
Evaluation completed by: Name and Location **Date:** **Contact details:**

Appendix E

Survey Questionnaire for Class Mobile Application

(Source: Adapted questions from QuestionPro anchored in Institute of Electrical and Electronics Engineers (IEEE) for Software Test Document (STD)
https://www.questionpro.com/survey-templates/software-evaluation/

	VERY SATISFACTORY	SATISFACTORY	POOR	NOT SATISFACTORY
	4	3	2	1
A.DESIGN				
1. The background is acceptable.				
2. Look and feel.				
3. The texts are readable.				
4. The graphics are unique.				
5. The overall theme and design is commendable and organized				
B. ACCESSIBILITY				
1. Can easily be used without the internet connection.				
2. Ease of access				
3. Operating system compatibility				
4. The application runs smoothly.				
5. All menus are accesible.				
C. ACCURACY				
1.Accurate in selecting items.				
2. Ease of use				
3. It responds correctly on the selected option.				
4. It shows the correct function when selecting an option.				
5. Button commands accurately functions.				
D. USEABILITY				
1.Error free				
2.Users satisfaction				
3. Ease of use				
4.The users likes using the system				
5. All menus are usable.				
E. RELIABILITY				
1.Performs correctly during specific time of duration				
2.No repair is required or perform				
3. The application adequately follows the defined performance specification.				
4. All command actions are reliable.				
5. Overall reliability				

F. FUNCTIONALITY				
1. The application worked for which it was intended.				
2. Compare actual and computed expected results.				
3. Understand the functional requirements.				
4. All pages and tabs lands on the correct landing page.				
5. All functions are functioning well.				
G. EFFICIENCY				
1. The application is effective to the highest utility of the user.				
2. The application can verify the correct output to be shown.				
3.The application can give efficient result of the command/selection				
4. The application processes commands fast.				
5. Runs well in android updated version.				

Signature over Printed Name of Evaluator

Appendix G
Content Validation Results

	INDICATORS	Evaluator 1	Evaluator 2	Evaluator 3	Mean	SD	Remarks
Factor A:	**Content Quality**						
1	Content is consistent with topics/skills found in the DepED Learning Competencies for the subject and grade/year level it was intended.	4	4	4	4.00	0.00	Very High
2	Concepts developed contribute to enrichment, reinforcement, or mastery of the identified learning objectives	4	4	4	4.00	0.00	Very High
3	Content is accurate.	4	4	4	4.00	0.00	Very High
4	Content is up-to-date	4	4	4	4.00	0.00	Very High
5	Content is logically developed and organized	4	4	4	4.00	0.00	Very High
6	Content is free from cultural, gender, racial, or ethnic bias	4	4	4	4.00	0.00	Very High
7	Content stimulates and promotes critical thinking	4	4	4	4.00	0.00	Very High
8	Content is relevant to real-life situations	4	4	4	4.00	0.00	Very High
9	Language (including vocabulary) is appropriate to the target user level	4	4	4	4.00	0.00	Very High
10	Content promotes positive values that support formative growth.	4	4	4	4.00	0.00	Very High
	Subtotal				4.00	0.00	Very High
Factor B:	**Instructional Quality**						
1	Purpose of the material is well defined	4	4	4	4.00	0.00	Very High
2	Material achieves its defined purpose.	4	4	4	4.00	0.00	Very High
3	Learning objectives are clearly stated and measurable.	4	4	4	4.00	0.00	Very High
4	Level of difficulty is appropriate for the intended target user	4	4	4	4.00	0.00	Very High
5	Graphics / colors / sounds are used for appropriate instructional reasons.	4	4	4	4.00	0.00	Very High
6	Material is enjoyable, stimulating, challenging, and engaging	3	4	4	3.67	0.58	Very High
7	Material effectively stimulates creativity of target user.	3	4	4	3.67	0.58	Very High
8	Feedback on target user's responses is effectively employed	3	4	3	3.33	0.58	Very High
9	Target user can control the rate and sequence of presentation and review.	4	4	4	4.00	0.00	Very High
10	Instruction is integrated with target user's previous experience.	4	4	3	3.67	0.58	Very High
	Subtotal				3.83	0.23	Very High
Factor C:	**Technical Quality**						
1	Audio enhances understanding of the concept.	4	4	4	4.00	0.00	Very High
2	Speech and narration is clear and can be easily understood.	4	4	4	4.00	0.00	Very High
3	There is complete synchronization of audio with the visuals, if any	4	4	4	4.00	0.00	Very High
4	Music and sound effects are appropriate and effective for instructional purposes	4	4	3	3.67	0.58	Very High
5	Screen displays (text) are uncluttered, easy to read, and aesthetically pleasing.	4	4	4	4.00	0.00	Very High
6	Visual presentations (non-text) are clear and easy to interpret	4	4	4	4.00	0.00	Very High
7	Visuals sustain interest and do not distract user's attention.	4	4	4	4.00	0.00	Very High
8	Visuals provide accurate representation of the concept discussed	4	4	4	4.00	0.00	Very High
9	The user support materials (if any) are effective.	4	4	4	4.00	0.00	Very High
10	The design allows the target user to navigate freely through the material.	4	4	4	4.00	0.00	Very High
11	The material can easily and independently be used.	4	4	4	4.00	0.00	Very High
12	The material will run using minimum system requirements.	4	4	4	4.00	0.00	Very High
13	The program is free from technical problems.	4	4	4	4.00	0.00	Very High
	Subtotal				3.97	0.04	Very High
Factor D:	**Other Findings**						
1	Conceptual errors	4	4	4	4.00	0.00	Very High
2	Factual errors	4	4	4	4.00	0.00	Very High
3	Grammatical and / or typographical errors	4	4	4	4.00	0.00	Very High
4	Other errors (i.e., computational errors, obsolete information, errors in the visuals, etc.)	4	4	4	4.00	0.00	Very High
	Subtotal				4.00	0.00	Very High
	Overall				**3.95**	**0.07**	**Very High**

Scale: 1.00–1.75 – Very Low; 1.76–2.5 – Low; 2.6–3.25 High; and 3.26–4.00 – Very High

Appendix H

Class Mobile App Questionnaire Results

	Evaluator 1	Evaluator 2	Evaluator 3	MEAN	SD	Remarks
A.DESIGN						
1. The background is acceptable.	4	4	4	4.00	0.00	Very High
2. Look and feel.	4	4	4	4.00	0.00	Very High
3. The texts are readable.	4	4	4	4.00	0.00	Very High
4. The graphics are unique.	4	4	4	4.00	0.00	Very High
5. The overall theme and design is commendable and organized.	4	4	4	4.00	0.00	Very High
	Criteria Performance			**4.00**	**0.00**	**Very High**
B. ACCESSIBILITY						
1. Can easily be used without the internet connection.	1	4	3	2.67	1.53	High
2. Ease of access	4	4	4	4.00	0.00	Very High
3. Operating system compatibility	4	4	4	4.00	0.00	Very High
4. The application runs smoothly.	4	4	3	3.67	0.58	Very High
5. All menus are accesible.	3	4	3	3.33	0.58	Very High
	Criteria Performance			**3.53**	**0.54**	**Very High**
C. ACCURACY						
1.Accurate in selecting items.	4	4	4	4.00	0.00	Very High
2. Ease of use	4	4	4	4.00	0.00	Very High
3. It responds correctly on the selected option.	4	4	4	4.00	0.00	Very High
4. It shows the correct function when selecting an option.	4	4	4	4.00	0.00	Very High
5. Button commands accurately functions.	3	4	4	3.67	0.58	Very High
	Criteria Performance			**3.93**	**0.12**	**Very High**
D. USEABILITY						
1.Error free	3	4	3	3.33	0.58	Very High
2.Users satisfaction	3	4	3	3.33	0.58	Very High
3. Ease of use	4	4	4	4.00	0.00	Very High
4.The users likes using the system	4	4	4	4.00	0.00	Very High
5. All menus are usable.	4	4	4	4.00	0.00	Very High
	Criteria Performance			**3.73**	**0.23**	**Very High**
E. RELIABILITY						
1.Performs correctly during specific time of duration	4	4	4	4.00	0.00	Very High
2.No repair is required or perform	4	4	4	4.00	0.00	Very High
3. The application adequately follows the defined performance specification.	4	4	4	4.00	0.00	Very High
4. All command actions are reliable.	3	4	4	3.67	0.58	Very High
5. Overall reliability	4	4	4	4.00	0.00	Very High
	Criteria Performance			**3.93**	**0.12**	**Very High**
F. FUNCTIONALITY						
1. The application worked for which it was intended.	4	4	4	4.00	0.00	Very High
2. Compare actual and computed expected results.	3	4	4	3.67	0.58	Very High
3. Understand the functional requirements.	4	4	4	4.00	0.00	Very High
4. All pages and tabs lands on the correct landing page.	3	4	4	3.67	0.58	Very High
5. All functions are functioning well.	4	4	4	4.00	0.00	Very High
	Criteria Performance			**3.87**	**0.23**	**Very High**
G. EFFICIENCY						
1. The application is effective to the highest utility of the user.	4	4	4	4.00	0.00	Very High
2. The application can verify the correct output to be shown.	3	4	4	3.67	0.58	Very High
3.The application can give efficient result of the command/selection	4	4	4	4.00	0.00	Very High
4. The application processes commands fast.	4	4	4	4.00	0.00	Very High
5. Runs well in android updated version.	4	4	4	4.00	0.00	Very High
	Criteria Performance			**3.93**	**0.12**	**Very High**
OVERALL				**3.85**	**0.19**	**Very High**