Journal of Education, Learning, and Management (JELM)

ISSN: 3079-2541 (Online)

Volume 2 Issue 1, (2025)

https://doi.org/10.69739/jelm.v2i1.371

https://journals.stecab.com/jelm

Published by
Stecab Publishing

Research Article

Design of a Computer Studies Subject for the Student of Remote Learning System for Junior Secondary School Grade Nine at Chisamba Day Secondary School

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About Article

Article History

Submission: February 06, 2025
Acceptance : March 10, 2025
Publication : April 12, 2025

Keywords

Cognitive Skill, Deep Learning, Learner, Teacher, Visualization Tool

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ABSTRACT

Technological advancements in tutoring systems for Computer Studies have increased research interest in this field. This study presents the design of a remote learning system specifically for Grade 9 Computer Studies at Chisamba Day Secondary School. The proposed system aims to optimize lesson preparation by providing teachers with easy, one-click access to all teaching resources via a web-based or desktop application. Equipped with an updated syllabus, this platform assists teachers in developing lesson plans efficiently, using pre-designed templates and examples. Lesson evaluation and analysis are streamlined, enabling teachers to assess instructional outcomes with minimal difficulty. Additionally, the system supports continuous student learning outside the classroom, offering a wide range of interactive resources accessible from any location. A central feature is its e-learning capability, which enables teachers to administer online tests and exams, thereby supporting remote learning when in-person instruction is not feasible. This functionality helps students engage with and understand new topics while accessing supplementary and remedial materials as needed. The application is built with Java, which enhances its stability and competitiveness in the educational technology market, setting it apart from other systems developed with different programming languages.

Citation Style:

Mumba, J. C., & Mupala, J. (2025). Design of a Computer Studies Subject for the Student of Remote Learning System for Junior Secondary School Grade Nine at Chisamba Day Secondary School. *Journal of Education, Learning, and Management, 2*(1), 121-132. https://doi.org/10.69739/jelm.v2i1.371

1. INTRODUCTION

1.1. Background of the Study

Learning ICT involves the visualization and representation of computer objects and procedures. Technology is a crucial component in this context, supporting visualization and interactive media that aid in representation, reasoning, calculation, exploration, and problem-solving. The National Science Council of Teachers of Computer Science (NSCTC) states that "technology is essential in teaching and learning; it influences the ICT skills taught and enhances learners' learning. Teachers' attitudes significantly impact the use of technology in ICT education." Technology integration in education markedly improves learning outcomes compared to traditional methods. Through technology, students connect schools to the broader world, engaging with dynamic displays, interactive models, and simulations of learning materials (Ashburn & Floden, 2016). Numerous studies have explored the integration of technology in education from various perspectives. Churchill (2020) noted, "Technology amplifies our intellectual and physical capacity," emphasizing its fundamental role in supporting complex learning. One approach to integrating technology in education is through multimedia instruction to present and communicate learning materials. Several applications address ICT challenges, such as the Intelligent Tutoring System (ITS) for third-grade computer studies, Microsoft Computing resources for problem-solving in computing, statistics, calculus, and trigonometry, and Computer Algebra Systems (CAS) for symbolic, algebraic, and graphical manipulations. However, few systems cater specifically to ICT at the grade nine level. This project aims to develop a Computer Studies tutoring application for grade nine junior secondary school learners, focusing on ICT skills. The web-based software will allow users to upload, download, and print materials and include a mini dictionary module with ICT terms, rules, and concepts, ensuring no student is left behind in Computer Studies.

1.2. Motivation of the Study

Students often struggle to study beyond classroom teachings, relying heavily on class notes and approaches shown by teachers. When these methods prove challenging, students may become stuck and fail to solve related problems. This application provides multiple approaches to problem-solving with detailed explanations, offering alternative methods if classroom approaches are difficult to follow (Churchill, 2020). Many Zambian libraries lack sufficient Computer Studies books, limiting students' ability to study beyond classroom teachings. National examinations cover all syllabus topics, assuming comprehensive classroom coverage. The system includes various Computer Studies materials (PDFs, books, pamphlets, and journals) to help students study beyond the classroom and prepare for exams. Additionally, students can use the application independently, facilitating self-learning similar to classroom instruction.

1.3. Scope

This project focuses on managing readable materials. The software is divided into modules containing selected Computer Studies topics, a mini dictionary of Computer Studies terms, a list of formulae grouped into sections, and an assessment with 20 questions after each lesson.

1.4. Problem Statement

Computer Studies has consistently recorded low pass rates in Zambia and other African countries, with percentages often below 50%. Khaji (2018) highlighted that "computer science pass rates are still below 50%, making it one of the worst-performing subjects." Various issues contribute to poor performance in Computer Studies. Mabumba (2018) reported that the grade 9 pass rates were lowest in Mathematics and Computer Studies, at 16.37% and 46%, respectively. In 2021, the pass rate for grade 9 Computer Studies was 49.37%, which is still discouraging. Several factors contribute to this problem. One significant issue is the inadequate number of teachers. Kitula Jalulgula, a Computer Studies teacher at Mlimwa Secondary School in Dodoma, Tanzania, stated, "In my school, there are more than 400 students, but only one Computer Studies teacher." This shortage of teachers has been a long-standing issue, and if not addressed, the pass rate will continue to decline. Negative perceptions towards the subject also contribute to poor performance. Many learners believe that Computer Studies is difficult, making it hard for them to grasp the material regardless of the teachers' efforts. Additionally, a lack of basic understanding of ICTs from primary school exacerbates the problem. Kitula noted, "Grade seven examinations are in a multiple-choice format, and passing often doesn't reflect a true understanding." Consequently, students struggle with Computer Studies when they advance to grade 8. Parental involvement is also lacking. Parents rely heavily on teachers to guide their children, contributing to the low pass rates. Laziness and insufficient practice are also issues; Computer Studies requires extensive practice, but without proper guidance, students find it challenging to concentrate and understand the subject fully. Furthermore, secondary school libraries in Zambia and other countries lack sufficient Computer Studies books, limiting students' study materials to classroom teachings. Over-enrollment in government schools also strains resources and negatively impacts learning outcomes.

2. LITERATURE REVIEW

The rapid advancement of technology has opened new avenues for learners worldwide, enabling the use of diverse technological tools in education. Sangra *et al.* (2019) define remote learning as a comprehensive integration of processes, content, and infrastructure leveraging computers and networks to enhance various aspects of the learning value chain. Garrison (2021) emphasizes that remote learning significantly improves the quality of learning experiences. A key aspect of remote learning is the incorporation of multimedia elements such as animations, videos, illustrations, photographs, audio, and text, which enhance the learning process. One of the primary objectives of education is to ensure all learners comprehend the subject matter. Computer Studies, often perceived as challenging, plays a crucial role in scientific education, given its wide application in daily life and various scientific fields. Therefore, educators must focus on developing students' understanding of Computer Studies concepts and provide a quality educational environment. Duval (Curri, 2013) states, "there is no understanding of

Computer Studies without visualization." Visualization serves as a concrete tool that helps learners explore Computer Studies concepts. The abstract and complex nature of many Computer Studies concepts poses significant challenges to learners. Computer-based systems present an opportunity to introduce new approaches that aid both students and teachers in comprehending these concepts better. These systems shift the focus from routine symbolic manipulation to higher-level cognitive skills centered on concepts and problem-solving. Indicators of deep learning and conceptual understanding include the ability to transfer knowledge between tasks and navigate different representations of Computer Studies objects. By utilizing technology, students can better visualize and understand Computer Studies, leading to improved learning outcomes. Multimedia instructions, in particular, allow for multiple modes of presentation, enhancing comprehension and retention. Thus, integrating technology into Computer Studies education is essential for fostering deeper understanding and engagement among learners.

2.1. Related Works

Review of Existing/Current Systems

Existing remote learning systems provide various tools for computer science education. Notable examples include:

Zoom: Widely used for virtual classes, it supports screen sharing and virtual whiteboards, enhancing collaborative learning.

Zoom Educational Use: Zoom is a video conferencing platform widely used for virtual classrooms, webinars, and collaborative learning. Key features include: Breakout Rooms facilitates small-group discussions, Screen Sharin enables teachers to present slides, code, or simulations, Recording allows students to revisit lectures and Interactive Whiteboard supports real-time problem-solving. Seraji *et al.* (2021) highlight Zoom's role in maintaining student engagement during remote learning, particularly through interactive features like polls and annotations. Churchill (2020) emphasizes its utility in fostering collaborative learning environments. Example: During the COVID-19 pandemic, Zoom became a primary tool for synchronous instruction in institutions like Chisamba Day Secondary School (as noted in the baseline study).

GitHub: Facilitates version control and collaboration on coding projects, essential for group assignments.

GitHub Educational Use: GitHub is a version control and collaboration platform for coding projects. It supports Collaborative Coding Students work together on group assignments, Code Review instructors provide feedback on student submissions and Portfolio Development students showcase projects to potential employers. Hsu *et al.* (2019) discuss GitHub's effectiveness in teaching software development workflows and collaborative problem-solving. The proposed system in the journal uses GitHub-like principles for version control in coding exercises.

Visual Studio Code: A versatile code editor with syntax highlighting and debugging features.

Visual Studio (Code) Educational Use: Visual Studio (and its lightweight variant, VS Code) is an integrated development environment (IDE) used for: Coding Practice syntax highlighting, debugging, and auto-completion aid beginners, Project Development and supports multiple programming languages (Java, Python, etc.). A study by Alshammari (2020) found that IDEs like Visual Studio improve coding efficiency and error resolution in computer science courses. The journal's proposed system was built using Java, likely leveraging IDEs like Visual Studio for development.

Slack: Enables real-time messaging and file sharing for project discussions.

Slack Educational Use: Slack is a communication tool for real-time messaging and file sharing. Applications include: Class Discussions channels for topic-specific conversations, Peer Support students ask questions and share resources and project Management organize group assignments with task-tracking features. Rasheed *et al.* (2020) note Slack's role in reducing transactional distance in online learning by fostering instructor-student interaction. The journal's literature review identifies Slack as a tool for project collaboration.

Google Drive: Offers cloud storage for sharing notes and assignments.

Google Drive Educational Use: Google Drive provides cloud storage and collaborative document editing. Features include: Shared Folders Teachers distribute syllabi, readings, and assignments, real-time Collaboration students co-edit essays or presentations and feedback instructors comment directly on student submissions. Nguyen *et al.* (2020) found that Google Drive enhances collaborative writing skills and resource accessibility. The proposed system's "Assessment Module" mirrors Google Drive's functionality for sharing exam materials.

Student Toolbox applications support academic performance with tools like Codecademy for coding lessons, GitHub for version control, and Google Drive for cloud storage. Microsoft Office and Trello aid in document creation and project management. Visual Studio Code serves as an advanced code editor.

Microsoft Mathematics provides tools for solving equations, graphing, and unit conversion, offering step-by-step solutions to enhance understanding.

Photomath Educational Use: Photomath is a mobile app that scans and solves math problems using augmented reality (AR). It aids in: Homework Help step-by-step explanations for algebraic equations and Concept Reinforcement visualizations of problem-solving processes. Chen *et al.* (2021) observed that Photomath improves procedural knowledge but cautioned against over-reliance on automated solutions. The journal's literature review compares Photomath to the proposed system's calculator module.

Photomath uses a smartphone camera to scan and solve math problems with augmented reality, providing step-by-step explanations and interactive animations.

Intelligent Tutoring Systems (ITS) Educational Use: ITS are AI-driven platforms that personalize learning through: Adaptive Lessons content adjusts to student performance, instant Feedback corrections and hints during problem-solving and progress tracking analytics for instructors. VanLehn (2011) demonstrated that ITS can improve learning outcomes by 0.5–1.0 standard deviations over traditional methods. The journal's

proposed system aligns with ITS principles by offering tailored assessments and remedial materials.
Intelligent Tutoring Systems (ITS) employ AI to personalize learning experiences, adapting to student needs with interactive lessons and real-time feedback.

Chabot: Chabot AI uses NLP and ML to simulate human conversation, offering automated support and personalized responses. It integrates with various platforms to handle transactions and provide multilingual support.

2.2. Comparison of Reviewed Systems

Table 1. Systems Comparison

System Name	What the System Solves
Microsoft Mathematics	Calculus, Linear Algebra, Statistics, and Trigonometry
Photomath	Mathematics equations
Intelligent Tutoring System (ITS)	Multiplication and division for third grade
Chatbot AI	Content from various subjects
Proposed System	Computer Studies topics/lessons in Grade 9

Source: Self-generated using Microsoft Word

2.3. Proposed System

The proposed Computer Studies Teacher/Student Tutoring Application Targets Grade 9 students, addressing the challenges in understanding ICT concepts. The application includes a mini-dictionary of terms, providing students with resources beyond traditional teaching methods. The system aims to ensure comprehensive understanding and engagement with Computer Studies topics, enhancing the learning experience and reducing reliance solely on teacher instruction.

2.4. Summary

This section reviewed existing systems relevant to computer science education, compared their features, and introduced a proposed tutoring application for junior secondary school students. The next section will detail the methodology for developing this system.

3. METHODOLOGY

This section provides a detailed overview of software methodologies, system analysis, and design, emphasizing the importance of choosing the right methodology for the proposed system. It highlights the technologies used, including programming languages and database technologies. Systems analysis and design aim to understand human needs to systematically process data, store it, and output information within an organization. Analysts identify and solve problems through thorough analysis, aiming to improve user support and business operations via computerized systems. The section presents the proposed system analysis for the Computer Studies Remote Learning Application, ensuring stakeholder agreement. The project followed the waterfall model, which restricts changes after each phase. The system analysis report targets major stakeholders: clients, academic supervisors, and the development team Ravipati (2016).

3. Baseline Study

3.1. Selected Methodology

This research uses a mixed design, combining open and closed questions in questionnaires to gather information from 50 participants (40 learners, 10 teachers). Consent was obtained from the district education office. Data was analyzed using STATA, Excel, and online applications, with STATA chosen for its user-friendliness and speed.

3.1.2. Step-by-Step Methodology

The waterfall model is employed for this project due to its linear and sequential approach. Each development phase has distinct goals, and once a phase is completed, development moves to the next phase without turning back.

3.2. Requirement Analysis and Specification

In this first phase of the waterfall model, system requirements are captured and documented in an SRS, verified by the client. The proposed system includes login pages, student modules, a mini-dictionary, and tutor modules.

3.2.1. Design

The design phase plans the system's hardware and software requirements, including interfaces and modules. The proposed system features login/sign-up pages, student modules, a mini-dictionary, and tutor modules.

3.2.2. Implementation and Unit Testing

Coding begins in the implementation phase, with modules/pages coded and tested individually. The system will use Java, PHP and MySQL, and will be web-based.

3.2.3. Integration and System Testing

After implementation, modules are integrated and system testing ensures functionality meets user requirements. Upon successful testing, the system is installed for user access.

3.2.4. Operations and Maintenance

This phase involves releasing patches to fix any post-implementation issues.

3.3. Justification of Selected Methodology

The waterfall model is chosen for its structured approach, clear requirements, stability, and short project duration.

3.4. Technologies and Framework

Java, PHP, and MySQL are selected for their suitability to the project's requirements. Java is used for its object-oriented capabilities, MySQL for its widespread use and efficiency, and PHP for its server-side scripting capabilities.

3.5. Resources Required

Hardware: Personal Computer with CD writer and External Hard Drive.

Software: Windows 10 OS, XAMPP, NetBeans IDE, Visio 2016, and research literature.

3.6. Investigation Plan

Interviews with teachers and students will assess the current web application at Chisamba Day Secondary. Feedback from the administration on application maintenance will also be gathered.

3.6.1. Project Development Plan

A Gantt chart and Work Breakdown Structure will outline the project's development stages and budget requirements.

3.7. System Design

3.7.1. System Analysis

System analysis involves understanding and improving the system to achieve its objectives. Requirement analysis ensures clear and unambiguous requirements.

3.7.2. Functional Requirements

The proposed system will have modules for a front page, tutor, assessment, calculator, dictionary, and tips.

3.7.3. Non-Functional Requirements

Non-functional requirements, such as constraints and standards, are crucial for the system's overall performance.

3.7.4. System Design

System design involves planning and creating diagrammatic representations of the system, including data flow diagrams, use case diagrams, class diagrams, and deployment diagrams.

3.8. Summary

This section outlines the design phases and software engineering standards for the proposed system, emphasizing the importance of structured development. Java will be used for development, MySQL for database management, and PHP for web content structuring (Hogstad & Brekke, 2010).

4. RESULTS AND DISCUSSION

This section presents the study's findings on the use of a remote application at Chisamba Day Secondary School in Chisamba District, Central Province. The study analyzed data from 50 respondents (10 teachers and 40 students) who all reside in Chisamba Ward. Teachers represented 20% of the participants, while students made up 80%. Qualitative and quantitative analyses were conducted, focusing on both biological and personal characteristics of the respondents. It references Sommerville's (2011) definition of unit testing, emphasizing the testing of individual program components to ensure functionality.

4.1. Baseline Study Results

4.1.1. Learners Study Results

Analysis of Pupils Data Collected: Figure 1 shows that of the

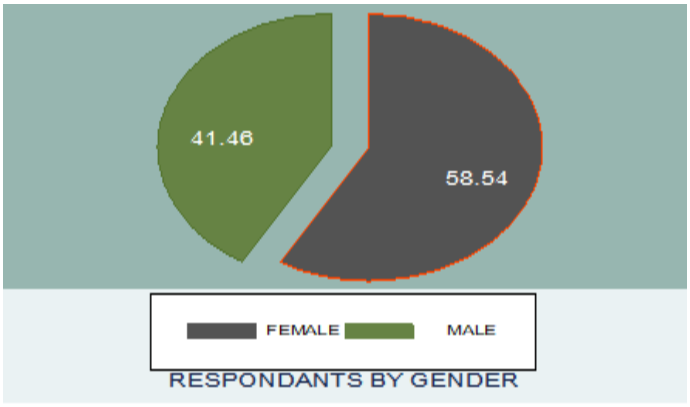

Figure 1. Sample

40 student respondents in the study, 24 (58.54%) were female, and 16 (41.46%) were male. These respondents, all in Grade 9 and aged between 14 and 17, were selected to align with the research focus. The study also included 10 teachers, making up 20% of the total participants.

Table 2. Showing Pupils who Know How to Use the Computer

Do you know how to use a computer?	Frequency	Percent	Cumulative
1	25	62.50	62.50
2	15	37.50	100.00
Total	40	100.00	

Source: Chisamba Day School Pupils

Table 2 shows. Among the 40 respondents, 25 learners (62.50%) reported knowing how to use a computer, while 15 learners (37.50%) indicated they did not know how to use Computer.

Table 3. Showing Pupils Who Use Computer to Play Games

Do you know how to play games on a computer or smart phone?	Frequency	Percent	Cumulative
1	37	92.50	92.50
2	3	7.50	100.00
Total	40	100.00	

Source: Chisamba Day School Pupils

Table 3 shows. Of the 15 learners (37.50%) who do not know how to use a computer, only 3 (7.50% of all participants) do not know how to play games on a smartphone. In contrast, 37 learners (92.50%) know how to play smartphone games.

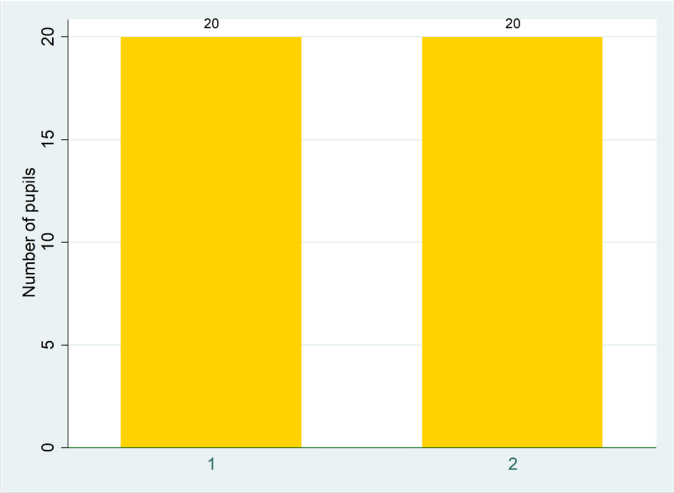

Figure 2. showing pupils who can learn using computer

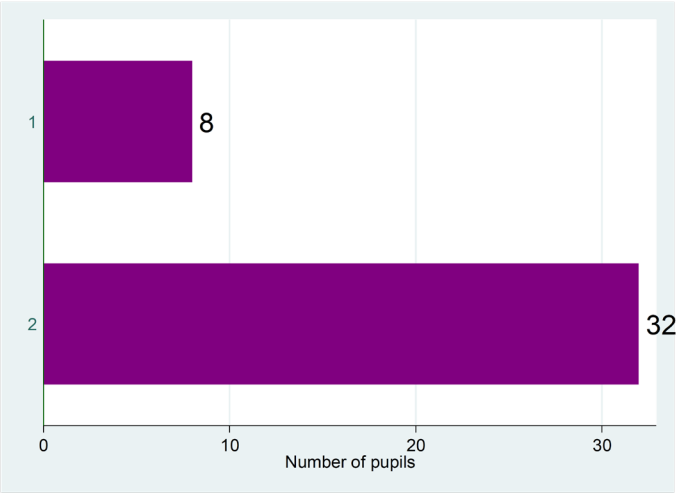

Figure 3. Shows pupils access to school remote learning application

Figure 2 shows the data 50% of learners (20 respondents) can learn independently using a computer, while the other 50% (20 respondents) require guidance from teachers or parents, despite knowing how to use a computer.

Of the 40 respondents, 8 learners (20%) stated they have access to a remote application for learning, while 32 learners (80%) confirmed that the school lacks any website or remote learning application.

4.2. Teachers Study Results

Table 4. Benefits of Remote Learning to Teachers

Variable	Obs	Mean	Std. Dev.	Min	Max
Learners can learn in their own time	8	1	0	1	1
Learners can learn at home, at school, library or community centres	5	1	0	1	1
e-learning will develop 21st century skills in learners	5	1	0	1	1
e-learning motivates learners that do not participate in conventional learning	6	1	0	1	1

Source: Chisamba Day School Teachers

In response to how remote learning could benefit students, 80% of teachers indicated it promotes independent learning. Half of the teachers noted that it enables learning in various locations, like home or community centers, and that it develops 21st-century skills. Additionally, 60% of teachers believed remote learning motivates students who may not engage in traditional classroom settings.

Table 5. Limitations of Remote Learning System

Variable	Obs	Mean	Std. Dev.	Min	Max
Lack of computer equipment	8	1	0	1	1
Lack of internet connection	3	1	0	1	1
Lack of computer skills	6	1	0	1	1
Learning style not suited to the use of computers	3	1	0	1	1
Negative attitudes towards using technology	4	1	0	1	1
Other, please specify	1	1		1	1

Source: Chisamba Day School Teachers

In response to challenges of implementing remote learning, 80% cited a lack of computer equipment, 60% mentioned insufficient computer skills, and 40% pointed to negative attitudes toward technology. Additionally, 30% noted issues with internet connectivity and unsuitable learning styles, while 10% identified other challenges.

Table 6. Teachers Skills in ICT Tools

How do you personally feel about using ICT?	Frequency	Percent	Cumulative
2	4	44.44	44.44
5	5	55.56	100.00
Total	9	100.00	

Source: Chisamba Day School Teachers

Among the 10 teachers surveyed (Table 6), 40.44% displayed low confidence in using ICT, while 50.56% demonstrated high confidence and some expertise.

In response (Table 7) to how teachers use computers, 80% reported using them for data storage and internet research, 50% for emailing, 40% for creating lessons, 20% for text/graphics creation, and 20% for designing educational materials.

Table 7. Use of Computer by Teachers

Variable	Obs	Mean	Std. Dev.	Min	Max
Text and graphics	2	1	0	1	1
Computer animations to enhance learning	0				
Storing or using data	8	1	0	1	1
Designing educational material	2	1	0	1	1
Designing websites	0				
Searching the internet	8	1	0	1	1
Creating lessons for learners	4	1	0	1	1
Email	5	1	0	1	1
Presenting lessons to learners	0				

Source: Chisamba Day School Teachers

4.2.1. Unit Testing

Testing is crucial in development, as it can identify critical issues early, preventing failure and downtime. According to Sommerville (2021), unit testing involves testing individual components, like methods or object classes, to ensure each unit functions as expected.

4.2.2. Test Planning

Testing is a time-consuming and costly process, so it must be focused and efficient. Test cases serve two main purposes: ensuring that a component produces the expected output when used correctly and confirming that incorrect use results in the wrong output. The system's test cases include verifying the accuracy of the tutor page content, calculator answers, test marking and recording, dictionary definitions, and the clarity of tips.

4.2.3. Junit Testing

Testing is a time-intensive and expensive process, requiring efficiency. Test cases aim to ensure components work as expected when used correctly and fail appropriately when used incorrectly. The system's test cases include checking the accuracy of the tutor page, calculator answers, test results, dictionary definitions, and the clarity of tips.

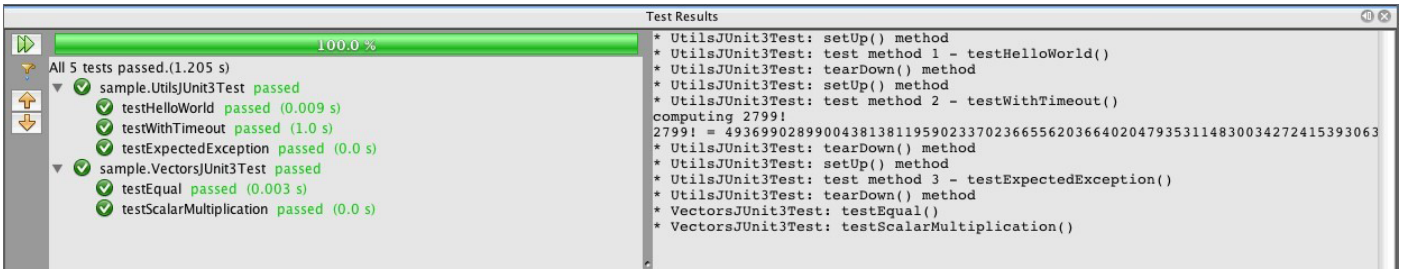

Figure 4. Junit test results

The JUnit testing results showed (Figure 4) that the system passed without errors, and the execution time for all analyzed methods was 1.205 seconds.

4.3. User Interface Testing

Interface testing is a software testing type that ensures correct communication between different software systems (Guru99,

2020). According to Pressman (2020), it focuses on testing interaction mechanisms and validating the aesthetic aspects of the user interface. The strategy for interface testing aims to: (1) identify errors in specific interface mechanisms (e.g., menu links or data entry forms) and (2) uncover errors in navigation, WebApp functionality, or content implementation. Screenshots of various user interfaces are provided.

Figure 5. Front page

Figure 5 shows the home page of the software which contains the many buttons of the system. It contains the many topics of the subject, the Exam Tips, Dictionary showing the computing terms, Calculator which helps to calculate computing calculations and the Examinations page.

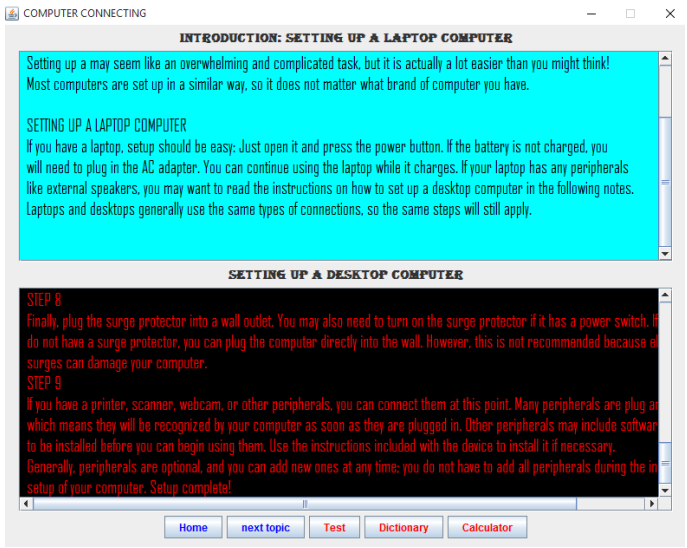

Figure 6. Tutor page

Figure 6 shows the tutor page which has the notes of the selected topic in the application.

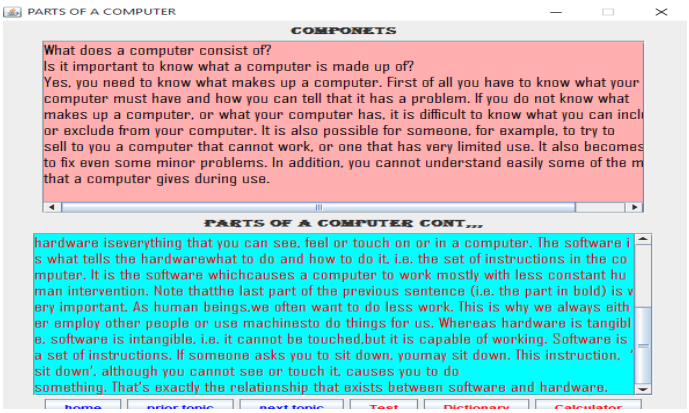

Figure 7. Tutor page

The Figure 7 shows the continuation of the tutor page notes.

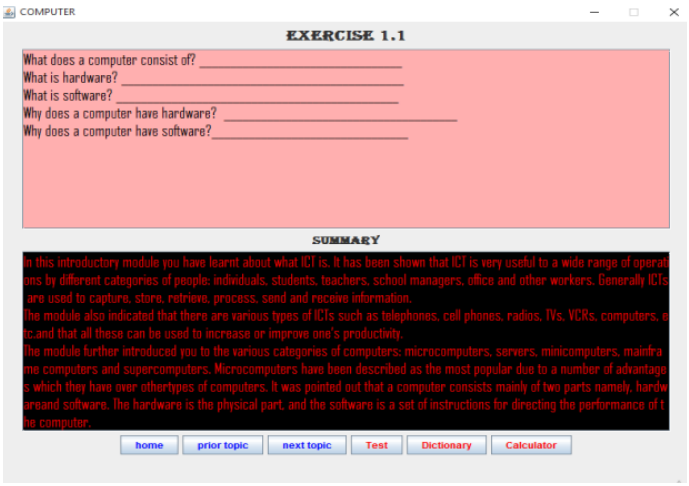

Figure 8. Tutor page

Figure 8 shows the tutor page with the exercise at the end.

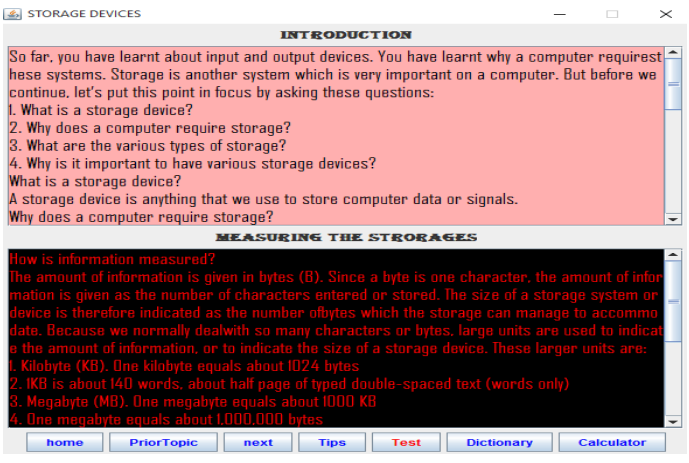

Figure 9. Tutor page

Figure 9 shows the tutor page with self -explanatory steps on how to measure storage.

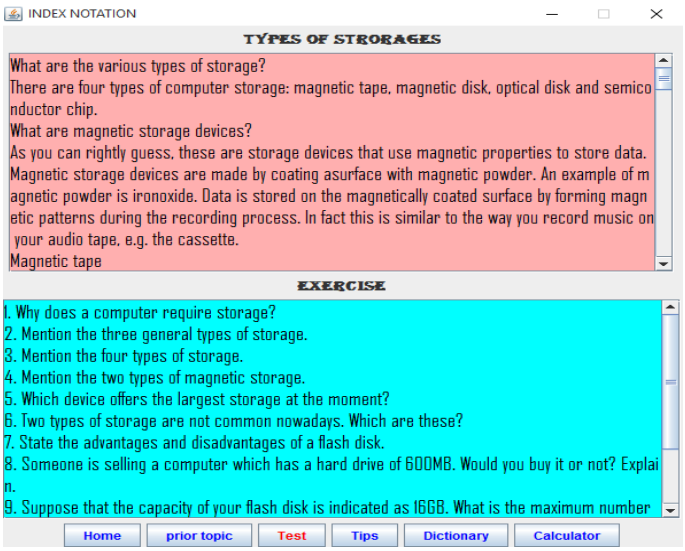

Figure 10. Tutor page

Figure 10 Shows the tutor page and exercise.

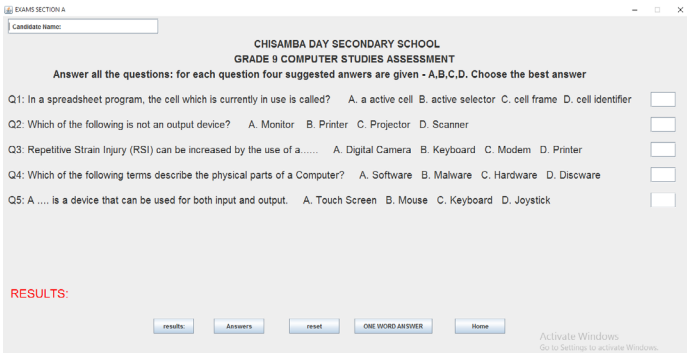

Figure 11. Assessment page

Figure 11 shows the Exam page for one word answer type of questions.

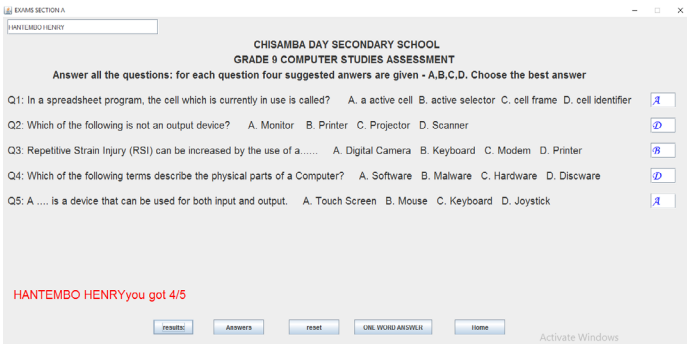

Figure 12. Assessment page

Figure 12 shows the Exam page for one word answer type of questions. It also marks the attempted questions and give the feedback.

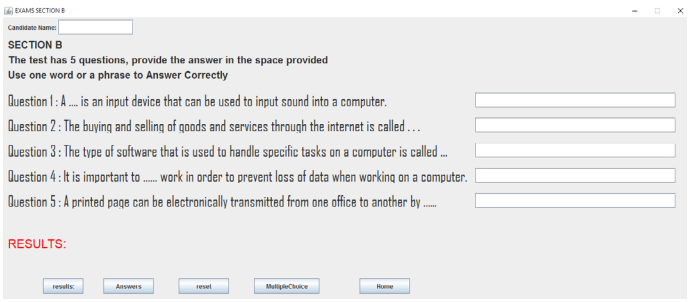

Figure 13. Assessment page

Figure 13 shows the one word or phrase exam page.

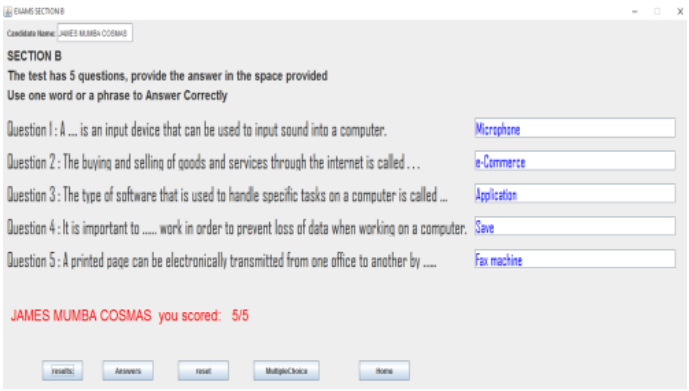

Figure 14. Assessment page

The figure 14 shows the one word or phrase Exams with the feedback after taking the exams.

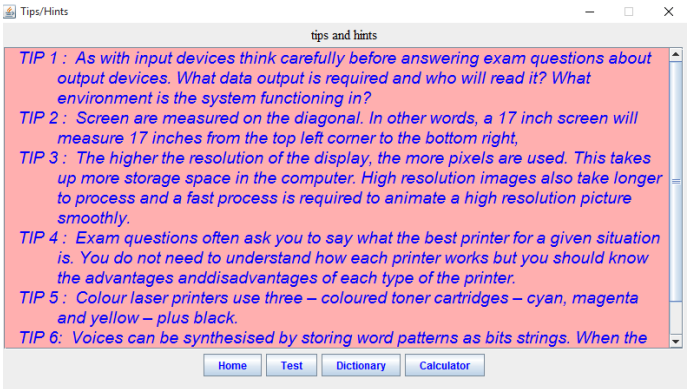

Figure 15. Tips page

This figure 15 shows the examination tips page of the system.

Figure 16. Calculator

This figure 16 shows the Calculator with the computing figures and computing units.

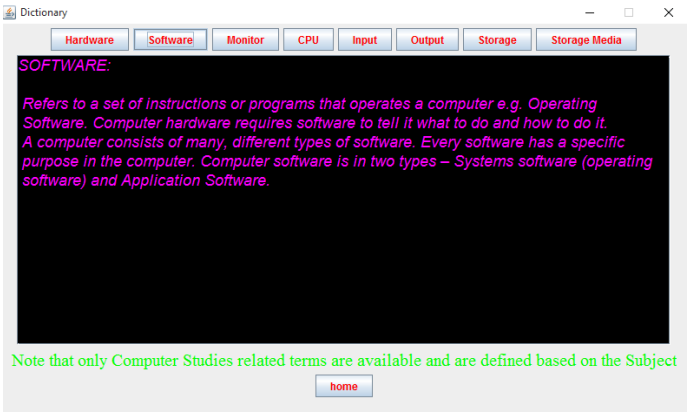

Figure 17. Dictionary

This figure 17 shows the Dictionary contains the Computing Terms.

4.4. Discussion

This section discusses the lessons learned throughout the software development process, as well as the challenges encountered during development.

4.4.1. Reason for Undertaking the Project

The project aimed to design a remote learning application for Grade 9 students at Chisamba Day Secondary School. The objectives were to review existing remote applications, design and implement a web-based learning system, and track student performance. The system was developed with several modules:

1. *Front Page Module:* Provides hyperlinks for easy navigation.
2. *Tutor Module:* Offers detailed lessons and examples for learning.
3. *Calculator Module:* Helps students with calculations, including binary numbers and time calculations.
4. *Tips Module:* Provides helpful hints for problem-solving.
5. Assessment Module: Tracks student performance and allows tests to assess comprehension.
6. *Dictionary Module:* Defines computing terms to aid understanding.

The system tracks student progress through the assessment module, marking tests and recording scores to show learners their progress.

4.4.2. Main Learning Outcome

Undertaking a software project involves various challenges that require a clear understanding of the objectives and effective problem-solving. Key outcomes from this project include:

1. *Clarity on Objectives:* Clear objectives serve as guides for the project, helping to focus on solving the right problems and delivering efficient solutions.
2. *Time Management:* Effective time management is crucial in software development to ensure the product is delivered within the set deadlines. The project was completed as planned with careful time allocation to each module.
3. *Problem-Solving Techniques:* Software development often presents barriers, requiring creative and efficient solutions to overcome challenges.
4. *Patience:* Software development is a process that involves setbacks; patience is essential to work through difficulties and find solutions.
5. *Research:* Researching through books, journals, and online resources helps developers understand concepts and build effective solutions, making the process smoother and more efficient.

4.4.3. Challenges Encountered

During the system development, several challenges were encountered:

1. *Power Issues:* Frequent power shortages and load shedding for over 3 hours affected development time. To address this, development was rescheduled during available power hours.
2. *Working Environment:* Working from home posed difficulties due to distractions, such as children and noise. Additionally, as the only Computer Studies teacher at the institution, the developer was unable to leave the school until all classes were attended to, which impacted the development process.

5. CONCLUSIONS

The design and development of the Computer Studies tutoring application for Grade 9 students at Chisamba Day Secondary School represent a significant step toward addressing the challenges faced in teaching and learning Computer Studies. By leveraging technology, this system provides a comprehensive, interactive, and accessible platform that enhances both teaching and learning experiences. The application's key features, such as the Tutor Module, Assessment Module, Mini Dictionary, and Calculator, empower students to engage with the subject matter independently while offering teachers a streamlined tool for lesson preparation and evaluation. The Computer Studies tutoring application for Grade 9 students at Chisamba Day Secondary aims to address the challenges in teaching and learning, ultimately improving student performance. Key contributions of the system include.

FUTURE WORK

The system currently covers only two topics, which is insufficient for students to excel in Computer Studies, as they will be examined on all topics in the syllabus. To address this, the system should include all syllabus topics and feature a page for administrators to easily update content without disrupting the system. The system's calculator can only handle simple calculations based on the available topics, but as more topics are added, the calculator will be enhanced to support more complex calculations. Additionally, content updates require programming knowledge in Java.

1. *Comprehensive Study Material:* Provides additional learning materials, allowing students to study beyond the classroom curriculum.
2. *Free Access to Materials:* Students can download materials for free, with options for softcopy or print versions for those without computers or smartphones.
3. *Practice and Verification:* Students can practice computing

questions, with the system verifying their answers.

4. Access Anywhere: As a web-based system, students can access it from any location with internet connectivity.

5. Portable Library: Acts as a personal library for Computer Studies.

6. Teacher's Guide: Functions as a guide in the teacher's absence.

7. Performance Tracking: Allows students to monitor their progress.

The system will be web-based, comprising four modules: Mini Dictionary, Tutor, Pupil, and Login. Developed in Java, PHP, and HTML, it is expected to improve Computer Studies results upon deployment.

ACKNOWLEDGMENT

My sincere thanks go to my elder brother and his wife Mr and Mrs Chilambe for making it possible for me to acquire this level of education and helping me reach this far in life. I really appreciate all the lessons I have learnt from them and the financial support. I as well thank all my relatives and friends who have assisted me to be the person I am today. Also, not to forget to thank my lecturers Dr. Sulumbe, Mr Nsama C, Dr. Chibomba, Dr. Njobvu S, Mr Kabubi and Mr Moyo for the help I have received to come up with this project which I have narrowed into this journal. It is my prayer that God continues to bless you all in everything you do.

REFERENCES

Alshammari, M. (2020). The impact of integrated development environments (IDEs) on coding efficiency in computer science education. *International Journal of Computer Science Education, 15*(2), 89-102. https://doi.org/10.1080/08993408.2020.1781325

Ashburn, E. A., & Floden, R. E. (2016). *Meaningful learning using technology: What educators need to know and do.* Teachers College Press.

Barrón-Estrada, M., Zatarain-Cabada, R., Zatarain-Cabada, R., & Barrón-Estrada, A. (2022). Design and implementation of an affective ITS. *Research in Computing Science, 56*, 123–134. Instituto Tecnológico de Culiacán.

Chen, L., Wang, Y., & Zhang, X. (2021). Photomath and math learning: A mixed-methods study. *Journal of Educational Technology & Society, 24*(1), 78-92. https://doi.org/10.1080/09523987.2021.543210

Churchill, D. (2020). Learning objects: An interactive representation and a mediating tool in a learning activity. *Educational Media International, 42*(4), 333–349. https://doi.org/10.1080/09523987.2020.1786774

Connolly, T. M., & Begg, C. E. (2015). *Database systems: A practical approach to design, implementation, and management* (4th ed.). Pearson Education.

Curri, E. (2013). *Using computer technology in teaching and learning mathematics in an Albanian upper secondary school.* University of Agder.

Garrison, D. R. (2021). *E-learning in the 21st century: A framework for research and practice* (3rd ed.). Routledge.

Hogstad, P. H., & Brekke, M. (2017). New teaching methods - Using computer technology in physics, mathematics, and computer science. *International Journal of Digital Society (IJDS), 1*(1), 17–24.

Hsu, Y. C., Rice, K., & Dawley, L. (2019). GitHub in computer science education: A tool for collaborative learning and version control. *Journal of Educational Computing Research, 57*(5), 1234-1256. https://doi.org/10.1177/0735633119874563

Khaji, J. (2018). *Why students continue to perform poorly in computer studies and maths.* Lusaka Times. https://www.lusakatimes.com

Lavanya, N., & Malarvizhi, T. (2018). *Risk analysis and management: A vital key to effective project management. Paper presented at PMI® Global Congress 2018, Asia Pacific, Sydney, New South Wales, Australia.* Project Management Institute.

Merriam-Webster. (n.d.). Risk. In *Merriam-Webster.com dictionary.* https://www.merriam-webster.com/dictionary/risk

Mulungushi University. (n.d.). *ICT 271: Introduction to database.*

National Council of Teachers of Mathematics. (2021). *Principles and standards for school mathematics.* Reston, VA: Author.

Nguyen, T. T., Nguyen, T. T., & Pham, Q. T. (2020). The effectiveness of Google Drive in enhancing collaborative writing skills. *Journal of Language and Education, 6*(3), 45-60. https://doi.org/10.17323/jle.2020.10345

Project Management Institute. (2008). *A guide to the project management body of knowledge (PMBOK guide)* (4th ed.). Project Management Institute.

Rasheed, R. A., Kamsin, A., & Abdullah, N. A. (2020). Challenges in the online component of blended learning: A systematic review. *Computers & Education, 144*, 103701. https://doi.org/10.1016/j.compedu.2020.103701

Ravipati, S. (2016). *Photomath app update solves handwritten math problems.* Campus Technology. https://campustechnology.com/articles/2016/09/23/photomath-app-update-solves-handwritten-math-problems.aspx

Raz, T., Shenhar, A. J., & Dvir, D. (2015). Risk management, project success, and technological uncertainty. *R&D Management, 32*(2), 101–112. https://doi.org/10.1111/radm.12345

Sangra, A., Vlachopoulos, D., & Cabrera, N. (2019). Building an inclusive definition of e-learning: An approach to the conceptual framework. *International Review of Research in Open and Distributed Learning, 20*(2), 1-15. https://doi.

org/10.19173/irrodl.v20i2.1234

Schwalbe, K. (2020). *Information technology project management* (6th ed.). Augsburg College.

Seraji, F., Marandi, S. S., & Siyyari, M. (2021). The role of Zoom in maintaining student engagement during remote learning. *Journal of Educational Technology & Society, 24*(3), 45-58. https://doi.org/10.1080/09523987.2021.1908497

Sommerville, I. (2015). *Software engineering* (9th ed.). Addison-Wesley.

VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. *Educational Psychologist, 46*(4), 197-221. https://doi.org/10.1080/00461520.2011.611369