

Interactive Science Courseware for Grade 7

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Abstract- This study designed and developed Interactive Science Courseware for Grade 7 as a web-based instructional resource for the Science Department of Bayambang National High School. The project addressed limitations associated with printed lectures, paper-based visual aids, and the absence of a dedicated digital courseware system for Grade 7 Science. A descriptive-developmental research design was used, and the Methodology chapter employed the ADDIE model through analysis, design, development, implementation, and evaluation. Semi-structured interviews with science teachers identified instructional needs and existing problems, prototypes guided the courseware interface, and a Software Usability Measurement Inventory-based questionnaire evaluated efficiency, helpfulness, and learnability. The system included multimedia Science lessons, activities, unit modules, a glossary, references, and informational pages. Three teachers and 17 Grade 7 students participated in testing, with a total of 20 respondents. The overall usability summary reported mean of 3.94 for efficiency, 4.07 for helpfulness, and 3.77 for learnability, with an overall mean of 3.92, interpreted as usable. The findings indicate that the developed courseware provided a more organized and interactive alternative to conventional instructional materials and was generally accepted by the intended users.

Keywords- interactive courseware, Grade 7 Science, multimedia learning, ADDIE, web-based learning, usability, SUMI

INTRODUCTION

Instructional materials support teachers in presenting concepts and helping students retain information. Digital courseware extends these materials by combining text, images, animation, video, and interactive activities within a structured learning environment. The source manuscript argues that technology-supported instruction can reduce dependence on printed materials and provide students with more engaging ways to review content (Bukoye, 2019; Exposito, 2020).

Bayambang National High School's Grade 7 Science teachers relied on PowerPoint presentations, photocopied lectures, paper visuals, hands-on demonstrations, textbook activities, and online videos. The manuscript reports that preparing and maintaining these materials consumed considerable time and that the Science Department did not have a dedicated

courseware system to organize visual and interactive learning resources.

Interactive and multimedia courseware can integrate visual, auditory, and activity-based content to help learners understand abstract or complex topics. Similar technology-supported approaches have been used to make instructional content more accessible and engaging, particularly when conventional classroom materials are insufficient (Kudale & Buktar, 2022; Abdulrahman et al., 2020).

The Interactive Science Courseware for Grade 7 was therefore developed as a web-based resource containing Grade 7 Science topics based on Department of Education learning competencies. The system was designed to support teacher-led lesson presentation, video lessons, unit modules, activities, glossary content, and student review. The study also evaluated

whether the resulting courseware was usable in terms of efficiency, helpfulness, and learnability.

OBJECTIVE OF THE STUDY

The purpose of the project was to design and develop an interactive Science courseware for Grade 7 students of Bayambang National High School to support a more effective and user-friendly teaching-learning process.

1. Describe the existing process used in teaching Grade 7 Science.
2. Identify the problems encountered in the existing teaching process.
3. Identify and develop the features required for the courseware system.
4. Test the usability of the courseware system in terms of efficiency, learnability, and helpfulness.

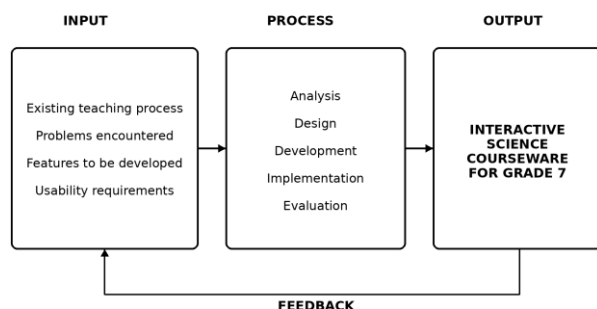


Figure 1. Conceptual framework of the Interactive Science Courseware for Grade 7.

Figure 1 presents the Input-Process-Output framework used to organize the project. The inputs consist of the existing teaching process, the problems encountered, the proposed courseware features, and usability requirements. These inputs pass through analysis, design, development, implementation, and evaluation to produce the Interactive Science Courseware for Grade 7, with feedback supporting continued refinement.

MATERIALS AND METHODS

Research Design

The project used a descriptive-developmental research design. The descriptive component documented the existing Grade 7 Science teaching process and the problems experienced by teachers,

while the developmental component covered the analysis, design, production, implementation, and evaluation of the courseware.

Development Model

The formal Methodology chapter states that the proponents employed the ADDIE model as the basis for development. The source conceptual-framework discussion separately refers to rapid application development; because the Methodology chapter explicitly identifies ADDIE, the present IMRAD Methods section follows ADDIE while retaining the original conceptual framework.

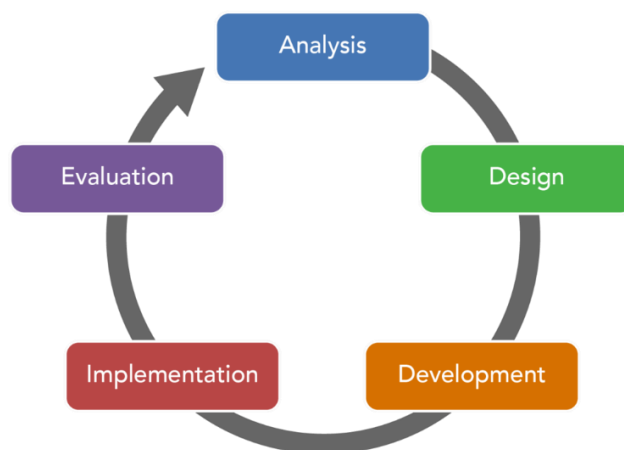


Figure 2. ADDIE model used in the development of the courseware.

Figure 2 illustrates the five phases applied in the project: Analysis, Design, Development, Implementation, and Evaluation. Analysis identified instructional problems and user needs; Design organized objectives, content, media, and assessment approaches; Development produced graphics, multimedia, and courseware functions; Implementation prepared the system for use; and Evaluation involved usability testing and identification of areas for improvement.

Study Locale and Participants

The project was conducted at Bayambang National High School, Quezon Boulevard, Bayambang, Pangasinan. The study focused on Grade 7 Science. The proponents interviewed the Science Department Head and teachers to determine how lessons and instructional materials were delivered. For usability

testing, three teachers and 17 Grade 7 students participated, for a total of 20 testers.

Data-Gathering Instruments

Semi-structured interviews were used for Objectives 1 and 2 to determine teaching needs, instructional-material practices, and difficulties experienced in Grade 7 Science. For Objective 3, visual prototypes were presented to demonstrate the proposed interface and features. For Objective 4, the proponents used a questionnaire based on the Software Usability Measurement Inventory, focusing on efficiency, helpfulness, and learnability.

Data Analysis

The existing workflow was represented using Data Flow Diagrams, while an Ishikawa diagram was used to organize the causes of problems in the existing teaching process. The proposed interface and functional requirements were derived from interview and prototype feedback. Usability responses were summarized using weighted means and interpreted through the five-point scale used in the source manuscript.

Table 1. Likert Scale for Usability Testing

Numerical Equivalent	Weighted Value	Descriptive Equivalent	Interpretation
5	4.21-5.00	Strongly Agree	Usable
4	3.41-4.20	Agree	Usable
3	2.61-3.40	Moderately Agree	Usable
2	1.81-2.60	Slightly Agree	Not Usable
1	1.00-1.80	Disagree	Not Usable

Table 1 presents the scale used to interpret the usability questionnaire. Responses with weighted means from 2.61 to 5.00 were classified as usable, whereas means from 1.00 to 2.60 were classified as not usable.

Development and Implementation Requirements

Table 2. Hardware Requirements

Hardware	Minimum Requirements
Computer/Laptop	Windows 10, macOS 11, or Ubuntu; 2.40 GHz processor; 64-bit system;

Hardware	Minimum Requirements
Mobile Phone/Tablet	8 GB RAM Android 10 or iOS 11; 4 GB RAM; 32 GB storage

Table 2 lists the minimum hardware requirements reported by the project. The courseware could be developed and demonstrated using a desktop or laptop computer, while mobile phones or tablets were also identified as devices capable of accessing the developed materials.

Table 3. Software Requirements

Software	Minimum Requirement
Adobe Animate	Version 23.0.1
HiPaint	Version 4.3.0
Flip a Clip	Version 3.9.2

Table 3 summarizes the software requirements documented in the manuscript. Adobe Animate supported interactive and animation-related development, while HiPaint and Flip a Clip were used in preparing visual designs and animated assets for the courseware.

RESULTS AND DISCUSSION

Existing Teaching Process

Interviews with Grade 7 Science teachers showed that lessons were delivered through classroom discussion, printed or photocopied lectures, paper visual aids, hands-on demonstrations, textbooks, PowerPoint presentations, and videos obtained from the Internet. The school did not have a dedicated instructional-material system for Grade 7 Science.

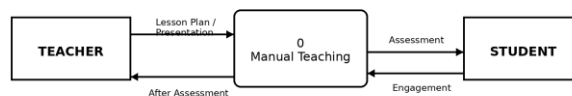


Figure 3. Context Data Flow Diagram of the existing teaching process.

Figure 3 summarizes the relationship between teachers, students, and the manual teaching process. Teachers prepare lesson plans and presentations,

students participate in learning activities and assessments, and results return to the teacher. The diagram reflects the reliance on teacher-prepared materials and conventional classroom interaction.

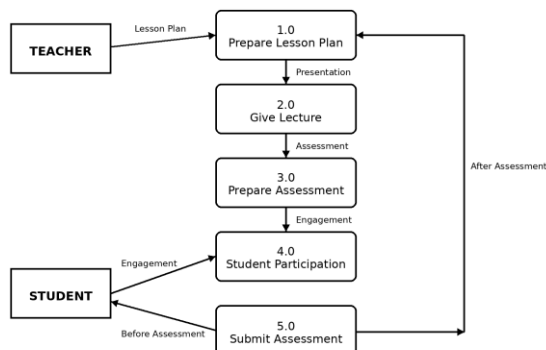


Figure 4. Top-level Data Flow Diagram of the existing teaching process.

Figure 4 expands the existing workflow into lesson-plan preparation, lecture delivery, assessment preparation, student participation, and assessment submission. The sequence demonstrates that several teaching and assessment activities depend on manually prepared instructional resources and repeated teacher effort.

Problems Encountered in the Existing Process

The interview findings identified increased teacher workload from preparing photocopies and paper visuals, limited hands-on activities, limited experimentation opportunities, reduced collaboration, difficulty explaining abstract concepts, and limited student engagement. The source manuscript grouped these problems using an Ishikawa diagram.

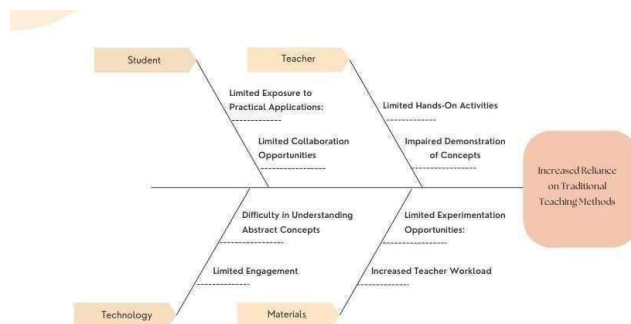


Figure 5. Ishikawa diagram of problems in the existing manual teaching process.

Figure 5 groups the problems under Student, Teacher, Technology, and Materials factors. Limited exposure to practical applications, limited collaboration, limited hands-on activities, difficulty understanding abstract concepts, limited experimentation, and increased teacher workload collectively contributed to continued reliance on traditional teaching methods.

Courseware Features and User Interfaces

Table 4. Major Courseware Features

Feature	Description
Start Button	Opens the courseware modules and learning content.
Table of Contents	Provides access to Units 1-4 and their modules.
Home	Displays the client's vision and mission and provides navigation.
Glossary of Terms	Provides definitions of scientific terms and concepts.
References	Displays sources used in the courseware.
Activity	Provides interactive learning exercises.
About	Provides information about the courseware and its developers.

Table 4 summarizes the major navigation and content features described in the source manuscript. Together, these components organize the Science modules, provide reference information, and support interactive activities and courseware navigation.



Figure 6. Splash screen of the Interactive Science Courseware for Grade 7.

Figure 6 shows the splash screen, which provides the first visual entry point to the courseware. Its purpose is to capture learner attention and establish the theme of the Science learning environment.



Figure 7. Homepage of the courseware.

Figure 7 presents the homepage containing the client school's vision and mission together with navigation options for the table of contents, activities, glossary, and information about the courseware.

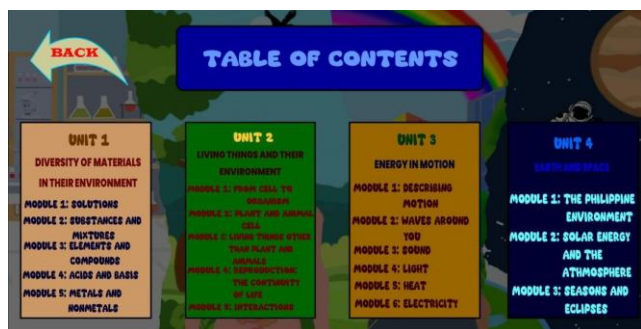


Figure 8. Table of contents page.

Figure 8 shows the table of contents, where Units 1 through 4 and their corresponding modules are presented as clickable items. The page allows users to move directly to selected Science topics.



Figure 9. Glossary page.

Figure 9 presents the glossary, which provides definitions and explanations of important scientific terms used throughout the courseware. The feature serves as a quick reference while students review the lessons.

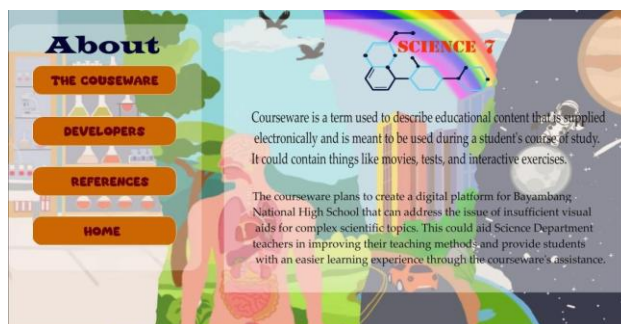


Figure 10. About page.

Figure 10 shows the About page, which provides information about the courseware, its purpose, the developers, references, and navigation back to the home page.



Figure 11. Activity page.

Figure 11 presents the Activity page. This feature provides a more interactive component in which students can apply or reinforce concepts introduced in the multimedia lessons.



Figure 12. Unit 1 modules.

Figure 12 shows the six modules under Unit 1. Each module is clickable and redirects the learner to the corresponding lesson content.



Figure 13. Unit 2 modules.

Figure 13 presents the five modules under Unit 2. The modular structure helps organize Grade 7 Science content into accessible topic groups.

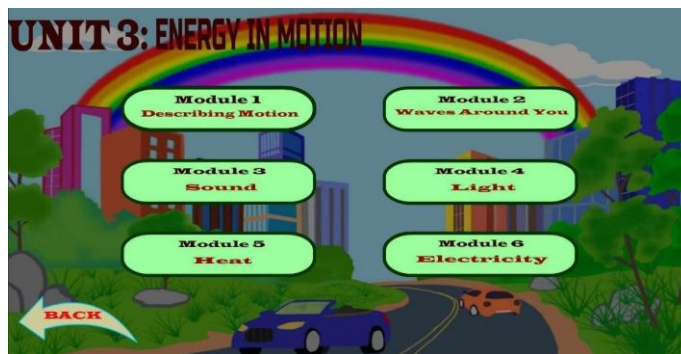


Figure 14. Unit 3 modules.

Figure 14 shows the modules under Unit 3. Each module functions as a selectable learning pathway leading to lesson materials and related content.



Figure 15. Unit 4 modules.

Figure 15 presents the three modules under Unit 4. The page completes the four-unit structure used to organize the Grade 7 Science courseware.

Table 5. Profile of the Testers

Variable	Profile	Frequency	Percentage
Gender	Male	10	50.00%
Gender	Female	10	50.00%
Gender	Total	20	100.00%

Table 5 shows an equal gender distribution among the 20 respondents who tested the courseware. The balanced distribution allowed both male and female Grade 7 user perspectives to be represented in the usability assessment.

Table 6. Usability Assessment in Terms of Efficiency

Item	Mean Score	Interpretation
This courseware responds to fast input.	4.05	Usable
The courseware documentation is very informative.	3.60	Usable
The courseware is consistent.	3.55	Usable
User needs have been fully taken into consideration.	3.70	Usable
It is easy to make the courseware do exactly what you want.	3.95	Usable
Average Weighted Mean	3.77	Usable

Table 6 reports an item-level average weighted mean of 3.77 for efficiency, interpreted as usable. However, the narrative immediately following the table

and the final overall usability summary report efficiency as 3.94. This inconsistency is present in the source manuscript and should be verified against the original computation before publication.

Table 7. Usability Assessment in Terms of Helpfulness

Item	Mean Score	Interpretation
I find the courseware system instructions helpful.	4.00	Usable
The information provided in the system is clear and understandable.	4.05	Usable
Error-prevention messages are adequate.	4.25	Usable
There is enough information on the screen when it is needed.	3.95	Usable
I never felt quite tense using the courseware system.	4.20	Usable
This courseware system did not give me a headache.	4.00	Usable
Average Weighted Mean	4.07	Usable

Table 7 shows a helpfulness mean of 4.07, the highest category mean in the overall usability summary. Respondents generally found the instructions and information useful, and all six indicators were interpreted as usable.

Table 8. Usability Assessment in Terms of Learnability

Item	Mean Score	Interpretation
Learning this courseware system environment is easy.	3.70	Usable
It is easy to learn the courseware system commands and functions.	3.90	Usable
I easily understand the rules and guidelines when using this	3.95	Usable

Item	Mean Score	Interpretation
application. I do not have to re-read the instructions while using the application.	3.55	Usable
Average Weighted Mean	3.77	Usable

Table 8 presents a learnability mean of 3.77, interpreted as usable. Respondents rated the clarity of rules and guidelines highest at 3.95, while the need to re-read instructions received the lowest means of 3.55. The results nevertheless remained within the study's usable range.

Table 9. Overall Usability Assessment

Category	Weighted Mean	Descriptive Interpretation	Interpretation
Efficiency	3.94	Agree	Usable
Helpfulness	4.07	Agree	Usable
Learnability	3.77	Agree	Usable
Overall Mean	3.92	Agree	Usable

Table 9 summarizes the source manuscript's final usability results. Helpfulness obtained the highest mean at 4.07, followed by efficiency at 3.94 and learnability at 3.77. The overall mean was 3.92, interpreted as usable. As noted in Table 6, the 3.94 efficiency value differs from the detailed efficiency table's 3.77 and should be checked by the authors.

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

The project identified that Grade 7 Science teachers relied on printed lectures, paper visuals, demonstrations, PowerPoint presentations, and online videos, while the school lacked a dedicated courseware platform. Preparing and maintaining these instructional materials increased teacher workload and limited the consistent availability of interactive visual resources.

The developed Interactive Science Courseware for Grade 7 provided a structured digital environment with multimedia lessons, unit modules, interactive activities, a glossary, references, and navigation features. These functions were intended to address insufficient visual aids for complex Science topics and

provide students with a more accessible learning experience.

The usability results were positive across efficiency, helpfulness, and learnability. The source manuscript's overall summary reported an overall mean of 3.92, interpreted as usable, indicating that the developed courseware generally met the usability expectations of the tested Grade 7 students and teachers.

RECOMMENDATIONS

1. Develop procedures and teacher-support strategies that will help integrate interactive courseware consistently into formal Grade 7 Science instruction.
2. Expand the courseware with additional interactive exercises and assessment features aligned with curriculum objectives to provide a more complete learning experience.
3. Continue using a user-centered design approach by collecting regular feedback from teachers and students and incorporating this feedback into future revisions.
4. Evaluate future versions using a larger sample and include learning-outcome measures in addition to usability so that the educational effect of the courseware can be assessed directly.

REFERENCES

- Abdulrahman, M. D., Faruk, N., Oloyede, A. A., Surajudeen-Bakinde, N. T., Olawoyin, L. A., Mejabi, O. V., Imam-Fulani, Y. O., Fahm, A. O., & Azeez, A. L. (2020). Multimedia tools in the teaching and learning processes: A systematic review. *Heliyon*, 6(11), e05312. <https://doi.org/10.1016/j.heliyon.2020.e05312>
- Aurum, K. P. (2021, March 14). Key features of an effective courseware. Stylus Solutions. <https://www.stylusolutions.com/blog/key-features-of-an-effective-courseware/>
- Bukoye, R. O. (2019). Utilization of instruction materials as tools for effective academic performance of students: Implications for counselling. *Proceedings*, 2(21), 1395. <https://doi.org/10.3390/proceedings2211395>
- Exposito, A., Sanchez-Rivas, J., Gomez-Calero, M. P., & Pablo-Romero, M. D. P. (2020). Examining the use of instructional video clips for teaching macroeconomics. *Computers & Education*, 144, 103709. <https://doi.org/10.1016/j.compedu.2019.103709>
- Greer, M. (2019). Psychological science can help students become good psychology teachers. American Psychological Association. <http://dx.doi.org/10.1037/e308892005-040>
- Kudale, P., & Buktar, R. (2022). Investigation of the impact of augmented reality technology on interactive teaching learning process. *International Journal of Virtual and Personal Learning Environments*, 12(1), 1-16. <https://doi.org/10.4018/IJVPLE.285594>
- Lane, S. (2022, September 1). The role of instructional materials in teaching and learning. Edudify. <https://edudify.com/role-of-instructional-materials/>
- Perez, C., & Tolentino, C. (2021). The impact on the utilization of courseware in the new normal among PSU students. IEOM Society International.
- Sir Bas TV. (2021, April 12). Waves: Carriers of energy | Characteristics of waves [Video]. YouTube. https://www.youtube.com/watch?v=8G46ltHs_nk
- Sir Bas TV. (2021, April 19). Characteristics of light | Source, speed, intensity, color [Video]. YouTube. <https://www.youtube.com/watch?v=E9JXaXaB8d8>