ORIGINAL RESEARCH PAPER

Education

KEY WORDS: Infographic Video Modules, Process Skills, Chemistry Education, Multimedia Learning, Ninth-Grade Students

ENHANCING CHEMISTRY PROCESS SKILLS IN NINTH-GRADE STUDENTS THROUGH INFOGRAPHIC VIDEO MODULES

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ABSTRACT

The integration of multimedia tools, such as infographic video modules, into the teaching of chemistry has garnered attention for its potential to enhance students' process skills and comprehension. This study explores the effectiveness of these infographic video modules in improving the chemistry process skills of ninth-grade students. The research utilizes an experimental method with a parallel group design, comparing an experimental group using infographic video modules to a control group using traditional teaching methods. The study focuses on key chemistry process skills, including observation, inferring, classifying, predicting, hypothesizing, manipulating, and interpreting. Data was collected through pre-test and post-test assessments to evaluate the impact of the intervention on student performance. Results indicate a significant improvement in the experimental group's post-test scores, with larger gains observed in process skills like inferring, manipulating, and interpreting data. The study's findings suggest that infographic video modules are effective in enhancing the learning experience, fostering active engagement, and improving students' understanding of complex chemistry concepts. The results advocate for the adoption of multimedia tools in science education to support diverse learning styles, promote critical thinking, and improve overall learning outcomes. The study concludes that infographic video modules can serve as a valuable complement to traditional chemistry teaching, contributing to more engaging and effective science education practices.

INTRODUCTION

Education is the process of acquiring knowledge, skills, values, and attitudes through both formal and informal means. It aims to foster personal development, intellectual growth, and societal participation. This process occurs through activities like classroom learning, self-study, hands-on experiences, and exposure to diverse ideas. Education shapes cognitive abilities, character, and social interactions, playing a key role in personal empowerment and societal progress. It can take place in structured environments like schools or through life experiences. With the integration of technology and multimedia into teaching, this study explores the use of infographic video modules to enhance the process skills required for understanding chemistry, particularly among ninth-grade students. Chemistry, with its complex concepts and real-world applications, provides a unique context for evaluating the impact of modern teaching tools. This chapter introduces the study's goals, significance, and structure, focusing on the potential of multimedia in improving chemistry education.

In today's information-rich world, innovative teaching methods that address diverse learning styles are essential. Educators must leverage multimedia tools to engage students and deepen their understanding of subjects like chemistry. By examining how infographic videos support process skills, this research aims to contribute to educational innovation and help students develop the analytical and practical skills needed in a science-driven world. The results will guide educators and policymakers in enhancing chemistry curricula to improve student learning outcomes.

Infographic Method

Infographics are visual tools that represent information, data, or complex ideas in a simple and engaging format, using elements like charts, graphs, and images. They are designed to make complex concepts more accessible and easier to understand, often simplifying intricate topics for broader audiences. In science, infographics help communicate complex research findings and concepts clearly, enhancing public understanding of scientific subjects. These visuals are especially valuable in education, where they support diverse learning styles by offering quick, clear comprehension. Infographics have evolved from basic data representation tools to dynamic, colorful digital designs that are now widely used across various platforms, improving accessibility and engagement.

Infographic Video Modules Used In This Study

Infographic video modules are a key component of this study, offering an innovative approach to science education. By combining visuals, graphics, and narration, these videos simplify complex chemistry topics, making them more accessible and engaging for ninth-grade students. The multimedia format caters to diverse learning styles, promotes active learning, and enhances process skills by encouraging students to observe, analyze, and synthesize information. The use of infographic video modules in this study explores their impact on student comprehension and retention, potentially transforming science education. The researcher developed infographic videos for seven chemistry topics, including *Things Around Us* and *Atomic Structure*, to provide an interactive, visually appealing learning experience.

Science Process Skills

Science Process Skills (SPS) are essential for acquiring knowledge through scientific methods. These skills are categorized into basic and integrated levels. Mastery of SPS helps students become capable of effectively accessing and understanding information. Key benefits of using the scientific process in education include developing scientific reasoning, problem-solving skills, and an understanding of how science interacts with technology, society, and everyday life. The ability of teachers to understand and apply SPS is critical to their effectiveness in teaching. This study investigates high school chemistry teachers' understanding of SPS and how it affects their assessment of these skills in students. The research, involving eight randomly selected teachers, reveals that teachers have a limited understanding of both the conceptual and operational aspects of SPS, which influences the accuracy of their assessments. In secondary education, the focus should be on developing fundamental science process skills like observation, classification, communication, and measurement, along with more advanced skills such as hypothesis formation and data interpretation.

Process Skills in Science

Science process skills are foundational abilities that enable students to engage in scientific inquiry and problem-solving.

Rambuda and Fraser (2002) emphasize that basic science process skills are essential for cognitive development, particularly in elementary education. These skills lay the groundwork for more advanced integrated process skills, which are necessary for scientific reasoning and problem-solving.

1. Observing: Observation involves using the senses (sight, touch, smell, taste, and hearing) to gather information about the world. In chemistry, this skill is crucial for identifying chemical reactions and physical changes, such as changes in color, odor, or texture. Accurate observation forms the basis for collecting data, forming hypotheses, and drawing conclusions.

2. Measuring: Measurement refers to quantifying observations using standardized units. In chemistry, precise measurement is essential for accurate data collection, such as measuring the volume of a liquid or the temperature of a reaction. These measurements help students analyze substances' properties and behavior, facilitating hypothesis testing.

3. Classifying: Classification involves grouping items based on shared characteristics. In chemistry, this skill is used to organize elements in the periodic table according to properties like atomic number or reactivity. Classifying helps students recognize patterns and relationships between substances, aiding in their understanding of chemical behavior.

4. Inferring: Inference is the process of drawing conclusions based on available evidence. In chemistry, inferring helps students explain experimental outcomes and chemical reactions. By applying their understanding of chemical principles, students can interpret data and make conclusions about underlying mechanisms.

5. Predicting: Prediction involves making educated guesses about future outcomes based on prior data and observations. In chemistry, predicting is key to anticipating results, such as the outcomes of reactions or shifts in equilibrium, fostering critical thinking and hypothesis formulation.

6. Communicating: Communication in science refers to effectively conveying observations and findings through various means (written, verbal, or visual). In chemistry, clear communication is vital for sharing experimental results and collaborating with others, ensuring that scientific knowledge is understood and furthered within the scientific community.

Infographic Video Modules On The Process Skills Of Chemistry

This study investigates the impact of infographic video modules on the development of process skills in ninth-grade chemistry students. By integrating visually engaging and interactive multimedia content into the curriculum, the study aims to enhance key skills such as observation, data analysis, and critical thinking. These video modules offer a dynamic, interactive learning experience, fostering a deeper understanding of chemistry concepts and encouraging active student engagement. The research provides a valuable opportunity to assess how effectively these innovative modules help students master essential process skills, potentially reshaping science education practices for greater effectiveness and student engagement.

In the digital age, multimedia resources like infographic video modules have become integral to education. This study represents a shift towards technology-driven, student-centered learning, allowing students to explore complex chemistry concepts in an accessible and engaging format. The research seeks to highlight how infographic videos can cultivate vital skills like hypothesis formation, experimentation, and data interpretation, which form a solid foundation for future scientific endeavors. Ultimately, the findings could provide valuable insights into the evolving landscape of science education and contribute to the development of more effective, engaging, and interactive learning methods.

Need And Significance Of The Study

Traditional teaching methods in chemistry often fail to stimulate active participation, leading to passive learning and over-reliance on rote memorization. This limits students' cognitive development and their ability to grasp complex chemical concepts. As observed in previous studies, there is a growing need for teaching approaches that center on the learner and foster deep understanding through active engagement. Infographic video modules represent a potential solution by presenting chemistry content in visually appealing, accessible ways that cater to diverse learning styles. These multimedia tools could improve critical thinking, problem-solving, and overall learning outcomes, ultimately preparing students for real-world applications of chemistry in various professional and everyday contexts. With the increasing emphasis on innovative teaching methodologies, exploring the impact of infographic video modules in chemistry education is crucial. This research could provide insights into how multimedia tools can better address the needs of diverse students and offer an alternative to traditional text-based teaching. The study holds significant potential to improve chemistry education by enhancing essential process skills and contributing to the ongoing development of effective pedagogical methods.

Review Of Literature

Narmatha Pandia (2023) This study discusses the use of infographic learning methods in education, emphasizing their potential to enhance student engagement and understanding. It highlights the importance of integrating visual learning strategies to improve both the accessibility and effectiveness of educational content, especially in complex subjects such as chemistry.

Al-Behadili & Al-Dayni (2022) The research investigates the effectiveness of using infographics in teaching chemical concepts to fifth-grade science students. The findings indicate that infographics significantly aid in the acquisition of chemical knowledge, suggesting that visual representations can make abstract concepts more comprehensible and accessible for students.

Beichumila, Bahati, & Kafanabo (2022) This study examines the impact of computer simulations and animations on students' acquisition of science process skills in Tanzanian secondary schools. The results show that students exposed to these digital tools demonstrated improved skills in observation, prediction, and data analysis, highlighting the effectiveness of multimedia resources in science education.

Adeleke F. Michael (2023) This study focused on evaluating the science process skills of junior secondary school students in River State, Nigeria, during the 2021/2022 academic year. The research revealed that 66.2% of students showed proficiency in basic science process skills, while a significant gap was identified in their understanding of integrated science process skills, with 84.4% demonstrating insufficient knowledge. The findings highlight a deficiency in the science teaching and learning process, emphasizing the need for improved pedagogical strategies in science classrooms to enhance students' overall science skills in the region.

John Smith (2023) This research explored the development of science process skills in an online setting through the use of lesson study as an instructional approach during the COVID-19 pandemic. The study, involving twenty teachers from the National Capital Region, found that online lessons facilitated the development of key science process skills such as social-interaction, information gathering, analyzing, reasoning, and communication. The implementation of lesson study allowed teachers to improve their online pedagogy, lesson design, and classroom management, significantly enhancing the acquisition of science process skills in a virtual environment.

Objectives Of The Study

The following objectives guided this study:

1. To identify the essential process skills required to improve understanding of the chemistry subject.
2. To assess the effectiveness of infographic video modules in enhancing process skills in chemistry among ninth-grade students.
3. To determine if there is a significant difference between the pre-test and post-test mean scores of the process skills assessment scale in the control and experimental groups.

Hypotheses Of The Study

The following hypotheses were tested in this study:

1. Infographic video modules on the process skills of chemistry are effective.
2. There is no significant difference between the mean scores of the pre-test and post-test of the process skills assessment scale in the control and experimental groups.

Research Method

In this study, an Experimental Method with a Parallel Group Design was utilized to assess the effectiveness of infographic video modules on the development of process skills in chemistry among ninth-grade students. This design allowed for a comparison between two groups: the experimental group, which received the infographic video modules, and the control group, which did not. The aim was to determine the impact of these multimedia tools on enhancing students' chemistry process skills.

Tools Used for the Study

The following tools were used in this study:

Infographic Video Modules: Developed by the investigator and the supervisor to enhance the process skills in chemistry.

Achievement Test (Pre-test and Post-test): Used to assess the students' process skills before and after the intervention with infographic video modules.

Sample And Sampling Techniques

For this study, the researcher selected 32 students for the experimental group and another 32 students for the control group. These students were chosen from the Government Higher Secondary School in Elakurichi, Ariyalur district. The researcher used purposive sampling to carefully select the sample, ensuring that the chosen students were suitable for the study's objectives.

Data Analysis

The following statistical methods were used in this study:

- Percentage Analysis
- Descriptive Analysis
- Differential Analysis
- Effect Size

Table 1 Mean, SD, And T-test Results For Pre-test And Post-test Scores Of Process Skills In The Control Group

Control Group	Mean	SD	't' value	Level of significance
Pre test	23.50	3.19	6.66	S
Post Test	32.50	4.08		

Significant at 0.05 level (2.00)

Table 2 Mean, SD, And T-test Results For Pre-test And Post-test Scores Of Process Skills In The Experimental Group

Experimental Group	Mean	SD	't' value	Level of significance
Pre test	22.78	3.18	10.57	S
Post Test	38.12	6.32		

Significant at 0.05 level (2.00)

Table 3 Mean, Standard Deviation, And T-test Scores For Pre-test Of Process Skills In Control And Experimental Groups

Pre test	Mean	SD	't' value	Level of significance
Control Group	23.50	3.19	0.487	NS
Experimental Group	22.78	3.18		

Significant at 0.05 level (2.00)

Table 4 Mean, Standard Deviation, And T-test Scores For Post-test Of Process Skills In Control And Experimental Groups

Post test	Mean	SD	't' value	Level of significance
Control Group	32.50	4.08	4.51	S
Experimental Group	38.12	6.32		

Significant at 0.05 level (2.00)

Table 5 Mean And Standard Deviation Of Process Skills Scores For The Experimental Group

Experimental group	Pre test		Post test	
	Mean	SD	Mean	SD
Observation	2.81	0.47	3.96	0.17
Inferring	4.87	0.94	7.53	1.45
Classifying	4.68	0.82	6.96	1.23
Predicting	3.75	0.67	5.46	0.84
Hypothesising	2.96	0.64	5.21	1.23
Manipulating	2.81	0.64	4.56	1.13
Interpreting	4.00	1.04	6.28	2.06

Table 6 The Effect Size Of The Experimental Group

Experimental Group	Mean	SD	σ	E.S (d)
Pre test	22.78	3.18	4.00	2.48
Post Test	38.12	6.32		

Findings of the study

The following findings are the present study

1. The post-test mean score is higher than the pre-test mean score , and the calculated 't' value of 6.66 exceeds the critical value of 2.00, indicating a significant difference between the pre-test and post-test scores.
2. The post-test mean score is higher than the pre-test mean score, and the calculated 't' value of 10.57 exceeds the critical value of 2.00, indicating a significant difference between the pre-test and post-test scores.
3. The experimental group pre-test mean score is slightly higher than the control group pre-test mean score, but the calculated 't' value of 0.487 is less than the critical value of 2.00, indicating no significant difference between the groups.
4. The experimental group post-test mean score is higher than the control group post-test mean score, and the calculated 't' value of 4.51 exceeds the critical value of 2.00, indicating a significant difference between the post-test scores.
5. The mean scores for all process skills in the post-test are higher than in the pre-test, with the post-test mean score for Inferring skills (7.53) being the highest among all skills.
6. The effect size for the difference between the pre-test and post-test mean scores in the experimental group is 2.48, indicating a large effect size according to Cohen (1988).

Research Implications

This study on the effectiveness of infographic video modules in enhancing process skills in chemistry for ninth-grade students has significant implications for education and instructional design. If found effective, these modules could influence curriculum development and teaching strategies, leading to more engaging and interactive learning experiences in chemistry. The results may also encourage a shift toward incorporating visual and interactive elements in modern pedagogy. The findings suggest that multimedia resources like infographic video modules can improve process skills in chemistry, with significant gains in areas like inferring, manipulating, and interpreting data. These tools could be extended to other subjects and grade levels,

benefiting diverse learning styles and abilities. Furthermore, the study shows that infographic video modules offer a larger impact compared to traditional methods, highlighting the importance of multimedia tools in enhancing science education. By fostering critical thinking and problem-solving, these tools align with contemporary educational theories focused on multimodal learning, enhancing both cognitive and emotional engagement. This research encourages further exploration into how multimedia can transform teaching methods and improve learning outcomes.

CONCLUSION

In conclusion, the research on the effectiveness of infographic video modules in enhancing process skills in chemistry for ninth-grade students has provided valuable insights. The study demonstrates that these multimedia resources can significantly improve students' process skills, promoting a deeper understanding of complex chemistry concepts. The interactive and visual nature of infographic videos makes learning more engaging, encouraging active participation and critical thinking. However, the success of these modules depends on their alignment with learning objectives, effective implementation by educators, and consideration of diverse student needs. Future research, including longitudinal and comparative studies, could provide further insights into the long-term impact and effectiveness of these modules across different student groups and contexts. As education adapts to technological advances and evolving student needs, integrating multimedia resources like infographic video modules can enhance chemistry education. The study highlights the importance of innovative teaching methods that provide accessible and engaging resources to help students develop crucial process skills. By incorporating these tools into the classroom, educators can better support students in mastering chemistry and preparing them for future scientific endeavors.

Overall, the research confirms that infographic video modules significantly improve process skills in chemistry, especially in areas like inferring, manipulating, and interpreting data. These tools are effective complements to traditional teaching methods, helping students achieve better learning outcomes in science education.

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