EFFECT OF INSTRUCTIONAL VIDEO FOR TEACHING AND LEARNING MECHANICAL DRAWING IN KWARA STATE COLLEGES OF EDUCATION

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Abstract
The instructional videos serve as an innovative approach to enhancing the teaching and learning of mechanical drawing in Colleges of Education. This study explores the design, production, and assessment of an instructional video tailored to improve students' understanding of complex mechanical drawing concepts. By integrating multimedia instructional strategies, the video aims to provide a structured, self-paced, and engaging learning experience that complements traditional teaching methods. The study examines the effectiveness of the instructional video in terms of student comprehension, retention, and performance. Key assessment criteria include instructional clarity, visual quality, content alignment with curriculum standards, and learner engagement. The study highlights the advantages of video-based instruction, such as accessibility, flexibility, and the ability to demonstrate intricate drawing techniques effectively. Findings reveal that incorporating instructional videos into the curriculum enhances male and female students' skill acquisition and overall academic performance. Based on these insights, it was concluded that, experimental group reported increased motivation and engagement due to the flexibility and self-paced nature of video-based learning. These findings align with established educational theories such as the Cognitive Load Theory and Dual-Coding Theory, which emphasize the importance of multimedia learning in reducing cognitive overload and enhancing information processing. The ability to visualize abstract concepts through animations and step-by-step demonstrations helped bridge the gap between theoretical knowledge applications, a key challenge in mechanical drawing education. The study therefore recommends the integration of digital instructional materials to improve teaching methodologies in technical education programs.

Keywords: Instructional Video, Teaching and Learning, Mechanical Drawing, Colleges of education, Technical Education, Educational Media, Visual Learning, Digital Instructional Materials, Student Performance.

Introduction

The integration of instructional videos into educational curricula has become increasingly prevalent, offering dynamic and engaging methods to enhance student learning. In the context of mechanical drawing education within Colleges of Education, the instructional videos are essential to improve pedagogical effectiveness. Mechanical drawing, a fundamental component of technical education, involves the precise representation of mechanical components and systems, requiring students to develop spatial visualization skills and a thorough understanding of geometric principles. Traditional teaching methods, often reliant on static diagrams and textbook descriptions, may not fully address the diverse learning needs of students or effectively convey complex spatial information. Recent studies have

highlighted the benefits of incorporating multimedia instructional materials in technical subjects. For instance, Ainswort et al. (2021) developed mechanical drawing instructional media based on the project-based learning model, finding that such media were valid, practical, and effective in enhancing learning outcomes.

Mayer (2020) emphasized the importance of innovative instructional practices in engineering graphics and design, focusing on the teaching and learning of isometric drawing to improve student comprehension and engagement. The advancement of technology in education has facilitated the creation of interactive and visually rich instructional videos that can demonstrate mechanical drawing techniques more effectively than traditional methods. These videos can provide step-by-step demonstrations, three-dimensional visualizations, and real-time annotations, thereby catering to various learning styles and enhancing male and female students' spatial reasoning abilities. The use of instructional videos allows for self-paced learning, enabling students to review complex concepts as needed, which is particularly beneficial in mastering the intricacies of mechanical drawing.

Mechanical drawing is a world-wide language that require excellent draughtmentship to create precise drawings. It is essentially a language used by mechanical related engineers, technicians, and craftsmen. This study effect of instructional video is specifically tailored for teaching mechanical drawing in Colleges of Education. The objective is to assess the video's effectiveness in improving male and female students' understanding, retention, and application of mechanical drawing principles to ensure gender balance in the study of mechanical drawing in Colleges of Education.

Statement of the Problem

Mechanical drawing is a critical subject in technical education, requiring students to develop spatial visualization skills and precision in interpreting and creating technical diagrams. However, traditional teaching methods, which often rely on static textbooks, whiteboard illustrations, and instructor-led demonstrations, may not effectively address students' diverse learning needs. Many students struggle with understanding complex geometric constructions, orthographic projections, and isometric drawings, leading to poor comprehension and low performance in the subject. With the increasing demand for skilled technical educators, there is a need for innovative instructional strategies that enhance student engagement and improve learning outcomes. Instructional videos have been identified as effective tools for delivering step-by-step demonstrations and interactive visualizations, the study on the effect of instructional video of teaching mechanical drawing remain limited. The absence of well-structured, curriculum-aligned instructional videos in Colleges of Education poses a challenge to both teachers and students, affecting the quality of learning and overall mastery of mechanical drawing concepts.

This study seeks to address these challenges by introducing the instructional video for teaching mechanical drawing in Colleges of Education. The study aims to determine the effectiveness of video-based instruction in improving student comprehension, retention, and performance, providing insights into its potential as a complementary teaching aid in technical education.

Purpose of the Study

The purpose of this study is to assess the effect of instructional video for teaching and learning mechanical drawing in Colleges of Education. This study aims to enhance students' understanding of mechanical drawing concepts by integrating multimedia instructional strategies that provide step-by-step demonstrations, interactive visualizations, and real-world applications.

Research Questions

This study seeks to answer the following research questions:

1. How can an instructional video be effectively used to enhance the teaching and learning of mechanical drawing in Colleges of Education?
2. To what extent does the use of instructional videos improve students' comprehension and retention of mechanical drawing concepts?
3. What is the impact of instructional videos on students' engagement and learning experiences in mechanical drawing?
4. How does the instructional video compare to traditional teaching methods in terms of effectiveness in teaching mechanical drawing?
5. What challenges and opportunities are associated with the integration of instructional videos into the mechanical drawing curriculum in Colleges of Education?

Hypotheses of the Study

1. **H_{01}**: There is no significant difference in students' comprehension of mechanical drawing concepts between those taught using instructional videos and those taught using traditional methods.
2. **H_{02}**: The use of instructional videos does not significantly improve students' retention of mechanical drawing concepts.
3. **H_{03}**: There is no significant difference in student engagement levels between those using instructional videos and those using conventional teaching methods.
4. **H_{04}**: The integration of instructional videos into the mechanical drawing curriculum does not significantly impact students' overall academic performance.

Methodology of the Study

This study employs a **quasi-experimental research design** using a **pre-test, post-test control group design** to compare the effectiveness of instructional videos with traditional teaching methods in teaching mechanical drawing. The experimental group receive instruction through an instructional video, while the control group are taught using conventional classroom methods. The study population consist of students enrolled in mechanical drawing courses in selected Colleges of Education offering technical education programs. A **purposive sampling technique** was used to select institutions that offer mechanical drawing courses, and a **random sampling method** was applied to select participants. The sample consist of **two groups (experimental and control)**, each comprising **50 students** to ensure adequate representation for statistical analysis. To collect data, various instruments was used. The **instructional video** developed based on key mechanical drawing concepts, such as orthographic projections, isometric drawings, and geometric constructions. A **pre-test and**

post-test are used to administered questions to measure students' comprehension before and after the intervention. A **validated questionnaire** was used to assess students engagement, learning experience, and perceptions of instructional videos. An **observation checklist** was employed to monitor students' participation and attentiveness during lessons. The validity and reliability of these instruments was established through expert reviews and pilot testing.

The study was conducted in ten (10) phases. First, the **instructional video** was designed following instructional design principles and expert validation. Then, a **pre-test** was administered to assess students' prior knowledge. During the intervention phase, the **experimental group** receive instruction using the instructional video, while the **control group** are taught using traditional methods. After the teaching phase, a **post-test** was administered to evaluate students' learning gains. Student engagement and perceptions was assessed through a **survey and observation checklist**. For data analysis, **quantitative statistical techniques** was employed. **Descriptive statistics**, mean and standard deviation summarize students' performance and engagement levels. A **paired sample t-test** was used to compare pre-test and post-test scores within groups, while an **independent sample t-test** were compare post-test scores between the experimental and control groups to determine the instructional video's effectiveness. **Analysis of Variance (ANOVA)** was conducted to analyze variations in performance across different demographic variables. All statistical analyses was performed using **SPSS (Statistical Package for Social Sciences) version 27**, with significance levels set at $\mathbf{p < 0.05}$.

Ethical considerations strictly observed throughout the study. Participants were informed about the study's objectives, and **informed consent** was obtained before participation. **Confidentiality** maintained by ensuring that all collected data remains anonymous and is used strictly for research purposes. The study also adhere to ethical research standards by ensuring that participants are not subjected to harm, discomfort, or coercion. **Institutional approval** was sought from the research ethics committee of the participating Colleges of Education. This methodological approach ensures a structured and rigorous investigation into the effect of instructional videos for teaching mechanical drawing. The findings from this study will provide empirical evidence on the effectiveness of video-based instruction, contributing to improved teaching strategies and curriculum enhancement in technical education.

Presentation of Data Analysis and Results

The results are presented in tables, figures, and narratives for clarity.

Demographic Information of Respondents

The demographic characteristics of the participants, such as age, gender, prior knowledge of mechanical drawing, and familiarity with instructional videos, were analyzed using descriptive statistics. The results provide insights into the background of the study participants and their potential influence on learning outcomes

Table 1: Demographic Characteristics of Respondents

Variable	Experimental Group (n=50)	Control Group (n=50)	Total (N=100)
Gender (Male)	45 (90%)	45 (90%)	90 (90%)
Gender (Female)	5 (10%)	5 (10%)	10 (10%)
Age (18-22 years)	25 (50%)	26 (52%)	51 (51%)
Age (23-27 years)	20 (40%)	18 (36%)	38 (38%)
Age (28+ years)	5 (10%)	6 (12%)	11 (11%)
Prior Knowledge of Mechanical Drawing (Yes)	35 (70%)	36 (72%)	71 (71%)
Prior Knowledge of Mechanical Drawing (No)	15 (30%)	14 (28%)	29 (29%)

The majority of participants were male (90%), while female participants made up only 10% of the sample. Most students (71%) had prior exposure to mechanical drawing, and the results indicate a balanced distribution between the experimental and control groups.

2. Pre-Test and Post-Test Score Comparisons

To evaluate the impact of the instructional video on students' learning, **mean scores from the pre-test and post-test** were compared within and between the two groups.

Table 2: Mean Pre-test and Post-test Scores

Group	Mean Pre-test Score	Mean Post-test Score	Mean Difference
Experimental Group	45.2 ± 6.4	78.6 ± 5.8	33.4
Control Group	44.8 ± 6.7	65.3 ± 7.2	20.5

The results indicate a significant improvement in both groups; however, students taught using the instructional video (experimental group) showed a **higher mean gain (33.4 points)** compared to those taught using traditional methods (20.5 points).

To determine statistical significance, an **independent sample t-test** was conducted.

Table 3: Independent Sample t-test of Post-test Scores

Group	Mean ± SD	t-value	p-value (p<0.05)	Decision
Experimental Group	78.6 ± 5.8	5.89	0.0001**	Significant
Control Group	65.3 ± 7.2			

The **p-value (0.0001)** is less than 0.05, indicating a **statistically significant difference** in post-test scores between the two groups. This confirms that the use of instructional videos significantly improves students' learning outcomes in mechanical drawing.

3. Impact on Student Engagement and Learning Experience

A questionnaire was used to assess students' engagement and perceptions of the instructional video. Responses were recorded on a **5-point Likert scale** (1 = Strongly Disagree, 5 = Strongly Agree).

Table 4: Students' Engagement and Learning Experience Scores

Engagement Indicators	Mean Score (Experimental Group)	Mean Score (Control Group)	p-value
The lesson was engaging	4.7 ± 0.6	3.2 ± 0.8	0.001
The instructional video improved understanding	4.8 ± 0.5	3.1 ± 0.9	0.000
I prefer instructional videos over traditional methods	4.5 ± 0.7	3.0 ± 1.0	0.002
The video helped with visualization of concepts	4.9 ± 0.4	3.3 ± 0.8	0.000

The results show that students in the experimental group rated their learning experience and engagement **significantly higher** than those in the control group

4. Qualitative Feedback from Students

Open-ended responses were collected to understand students' experiences with the instructional video. Key themes that emerged include:

- **Improved Concept Clarity**: Students reported that the video's step-by-step illustrations helped them better understand complex mechanical drawing techniques.
- **Increased Retention**: Many students mentioned that the ability to **pause, rewind, and re-watch** the video improved their retention of information.
- **Engagement and Interest**: Students found the video approach more engaging compared to traditional lecture.

6. Summary of Findings

1. The instructional video significantly improved students' **post-test scores**, with a higher mean gain compared to traditional teaching methods.
2. **Student engagement** was significantly higher in the experimental group, as evidenced by Likert-scale questionnaire responses.
3. Students reported **positive experiences** with instructional videos, emphasizing **better visualization, retention, and engagement**.
4. Challenges such as **limited digital access and internet connectivity** were identified, highlighting areas for improvement in implementing video-based instruction.

Discussion of the findings

The purpose of this was to assess the effectiveness of instructional videos in teaching and learning mechanical drawing in Colleges of Education. The findings provide strong evidence that the use of instructional videos significantly enhances students' comprehension, engagement, and learning outcomes compared to traditional teaching methods. The study revealed a statistically significant improvement in students' post-test scores in the experimental group (Mean = 78.6, SD = 5.8) compared to the control group (Mean = 65.3, SD = 7.2). The independent sample t-test ($p = 0.0001$) confirmed that the difference was significant. This aligns with findings from previous studies (Mayer, 2020; Ibrahim

et al., 2022) that suggest instructional videos enhance knowledge retention and conceptual understanding, particularly in technical subjects. The observed learning gains can be attributed to the multimodal nature of instructional videos, which integrate visual and auditory elements to improve comprehension (Sweller, 2019). According to the Cognitive Load Theory (CLT), well-designed instructional videos reduce extraneous cognitive load, allowing students to focus more on essential learning content (Paas & Van Merriënboer, 2021). In this study, students exposed to the instructional video demonstrated better recall and application of mechanical drawing principles, supporting the argument that videos facilitate deep learning.

Findings from the questionnaire on student engagement indicated that students in the experimental group reported higher engagement levels compared to those in the control group. Key indicators such as lesson enjoyment (Mean = 4.7, SD = 0.6) and improved conceptual understanding (Mean = 4.8, SD = 0.5) were significantly higher in the experimental group. This result supports research by Guo et al. (2020), who found that video-based learning increases motivation and engagement, particularly in STEM and technical education settings. Instructional videos provide self-paced learning, allowing students to pause, rewind, and replay content as needed. This feature was highlighted in student feedback, where many respondents stated that they appreciated the flexibility of learning at their own pace. This finding aligns with the Self-Determination Theory (Deci & Ryan, 2017), which suggests that learners are more motivated when they have autonomy over their learning process.

A significant advantage of instructional videos identified in this study is their ability to enhance visualization of abstract mechanical drawing concepts. The experimental group reported that the videos improved their ability to interpret orthographic and isometric drawings, a finding consistent with research by Ainsworth (2021) on dual-coding theory, which suggests that combining verbal explanations with visual representations improves cognitive processing. In traditional teaching methods, students often struggle with translating 2D projections into 3D models, leading to misconceptions in mechanical drawing. The instructional video provided animated step-by-step demonstrations, which helped students bridge the gap between theoretical knowledge and practical application. Findings also revealed studies on multimedia learning by (Fiorella & Mayer, 2021), where students who receive instruction through videos outperform those solely on textbook-based learning.

Conclusion

The study examined the effect of instructional videos as a teaching and learning tool for mechanical drawing in Colleges of Education. The findings confirmed that instructional videos significantly enhance students' understanding, engagement, and performance in mechanical drawing compared to traditional teaching methods. The experimental group, which received instruction through video-based learning, demonstrated higher post-test scores and greater conceptual comprehension, reinforcing the effectiveness of multimedia instructional strategies in technical education. The integration of visual and auditory elements in the instructional videos provided students with clearer explanations of complex mechanical

drawing concepts, leading to improved retention and application of knowledge. The study found that students in the experimental group reported increased motivation and engagement due to the flexibility and self-paced nature of video-based learning. These findings align with established educational theories such as the Cognitive Load Theory and Dual-Coding Theory, which emphasize the importance of multimedia learning in reducing cognitive overload and enhancing information processing. The ability to visualize abstract concepts through animations and step-by-step demonstrations helped bridge the gap between theoretical knowledge and practical application, a key challenge in mechanical drawing education.

Recommendations

Based on the findings of this study, the following recommendations are proposed to enhance the effectiveness of instructional videos in teaching and learning mechanical drawing in Colleges of Education:

1. **Integration of Instructional Videos into the Curriculum** – This will help standardize multimedia-based learning and enhance students' understanding of complex concepts.
2. **Provision of ICT Infrastructure and Digital Resources**
3. **Training for Educators on Multimedia Instruction** – This will ensure that they maximize the benefits of multimedia learn
4. **Further Research on Long-Term Impact** – Future studies should explore the long-term effects of instructional videos on students' practical skills acquisition and industry readiness, ensuring that they effectively bridge the gap between theoretical knowledge and real-world application.

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