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Exploring the research landscape of scenario and video-based learning: A bibliometric and content analysis from 2018-2024

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Abstract

This study investigates the research landscape of scenario and video-based learning through a combined bibliometric and content analysis, guided by the PRISMA framework. A Scopus database search (2018-2024) identified 965 relevant articles (from 8,415 initially). Bibliometric analysis, utilizing VOS-viewer, assessed publication trends, citation networks, and thematic clusters, revealing a growing body of research in intelligent and e-learning systems. Detailed content analysis examined methodologies and samples, highlighting an increasing use of quantitative methods (RCTs, quasi-experimental designs) and diverse samples including medical/software engineering students and professional trainees. Findings indicate research focuses on knowledge gain, performance improvement, and user satisfaction, with emerging interest in VR/AR/simulation technologies. This study provides a roadmap for future research directions, including longitudinal assessments, exploration of user preferences, and innovative technological integration to enhance engagement and effectiveness in varied learning environments.

Keywords: Digital learning environments, Educational technology, Interactive learning, Scenario-based learning, Video-based learning.

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1. Introduction

In recent years, scenario-based and video-based learning have emerged as powerful pedagogical approaches across diverse educational and training contexts [1, 2]. By simulating real-life environments and enabling learners to engage in experiential [3-5] situated learning [6] these methods offer distinct advantages over traditional didactic instruction. Scenario-based learning fosters critical thinking [7] decision-making [8] and problem-solving skills [9] while video-based learning enhances visualization [10] retention [11] and learner engagement [12]. The convergence of these two

modalities—often augmented by digital and immersive technologies—has led to innovative instructional strategies that are increasingly adopted in medical education, engineering, teacher training, and workplace development [13, 14].

The rapid integration of digital tools and intelligent learning systems has further accelerated the global interest in these approaches. Technologies such as virtual reality (VR), augmented reality (AR), and AI-driven simulation have expanded the boundaries of what scenario and video-based learning can achieve [5, 11]. Consequently, the academic community has witnessed a substantial increase in empirical studies examining the effectiveness, design, and implementation of these methods. However, despite this growth, the research landscape remains fragmented, with limited synthesized understanding of prevailing trends, dominant research methods, thematic areas, and future directions [15].

To address this gap, the present study offers a comprehensive review of the research landscape on scenario and video-based learning from 2018 to 2024, combining bibliometric and content analysis under the guidance of the PRISMA framework. Through an initial screening of 8,415 articles retrieved from the Scopus database and systematic filtering based on relevance, quality, and scope, 965 records were reviewed, and 32 studies were ultimately included for in-depth analysis. This study is guided by the following key research questions:

1. What was the yearly distribution of articles in the field of scenario and video-based learning over the past five years?
2. What keywords concerning about scenario video-based learning were used for the preceding studies in 2018-2024?
3. What research methods, tools, and analytical techniques were employed in previous studies?
4. What kinds of samples have been used in prior studies?
5. What variables have been examined in prior studies?
6. What were the primary findings and thematic focuses of previous research?
7. What were the recommendations and future agenda items proposed by preceding studies?

To answer these questions, the study employs VOSviewer for bibliometric mapping of publication trends, co-authorship networks, and keyword co-occurrence, revealing thematic clusters and influential research actors. In parallel, a detailed content analysis categorizes methodological approaches (e.g., RCTs, quasi-experiments, surveys), sample diversity (e.g., medical students, engineers, professionals), and emerging focal areas such as immersive learning, intelligent tutoring, and technology-enhanced engagement.

By integrating both macro-level scientometric data and micro-level qualitative insights, this study contributes a multi-dimensional overview of current knowledge in the field [16]. The findings not only illuminate research gaps but also provide a forward-looking roadmap for future exploration—emphasizing the need for longitudinal studies, adaptive instructional design, and the integration of advanced technologies to enrich learner experiences.

Ultimately, this review aims to support educators, researchers, instructional designers, and policy-makers in understanding the trajectory and impact of scenario and video-based learning, and in designing more effective, engaging, and evidence-based learning environments.

2. Literature Review

Scenario-based and video-based learning have been widely studied for their potential to improve learner outcomes in both academic and professional training settings [3, 11]. Numerous studies have reported positive impacts on knowledge retention [17] learner satisfaction [18] problem-solving ability [19] and skill acquisition [20] especially in complex domains such as healthcare, engineering, and vocational training. For instance, video-based simulations have proven effective in fostering procedural knowledge and supporting repeated practice in a risk-free environment [6, 20-22]. Scenario-based methods, in turn, support contextual learning and transferability of skills by encouraging learners to make decisions in authentic, problem-centered contexts [18].

Despite these strengths, prior research in this field shows several limitations. First, the diversity of learning environments and implementation strategies has led to inconsistent findings regarding effectiveness [23]. Second, much of the existing literature remains discipline-specific and lacks cross-disciplinary generalization [24]. Third, many reviews have been narrative in nature, offering descriptive summaries without systematic synthesis of publication trends, research designs, or common outcome variables. Lastly, few studies have examined the integration of emerging technologies—such as VR, AR, and AI—in scenario and video-based learning, despite their growing adoption in instructional design [25].

Recent trends suggest a growing interest in more empirical, data-driven approaches to evaluate the efficacy of such methods [26]. An increasing number of studies employ randomized controlled trials (RCTs), quasi-experimental designs, and mixed methods research to assess learning gains and behavioral changes [5, 27]. Moreover, researchers have begun exploring user engagement, cognitive load, and affective outcomes in addition to academic performance. However, these studies are often scattered, making it difficult to identify dominant themes, gaps, and future research priorities [28].

In light of these challenges, a systematic literature review analysis that consolidates current findings and maps the methodological landscape is timely and necessary [16]. By synthesizing publication trends, research methods, and key focus areas, this study fills a crucial gap in the literature and sets the stage for a more cohesive and informed research agenda. The integration of bibliometric mapping with detailed content analysis not only enhances the analytical rigor but also ensures that both quantitative and qualitative aspects of the field are thoroughly explored [16, 29].

3. Methods

3.1. Materials and Criteria

This study employed PRISMA [30] a bibliometric analysis to provide the research landscape of scenario and video-based learning. The bibliometric analysis mapped the overall structure and evolution of the field. The study adhered to the PRISMA 2020 guidelines for systematic reviews. PRISMA which stands for "Preferred Reporting Items for Systematic Reviews and Meta-Analyses," and is a well-known standard for systematic reviews in many fields [31].

The primary data source for this study was the Scopus database, a comprehensive abstracting and indexing database covering a wide range of scholarly literature [32]. Therefore, the database was chosen as the data source. To ensure that this review covers a wide range of scholarly literature on the topic. A systematic search strategy was developed to identify relevant publications. The search string used was: "scenario" AND "video-based" AND "learning" with the following inclusion and exclusion criteria:

Table 1.
Inclusion & Exclusion Criteria.

Inclusion Criteria:	Exclusion Criteria:
Articles published between 2018 and 2024 (inclusive). Articles published in English. Studies focusing on scenario learning, video-based learning, or a combination of both. Studies that investigate the use of these methods in an educational or training context. Studies published in scholarly journals (i.e., not conference proceedings, book chapters, etc.).	Studies not related to an instructional system. Studies not related to teaching and learning. Studies that are not peer-reviewed. Studies that are not available in full text. Studies that are only abstracts or editorials. Non-English language publications. Studies not a research article.

This study developed several inclusion and exclusion criteria to ensure that the selected articles were within their scope, and these criteria were based on the research questions obtained from previously identified research gaps. The inclusion and exclusion criteria for this study were derived from exhaustive previous literature studies. Table 2 summarizes the inclusion and exclusion criteria for this SLR. After screening using inclusion and exclusion criteria, we were unable to extract 626 of the 965 articles, and a further 32 articles were rejected for various reasons, such as mentioning only 'video-based learning' without using scenario in the study. Another reason is the use of materials outside of the academic setting. In addition, the lack of teaching and learning in the study was also a reason for exclusion. Figure 1 illustrates the PRISMA framework for this study. All authors agreed to the inclusion and exclusion of the selected papers.

4. Data Sources and Search Strategies

4.1. Selection Proces

After searching for Scopus, the initial search of the Scopus database yielded 8,415 records, and an additional 965 articles came from registers. After duplicates were removed and initial screening was completed, 965 records were screened based on title and abstract to see if they could be included. 626 records were excluded. 339 reports were sought for retrieval and assessed for eligibility. 64 reports were assessed for eligibility. 19 reports were excluded because they were not instructional systems and 12 reports were excluded because they did not relate to teaching and learning. Another one was excluded because this article was not a research article. A final dataset of 32 articles were included in this review.

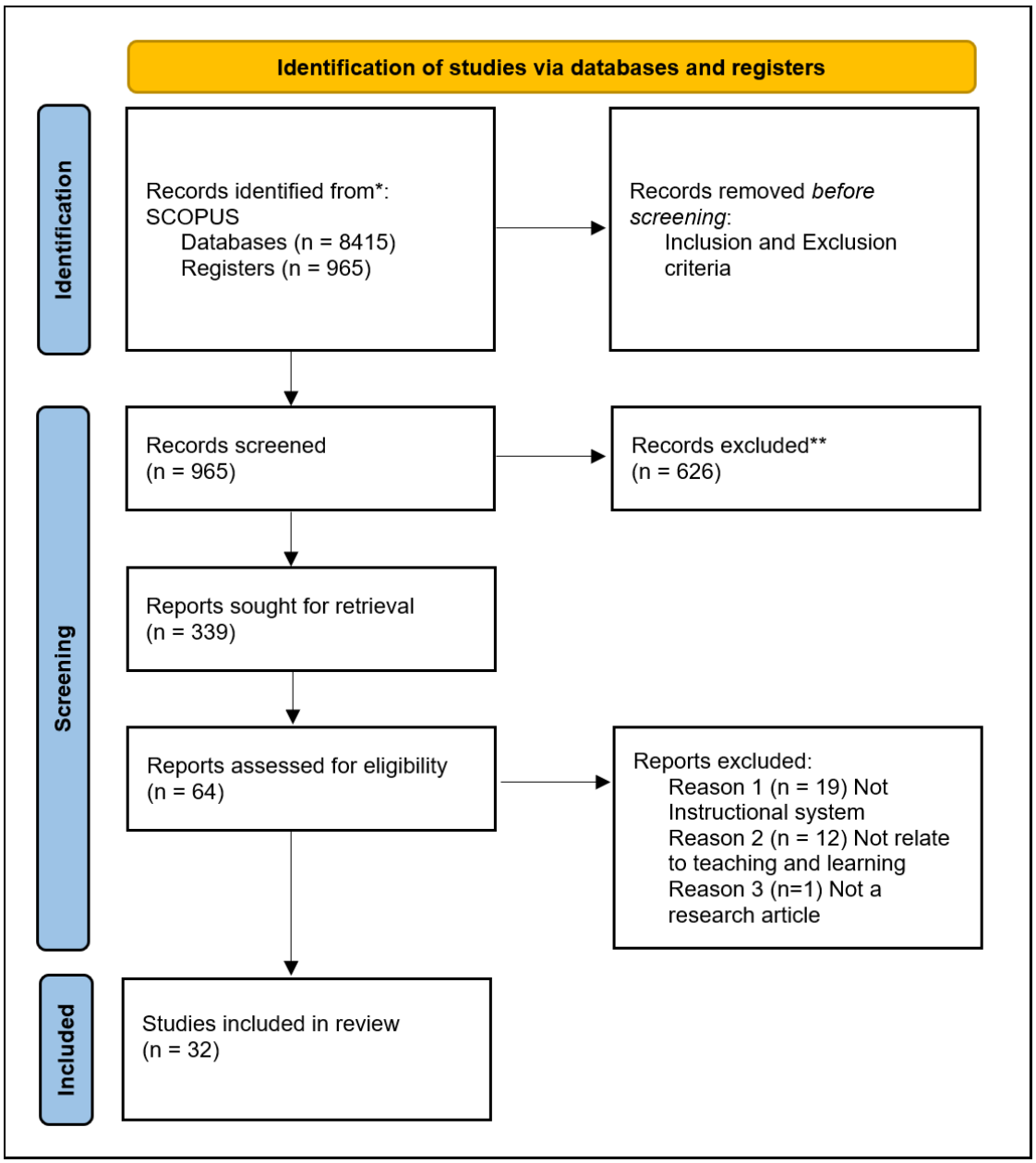

Figure 1.
The PRISMA framework.

4.2. Bibliometric Analysis

The bibliometric analysis was conducted using VOSviewer software. This analysis focused on: Keyword co-occurrence analysis.

This study employed a co-occurrence analysis of author keywords using VOSviewer to uncover the major research themes and evolving topics in the field of scenario and video-based learning. This method is particularly suited for identifying the conceptual structure and knowledge domains within a specific research area [33].

5. Results

5.1. What is the Yearly Distribution of Articles in the Field of Scenario and Video-Based Learning Over the Past Five Years?

The first research question will illustrate yearly distribution of the article in the field of scenario, video-based and learning for the last 5 years, as shown in Figure 2.

The number of publications in the field exhibited a generally *increasing* trend over the period 2019-2024 (see Figure 1). Publication numbers were: 2019: approximately 70, 2020: approximately 90, 2021: approximately 130, 2022: approximately 170, 2023: approximately 230, 2024: approximately 310.

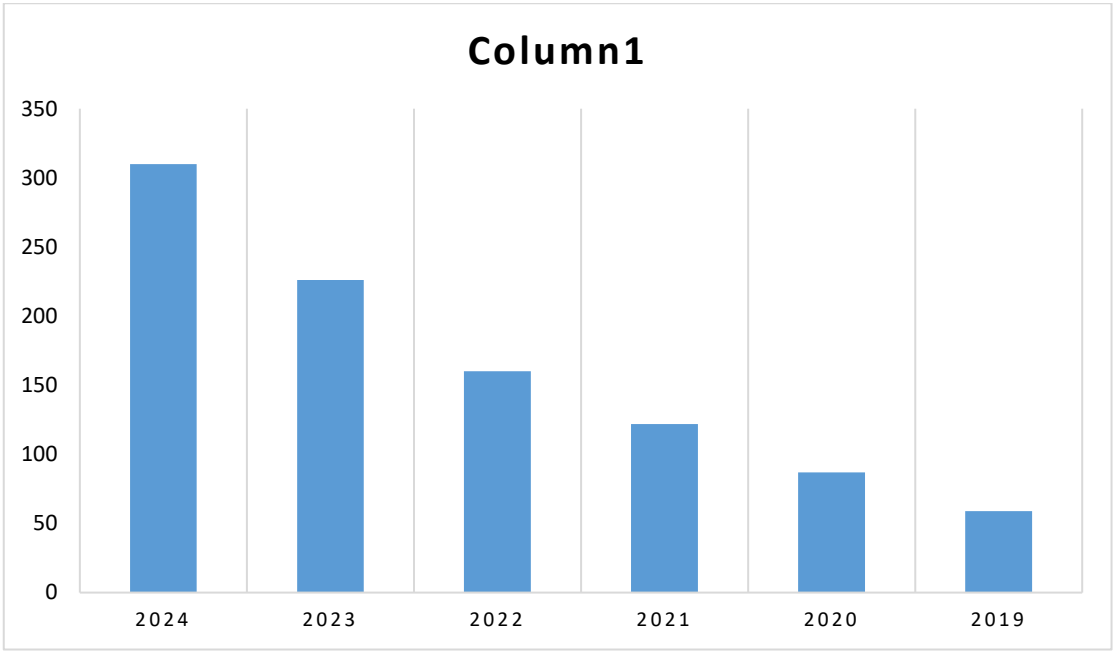

Figure 2.
Yearly distribution

5.2. What Keywords Concerning About Scenario Video-Based Learning Were Used for the Preceding Studies in 2018-2024?

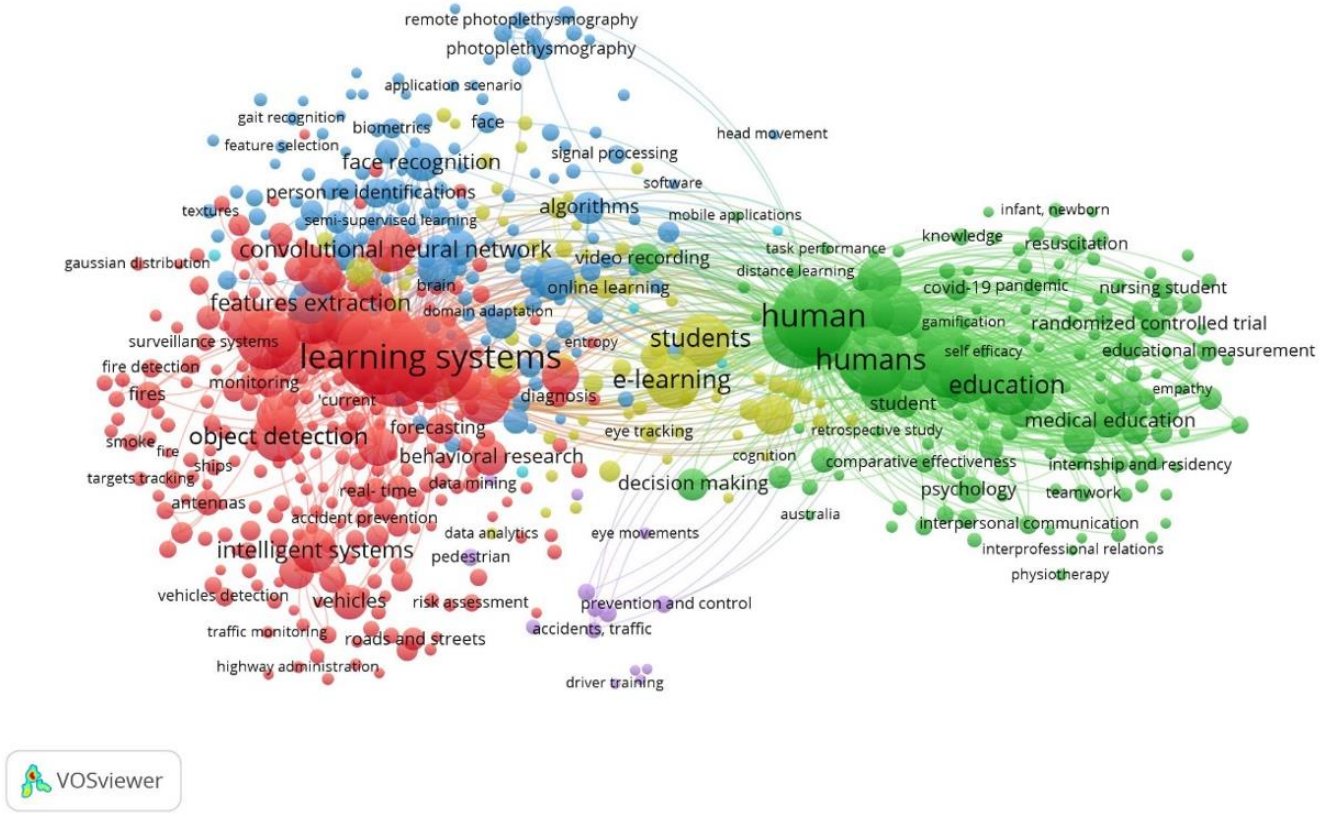

Figure 3.
Keyworks on scenario video-based learning in 2018-2024.

From 2018 to 2024, the main research keyword on scenario video-based learning, the most commonly used keyword in bibliometric analysis, "Co-occurrence", was selected as the analysis type, and "all keywords" were tagged as units. In this context, 629 keywords were identified from the dataset. As shown in the graph, among the keywords used in all the articles listed, "Learning System" appears 278 times, "Deep Learning" occurs 274 times, and "Computer Vision" occurs 256 occurrences, 237 occurrences of "Human", and "Image Enhancement". Appeared 130 times. The words that came up next were Education, E-learning, Students, Female and Machine learning. When examining all keywords, it was found that

about 75% (n=472) of the vocabulary used terms related to educational technology. In addition, keywords such as attitude, motivation, and cognitive load are rarely favored in bibliometric analysis.

5.3. What Research Methods, Tools, and Analytical Techniques Were Employed in Previous Studies?

Table 2.
Research Method employed in previous studies.

Research Method	Estimated Frequency (Number of Articles)	Estimated Percentage of Total Articles (N=32)
Quantitative Methods		
Randomized Controlled Trials (RCTs)	5	15.63%
Quasi-Experimental Designs	8	25%
Pre/Post Intervention Surveys	8	25%
Qualitative Methods		
Semi-Structured Interviews	3	9.38%
Open-Ended Questions	4	12.5%
Thematic Analysis	3	9.38%
Content Analysis	1	3.13%

5.4. Quantitative Methods

Pre/Post Intervention Surveys were used in approximately 25% of articles, indicating a focus on measuring changes in learning outcomes, attitudes, or perceptions before and after an intervention.

Quasi-Experimental Designs were employed in approximately 25% of articles, suggesting an interest in evaluating the impact of interventions or technologies in real-world settings where random assignment is not feasible.

Randomized Controlled Trials (RCTs) were used in approximately 15.63% of articles, highlighting the use of rigorous experimental designs to compare the effectiveness of different instructional methods or interventions.

Qualitative Methods:

Semi-Structured Interviews (9.38%) and Open-Ended Questions (12.5%) were used to gain in-depth insights into learner experiences and perspectives.

Table 3.
Research Tools employed in previous studies.

Specific Technologies/Tools	Estimated Frequency (Number of Articles)	Estimated Percentage of Total Articles (N=32)
Virtual Reality (VR)	3	9.38%
Augmented Reality (AR)	1	3.13%
High-Fidelity Simulation	2	6.25%
AVW-Space	1	3.13%
Video-Based Communication Assessment (VCA)	1	3.13%

5.5. Emerging Technologies

Virtual Reality (VR) and Augmented Reality (AR) technologies were explored in approximately 9.38% and 3.13% of articles, respectively, indicating a growing interest in immersive learning environments.

Table 4.
Research Analyses employed in previous studies.

Research Analyses	Estimated Roughly Percentage of Total Articles (N=32)
Statistical Analyses	60%
Qualitative Data Analysis	30%
Descriptive Statistics	10%

Research analyses:

The analyzed studies employed a variety of data analysis techniques. Based on a general categorization, the distribution of analysis methods is estimated as follows:

i Statistical Analyses: Approximately 60% of the studies employed statistical analyses. This category includes:
   a) T-tests
   b) ANOVA (Analysis of Variance)
   c) Regression analysis (linear, multiple)
   d) Chi-square tests
   e) Non-parametric tests (e.g., Mann-Whitney U test)

ii Qualitative Data Analysis: Approximately 30% of the studies employed qualitative data analysis techniques. This category includes:
   a) Thematic analysis

b) Content analysis
c) Discourse analysis

iii Descriptive Statistics: Approximately 10% of the studies relied primarily on descriptive statistics. This includes:
a) Means, standard deviations, frequencies, percentages

5.6. What Kinds of Samples Were Used in Prior Studies?

The analyzed studies employed a variety of sample types. As shown in Figure 2 the distribution across broad categories is estimated as follows:

a) Studies focused Primarily on Students:

Approximately 46.88% of studies focused primarily on students. This includes medical students, software engineering students, nursing students, dental hygiene students, middle school students and vocational education students.

b) Studies focused Primarily on Teachers:

Approximately 3% of studies focused primarily on teachers.

c) Studies focused on other professional respondents:

Approximately 9% of studies focused on residents or general surgery.

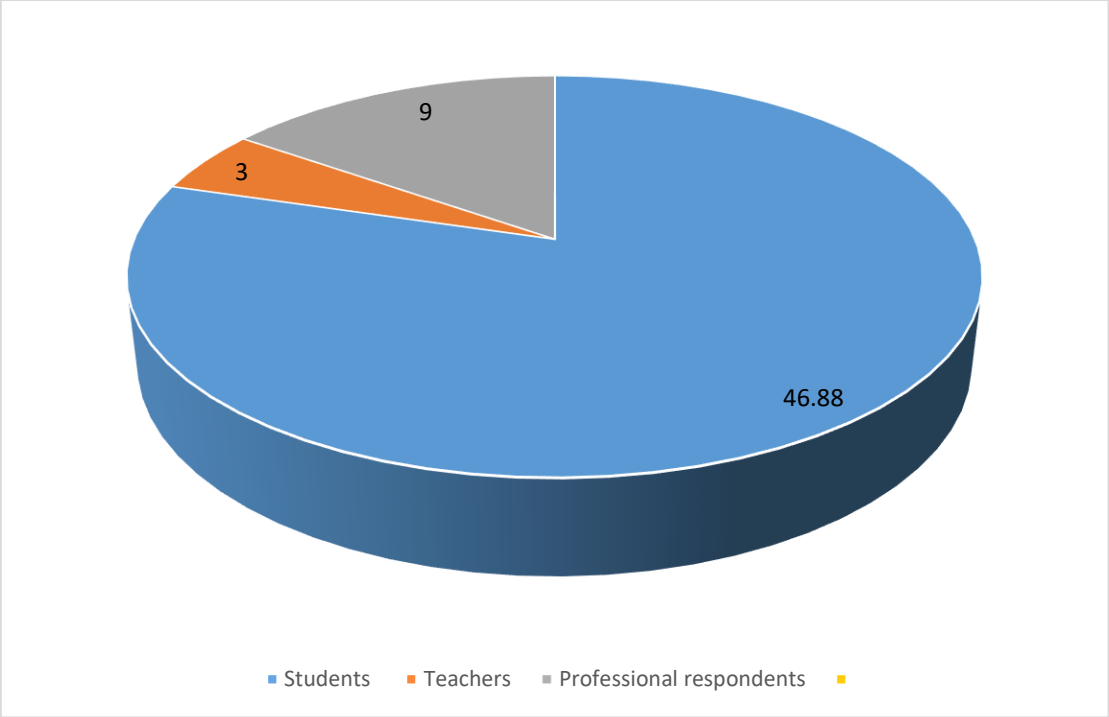

Figure 4.
Sample type Probability.

5.7. What Variables Were Examined in Prior Studies?

The analyzed studies examined a wide range of variables related to the effectiveness and impact of scenario and video-based learning. Based on a general categorization, the distribution of variables examined is estimated as follows:

i. Learning Outcomes:
a) Approximately 45% of the studies examined learning outcomes. This includes variables such as:
b) Knowledge acquisition (measured through pre/posttests, quizzes, etc.)
c) Skill performance (measured through practical assessments, simulations, etc.)
d) Critical thinking abilities (measured through standardized tests or rubrics).

ii. Affective and Attitudinal Variables:
a) Approximately 30% of the studies examined affective and attitudinal variables. This includes:
b) Student engagement (measured through surveys, observation)
c) Motivation (measured through surveys, self-report scales)
d) Satisfaction (measured through questionnaires)
e) Anxiety (measured through standardized anxiety scales)

iii. System Usability and Acceptance:
a) Approximately 10% of the studies examined system usability and acceptance. This includes:
b) Perceived usefulness (measured through questionnaires)
c) Ease of use (measured through questionnaires)
d) Technology acceptance (measured through standardized scales like TAM)

iv. Communication Skills:
a) Approximately 6% of the studies examined the communication skills.

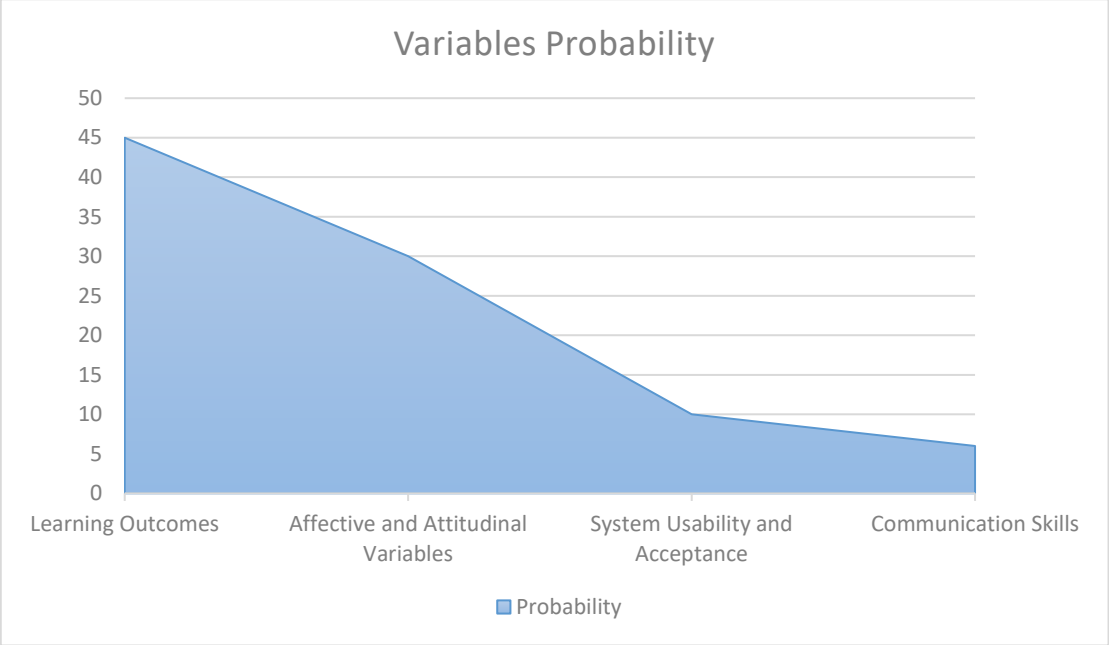

Figure 5.
Variables Probability.

Question 6 : What Were the Main Findings and Foci in Previous Studies?

The main findings across the analyzed studies generally focused on the following, with varying degrees of emphasis: 1. Improved Learning Outcomes (Significant Focus); 2. Enhanced Engagement and Motivation (Moderate Focus); 3. Positive Impact on Attitudes and Perceptions (Moderate Focus); 4. Technological Usability and Effectiveness (Emerging Focus).

1. Improved Learning Outcomes (Significant Focus): A large number of studies provided evidence that scenario and video-based learning interventions can lead to significant improvements in learning outcomes. These improvements were observed across various domains, including:
   Knowledge Acquisition: Participants demonstrated increased factual knowledge and comprehension of key concepts, often measured through pre- and post-tests or quizzes [4, 6, 19].
   Skill Development: Learners exhibited enhanced practical skills and competencies, assessed through performance-based tasks, simulations, or clinical evaluations [34-36].
   Critical Thinking Abilities: Some studies indicated that these methods can foster higher-order thinking skills, as measured by standardized tests or the ability to solve complex problems [9, 18, 37].
2. Enhanced Engagement and Motivation (Moderate Focus): Several studies highlighted the role of scenario and video-based learning in boosting student engagement and motivation. This included:
   Increased Interest and Enjoyment: Learners reported higher levels of interest and enjoyment in the learning material, leading to greater participation and persistence [20, 38, 39].
   Improved Self-Efficacy and Confidence: Some studies suggested that these methods can enhance learners' self-confidence and belief in their ability to succeed [19, 37, 40].
3. Positive Impact on Attitudes and Perceptions (Moderate Focus): A number of studies found that scenario and video-based learning can positively influence student attitudes and perceptions towards specific topics or skills. This included:
   Reduced Stigma: In the context of substance use disorders, these methods were found to reduce stigma and promote more positive attitudes towards individuals with SUDs [17, 21, 41].
   Increased Perceived Relevance: Learners often reported that these methods made the learning material more relevant and applicable to real-world situations [4, 5, 42].
4. Technological Usability and Effectiveness (Emerging Focus): A smaller but growing number of studies focused on evaluating the usability and effectiveness of specific technologies and platforms used for scenario and video-based learning. These studies explored factors such as:
   User-Friendliness: The ease of use and intuitiveness of the technology [5, 11, 43].
   Immersiveness: The degree to which the technology creates a realistic and engaging learning environment [5, 20, 39].
   Technical Feasibility: The practicality and cost-effectiveness of implementing the technology in different settings [3, 27, 44].

5.8. What are the Recommendations and Future Agenda Items Proposed by Preceding Studies?

The analyzed studies proposed several recommendations and future agenda items, highlighting areas where further research and development are needed [45].

i Longitudinal Studies and Long-Term Impact [4, 12, 37]:

Several studies recommended conducting longitudinal studies to assess the long-term impact of scenario and video-based learning on knowledge retention, skill development, and clinical performance.

ii Exploration of Emerging Technologies [5, 17, 41]:

A common recommendation was to explore the use of emerging technologies such as virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) to enhance scenario and video-based learning experiences.

iii Personalization and Adaptive Learning [20, 44, 46]:

A number of studies suggested developing more personalized and adaptive learning experiences that cater to individual learner needs and preferences.

iv Assessment of Clinical Performance and Impact on Patient Outcomes [3, 4, 6, 21, 27]:

Some research focused on clinical aspects and assessment for the performance.

v Integration with Existing Curricula and Real-World Practice [21, 36, 37]:

A strong theme was the need to better integrate scenario and video-based learning with existing curricula and real-world clinical practice.

vi Further Investigation of Specific Design Elements [5, 9, 11, 27, 39]:

Some studies called for further investigation of specific design elements.

vii Diversity and Inclusivity Considerations [5, 10, 12]:

A few studies mentioned the need to develop scenario and video-based learning materials in multiple languages and for diverse populations.

viii More emphasis on psychosocial interventions [19, 38, 47]:

Future studies can include more emphasis largely on psychosocial interventions like AA/NA, with relatively small attention to other aspects of SUD care, such as medication-assisted treatment.

6. Discussion

Question 1: What is the Yearly Distribution of Articles in the Field of Scenario and Video-Based Learning Over the Past Five Years?

The annual distribution of publications in the field of scenario-based, video-based, and learning-related research from 2019 to 2024 reveals a clear and steady upward trend (see Figure 1). Beginning with approximately 70 publications in 2019, the number grew each year—reaching around 90 in 2020, 130 in 2021, and 170 in 2022. The most significant surges occurred in 2023 and 2024, with publication counts rising to approximately 230 and 310, respectively. This sharp increase, particularly in the last two years, suggests a growing academic interest and recognition of scenario and video-based learning as effective instructional strategies, likely driven by the acceleration of digital transformation in education during and after the COVID-19 pandemic. The data reflects not only the rising adoption of immersive and interactive learning technologies but also the diversification of research themes and applications across disciplines such as education, healthcare, and computer science. This upward trend underscores the timeliness and relevance of further investigating the development, implementation, and effectiveness of these learning modalities.

6.1. Possible Reasons for this Growth Trend

Increased Accessibility of Technology: The increasing accessibility of video recording and editing tools, along with more affordable software for creating scenario simulations, may have lowered the barrier to entry for researchers in this field.

Growing Recognition of Effectiveness: Evidence from prior studies may have demonstrated the effectiveness of scenario and video-based learning in improving learning outcomes, leading to greater interest and investment in this area.

Shifting Educational Paradigms: There may be a broader shift towards more active and engaging learning methods, with scenario and video-based learning aligning well with these trends.

Impact of the COVID-19 Pandemic: The COVID-19 pandemic may have accelerated the adoption of online and remote learning methods, leading to increased research on scenario and video-based learning as potential solutions for delivering effective instruction in virtual environments.

Question 2: What keywords concerning about scenario video-based learning were used for the preceding studies in 2018-2024?

The co-occurrence analysis of all keywords from 2018 to 2024 revealed significant insights into the thematic focus of contextual video-based learning research. A total of 629 distinct keywords were identified, reflecting a wide-ranging vocabulary across disciplines. Notably, high-frequency terms such as "Learning System" (278 occurrences), "Deep Learning" (274), "Computer Vision" (256), "Human" (237), and "Image Enhancement" (130) indicate a strong intersection between educational contexts and advanced technological applications. Additional frequent terms such as "Education," "E-learning," "Students," "Female," and "Machine Learning" further reinforce the dominance of technology-enhanced learning themes. Approximately 75% (n=472) of the keywords were directly related to educational technology, underscoring the field's strong emphasis on digital and intelligent systems. However, affective and psychological dimensions—represented by terms like "attitude," "motivation," and "cognitive load"—were significantly underrepresented, suggesting a research gap in the exploration of learners' emotional and cognitive experiences within contextual video-based environments. This imbalance highlights an opportunity for future studies to integrate more holistic perspectives that encompass not only technological innovation but also learner-centered psychological factors.

Question 3: What research methods, tools, and analytical techniques were employed in previous studies?

The analyzed articles (n=32) reveal a diverse range of research methods and tools employed in the study of scenario and video-based learning. Quantitative methods were more prevalent than qualitative approaches, with Pre/Post Intervention Surveys, Quasi-Experimental Designs, and Randomized Controlled Trials being the most common. The integration of specific technologies and tools, while limited, indicates a growing interest in immersive and interactive learning environments.

Quantitative methods centered on controlled experiments (RCTs, quasi-experimental designs) and pre/post intervention surveys to measure changes in learning outcomes, attitudes, and perceptions. The prevalence of quantitative methods suggests a strong emphasis on establishing the effectiveness of scenario and video-based learning through empirical evidence. The use of RCTs allows for rigorous comparisons between different interventions, while quasi-experimental designs enable researchers to evaluate the impact of these methods in real-world educational settings. Pre/post intervention surveys provide valuable data on changes in learner knowledge, attitudes, and perceptions.

Qualitative methods leveraged semi-structured interviews and open-ended questions to explore learner experiences and gain in-depth insights. Qualitative methods offer a complementary perspective, allowing researchers to understand the nuances of learner experiences and the factors that contribute to the success (or failure) of scenario and video-based learning interventions. These methods can provide rich contextual data that is not captured by quantitative measures alone.

Technology-driven approaches focused on virtual and augmented reality, high-fidelity simulations, and platforms like AVW-Space and Video-based Communication Assessment (VCA). The integration of technology-driven approaches highlights the potential of these methods to create more immersive, engaging, and personalized learning experiences. Virtual and augmented reality can transport learners to realistic or simulated environments, while high-fidelity simulations provide opportunities to practice skills in safe and controlled settings. Platforms like AVW-Space and VCA facilitate interaction, feedback, and assessment in online learning environments.

Dominance of Statistical Analyses: The high prevalence of statistical analyses (60%) indicates a strong emphasis on quantitative, empirical research. Researchers are primarily focused on identifying statistically significant relationships between variables and testing hypotheses about the effectiveness of scenario and video-based learning. The variety of statistical tests used (t-tests, ANOVA, regression, chi-square, non-parametric tests) suggests that researchers are employing a range of analytical approaches to address different types of research questions and data.

Value of Qualitative Insights: The use of qualitative data analysis techniques (30%) underscores the importance of understanding the nuances of learner experiences, attitudes, and perceptions. Thematic analysis, content analysis, and discourse analysis allow researchers to delve deeper into the data and identify patterns and themes that may not be apparent through quantitative analysis alone.

Descriptive Statistics as a Foundation: The use of descriptive statistics (10%) highlights the importance of providing a clear and concise summary of the key characteristics of the data. Descriptive statistics serve as a foundation for more advanced statistical analyses and provide valuable insights into the basic properties of the sample and the variables being studied.

Question 4: What kinds of samples were used in prior studies?

Student-Centric Focus: The clear emphasis on student samples suggests that much of the research in this area is geared towards understanding how scenario and video-based learning impacts student learning outcomes, engagement, and attitudes. This may reflect the broader focus on student-centered learning approaches in contemporary education.

Limited Teacher Focus: The relatively small number of studies focusing on teachers may indicate a gap in the literature. Further research is needed to explore how teachers can effectively design, implement, and assess scenario and video-based learning activities.

Targeted Professional Groups: The inclusion of other professional groups, such as residents and general surgery, highlights the potential of these methods for professional development and training in specialized fields.

Question 5: What variables were examined in prior studies?

Emphasis on Learning Outcomes: The strong emphasis on learning outcomes (45%) underscores the primary goal of most educational interventions: to improve student knowledge, skills, and cognitive abilities. The use of diverse measurement methods (tests, assessments, simulations) suggests a commitment to evaluating these outcomes in a comprehensive manner.

Importance of Affect and Attitudes: The significant attention given to affective and attitudinal variables (30%) highlights the recognition that learning is not solely a cognitive process. Student engagement, motivation, satisfaction, and even anxiety can significantly influence the effectiveness of scenario and video-based learning. Researchers are likely interested in understanding how these methods impact student attitudes and create a more positive learning experience.

Usability as a Secondary Concern: While important, system usability and acceptance (10%) appear to be a secondary concern compared to learning outcomes and affective factors. This may suggest that researchers are primarily focused on the pedagogical aspects of these methods, with usability considered as a necessary but perhaps less central factor.

Communication Skills Focus: The very few numbers of studies is focused on Communication Skills might be because of the focus is not in soft skills category of learning in video-based and scenario research.

Question 6: What were the main findings and foci in previous studies?

Learning Outcomes as Primary Goal: The dominant focus on improved learning outcomes reflects the fundamental purpose of education and training. Researchers are keen to demonstrate that scenario and video-based learning can

effectively enhance knowledge acquisition, skill development, and critical thinking abilities. This emphasis also aligns with the need to provide empirical evidence to support the adoption of these methods in educational settings.

Holistic Learning Experience: The significant attention given to engagement, motivation, attitudes, and perceptions highlights a shift towards a more holistic view of learning. Researchers recognize that cognitive outcomes are not the only important factor; learners' emotional and motivational states also play a crucial role in their learning journey. By creating more engaging, relevant, and positive learning experiences, scenario and video-based learning can potentially lead to deeper and more lasting learning gains.

Technological Considerations are Growing: The emerging focus on technological usability and effectiveness underscores the increasing importance of technology in education. As scenario and video-based learning become more integrated with digital platforms and virtual environments, it is essential to evaluate the user-friendliness, immersiveness, and practicality of these technologies. Further research is needed to identify the optimal technological features and design principles that maximize learning outcomes and engagement.

Question 7: What are the recommendations and future agenda items proposed by preceding studies?

Addressing the Limitations of Existing Research: The strong call for longitudinal studies reflects a growing awareness of the limitations of relying solely on short-term evaluations. By tracking learners over extended periods, researchers can gain a more nuanced understanding of the lasting impact of scenario and video-based learning and identify factors that contribute to long-term retention and transfer of learning.

Harnessing the Potential of Technology: The enthusiasm for emerging technologies highlights the transformative potential of these tools to create more engaging and effective learning experiences. However, it is important to note that the successful integration of these technologies requires careful planning and consideration of pedagogical principles. Technology should not be used for its own sake, but rather as a means to enhance learning outcomes and address specific instructional challenges.

Catering to Individual Needs: The emphasis on personalization and adaptive learning underscores the growing recognition that learners have diverse needs, preferences, and learning styles. Effective scenario and video-based learning experiences should be designed to accommodate these individual differences, providing learners with the support and challenges they need to succeed.

Bridging Theory and Practice: The call for better integration with existing curricula and real-world practice reflects a desire to make learning more relevant and applicable to learners' lives. This can involve aligning the content and activities with real-world scenarios, providing opportunities for learners to apply their knowledge and skills in authentic contexts, and fostering collaboration between educators and practitioners. These efforts may also need to address and include a focus on psychosocial interventions.

7. Conclusion

The present study offers a comprehensive overview of the research landscape surrounding scenario and video-based learning between 2018 and 2024. Over this period, the volume of related publications has shown a consistent upward trend, especially in recent years, reflecting the increasing academic interest driven by the integration of digital learning technologies and the global shift toward more interactive and immersive instructional methods. The co-occurrence analysis of keywords reveals that research in this field has largely centered around technological terms such as “Learning System,” “Deep Learning,” and “Computer Vision,” indicating a strong emphasis on system-level development and AI-driven tools. While this reflects the field’s alignment with cutting-edge educational technology, it also highlights a notable underrepresentation of learner-centered aspects, such as cognitive load, motivation, and attitude, which remain critical yet underexplored dimensions.

Methodologically, the field is dominated by empirical research designs, with a growing use of randomized controlled trials, quasi-experimental methods, and statistical analysis, demonstrating a shift toward evidence-based evaluations. However, qualitative methods are also employed to gain deeper insights into learner experience and instructional impact, enriching the understanding of how scenario and video-based learning functions across various contexts. Most of the reviewed studies focus on student populations, particularly in higher education and vocational settings, while teachers and other professionals appear less frequently as research subjects. The variables explored span cognitive, behavioral, and emotional dimensions, though soft skills such as communication and collaboration remain less studied—offering promising directions for future inquiry.

Findings consistently emphasize the benefits of scenario and video-based approaches in enhancing learning engagement, performance, and satisfaction, with usability and instructional effectiveness also emerging as key concerns. In light of this, scholars have recommended expanding future research to explore long-term learning outcomes, the use of emerging technologies such as VR and AI, and the development of adaptive, personalized learning strategies in diverse, real-world environments. Overall, this review not only maps the evolution of scenario and video-based learning research but also provides a foundation for advancing more learner-centered, technologically enriched, and empirically grounded educational practices in the years to come.

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Appendix A

Table A1.
List of sampled articles.

Label	Article	Research Method	Sample	Variables (Independent Variables=IV; Dependent Variables=DV)	Research Tool	Analysis Method	Findings	Recommendations and Future Work
A1	Abreu, et al. [3]	Quantitative.	General surgery residents (n=27).	IV: Simulation performance metrics. DV: Intraoperative performance metrics, Incidence of Clinically Relevant Delayed Gastric Emptying (CRDGE).	Objective Structured Assessment of Technical Skills (OSATS) scale. Case logs and operative notes.	Descriptive statistics, Intraclass Correlation Coefficient (ICC), Pearson's chi-squared, Kruskal-Wallis tests, Spearman's rho correlation.	Better simulation performance associated with better technical skills in the operating room, faster operative times, and a lower incidence of CRDGE.	Simulation as a predictive tool for trainee performance. Further investigation of technical factors and CRDGE. Using machine learning algorithms to grade operative performance in real-time.
A2	Ahmed, et al. [5]	Mixed Methods (Quantitative and Qualitative).	Professional snowplow truck drivers from the Wyoming Department of Transportation (n=18).	IV: CV training program. DV: Knowledge and understanding of CV technology, perceived usefulness of CV applications, self-reported safety improvements.	Quizzes, Simulator training module, questionnaire, Face-to-face discussions/interviews.	Descriptive statistics. Inductive content analysis.	Participants showed improved understanding of CV technology and perceived the CV system as useful for improving safety. The training was considered easy to understand and provided improved road condition information.	Training materials need to be regularly updated with evolving technologies. Future research should include: a. Field data collection and surveys. b. Feedback from commercial truck drivers. c. Develop methods to transfer CV-related driving skills from the simulator to real trucks.
A3	Álvarez, et al. [27]	Mixed methods (Quantitative& qualitative).	Participants: 28 teachers and 56 per-service teachers (n=84).	IV: Virtual reality platform DV: Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitude toward Technology (ATT), Behavioral Intention (BI)	Questionnaire, semi-structured interviews.	Descriptive statistics, ANOVA, qualitative thematic analysis.	High scores on all TAM dimensions, particularly Attitude (ATT). Positive perception of Didascalies VC's potential for classroom management training.	Improve realism and interactivity. Offer progressive training within a module. Further trials in successive years and other universities. Incorporate the IVR tool into a training module. Examine short and long-term outcomes in various conflict situations.
A4	Besbes, et al. [21]	Quantitative: Randomized controlled trial.	Interns rotating in the pediatric department (n=33).	IV: Educational method (High-fidelity simulation vs. Video-based learning). DV: Knowledge test scores (pre-test, post-	Questionnaires.	Descriptive statistics, Non-parametric Mann-Whitney test, Wilcoxon test.	Both HFS and VBL improved knowledge scores. HFS led to significantly higher improvement and better short-term retention. Intern	Combine HFS and VBL for a synergistic effect. Future studies should assess clinical performance and impact on patient management, addressing long-term retention

				test 1, post-test 2) and Satisfaction scores.			satisfaction was higher in the HFS group.	and skill translation into real-world scenarios.
A5	Bucher, et al. [6]	Mixed methods (qualitative and quantitative).	Study 1 (Qualitative): (n=8). Study 2 (Quantitative) (n-22).	IV: VReanimate II DV: Knowledge gain, usability, presence, authentic contexts.	Semi-structured interviews, questionnaires, knowledge tests, non-participant observation.	Qualitative content analysis, descriptive statistics, Wilcoxon signed-rank test.	Stuay shows potential for teaching first aid and reanimation skills. Continue development of to create accessible and engaging training. Address design aspects to reduce distractions.	Investigate the influence of gender and VR experience. Gather more data with a larger sample size. Further investigate the distinction between action sequences and declarative knowledge.
A6	Budakoğlu, et al. [22]	Mixed methods (Design-Based Research (DBR) both qualitative & quantitative).	Medical undergraduate (n=92).	IV: e-PBL with multimedia animations. DV: Attitudes, clinical reasoning skills, GPA, PBL scores, evaluation of PBL.	Scale, Clinical Objective Reasoning Exam (CORE).	Descriptive statistics, t-tests, chi-square tests, Pearson correlation.	e-PBL with animations is as effective as f2f PBL; positive relationships between attitudes, GPA, and PBL scores; no difference in CORE scores between groups.	Explore technological familiarity's impact, consider the facilitator effect, and investigate multimedia animations further; examine outputs and adverse effects more thoroughly, including skills, attitude, and satisfaction needs.
A7	Buijs-Spanjers, et al. [43]	Qualitative.	Nursing Students (n=7), Medical Students (n=9).	IV: Serious game DV: Attitudes and Learning experiences regarding delirium, perspectives of the characters, interactivity to experiment, realism, feedback.	Semi-structured interviews.	Thematic inductive content analysis with constant comparison.	Enhance their attitudes towards delirious patients and enrich their learning experiences. A patient-oriented narrative provides a clinically relevant experience in which reflection plays an important role.	Incorporate patient perspectives into delirium education, investigate perspective-taking to improve inter-professional cooperation in delirium care, replicate this study using a broader sample of healthcare professionals.
A8	Calandra, et al. [44]	Quasi-experimental.	Volunteers enrolled in beginner lessons of forestry (n=45).	IV: Training Method (Video, Video+VR, Video+Real World Practice). DV: Skill Performance, Motivation, Learning Experience.	Questionnaire.	Non-parametric statistical data analyses.	The additional use of VRTS improved the trainees' procedural learning, as well as their motivation and perceived quality of the overall learning experience	Investigation of different immersive technologies to the system with high validity.
A9	de Andrade, et al. [48]	Quantitative.	220 images of mooring bitts labeled "tied" or "not tied".	IV: A Computer Vision Approach. DV: Vessel velocity, approximation angle, presence of tied cables on mooring bitts.	Video recordings from mobile phones.	Algorithms for image processing, calculation of velocity and angle, SSIM-based image comparison, grid search for optimal SSIM threshold.	The vessel velocity estimation algorithm was effective in measuring the velocity of approaching vessels. Challenges remain with occlusions and illumination variations.	Addressing challenges related to occlusions and illumination variations. Enhancing the robustness and accuracy of classification algorithms. Integrating other data sources such as radar or GPS.
A10	Faro, et al. [49]	Mixed Methods (Qualitative & Quantitative).	Internal Medicine categorical residents (n=16).	IV: Assessment (VCA) platform, Vignettes DV: Resident	Questionnaires, Interviews.	Descriptive statistics, Thematic	VCA provides alternatives and practice scenarios to real life patient situations	Implement VCA training into medical education curriculum. Assess correlation with other

				communication skills, Patient perception of care Video-based Communication.		analysis.	when they aren't always accessible.	measures (patient communication, experience, satisfaction).
A11	Fitzgerald, et al. [10]	Quantitative.	Third-year osteopathy students (n=76).	IV: Simulated learning vs. traditional clinical placement. DV: Performance in Objective Structured Clinical Examination (OSCE).	Objective Structured Clinical Examination (OSCE).	Descriptive statistics, ANOVA, t-tests, correlation statistics, retrospective power calculation.	No significant difference in overall OSCE performance between groups, but the intervention group performed better in technique selection. Pre-clinical GPA was higher in the intervention group.	Further investigation with larger, randomized cohorts is recommended. Explore student confidence and the use of simulation, also explore future clinical placement performance.
A12	Fuehrlein, et al. [37]	Mixed-methods (Quantitative & qualitative).	Second-year medical students (n=42).	IV: Video-based educational module. DV: ACT-SUDS scores, associations with SUDs, factual knowledge.	ACT-SUDS questionnaire, open-ended questions.	Paired t-tests, McNemar tests, open-ended responses.	Increased ACT-SUDS scores, shift to positive associations with SUDs, improved factual knowledge.	Recommendation is to use video clips of clinical interactions. Future work can include more emphasis largely on psychosocial interventions.
A13	Geng, et al. [41]	Quantitative.	ScenicSpot dataset (18 video clips), Avenue dataset (37 videos), UCSD Ped1 dataset (70 videos).	IV: Abnormal event detection in video based. DV: Salient spatio-temporal features, frames per second, precision, recall, F1 value.	Video surveillance data.	Quantitative analysis; Comparison with AEDSCL and other algorithms.	The proposed method improves frames per second, recall and F1 value compared to classical methods, achieving better performance in abnormal event detection in tourism videos.	Future work aims to achieve the recognition of abnormal events, identifying the type of event.
A14	Guirado, et al. [12]	Experimental and Applied Research.	UAS (fixed-wing and multicopter platforms), 4G network infrastructure, video and imagery data acquired by drones.	IV: StratoTrans DV: Video and telemetry data transmission, network throughput, latency, distance between drone and base station, traffic flow parameters, infrastructure mapping data.	Cameras and 4G communication modules, software for video processing, photogrammetric software, GIS software (QGIS).	Telecommunications analysis. Computer Vision algorithms. Photogrammetric processing.	Feasibility of using 4G networks for real-time video and telemetry data transmission from UAS.	Upgrade to 5G networks to overcome data consumption and latency limitations. Further enhancements of traffic monitoring tools. Continued data collection and refinement of the system.
A15	Hwang and Koike [40]	Mixed methods. (Quantitative & Qualitative).	Participants for user study (n=12).	IV: Content types and display types. DV: Depth perception, immersiveness, attractiveness.	Questionnaires, Performance assessments.	Friedman test, Wilcoxon signed-rank test, ANOVA, Descriptive statistics.	The proposed MonoMR system allows users to perceive depth information more easily and improves immersiveness and attractiveness.	Address limited camera posture, improve 3D position estimation for y-axis movement, enhance texture quality, explore 3D mesh models or generative adversarial networks, improve content

								compression.
A16	Im, et al. [38]	Mixed-methods (Single group, evaluation, statistic comparison).	Third-year dental hygiene students.	IV: EMBAT-VR program. DV: Questionnaire with the objective of comparing two media and how the experience of the tool was.	Questionnaire for three factors of the learning tool: actions, browsing, and satisfactions.	Descriptive statistics, two sample Mann-Whitney U test.	EMBAT-VR allows learners to experience BAT process and performed repeated learning indirectly.	Follow-up research on effect when performing actual IOR imaging should be done.
A17	Iqbal, et al. [47]	Quantitative.	Second-year dental students (n=50).	IV: Teaching method. Dependent: OSPE scores.	Objective Structured Practical Examination (OSPE) and a questionnaire.	Descriptive statistics, McNemar test, and logistic regression analysis.	E-learning-assisted procedure-specific videos improved the knowledge and preclinical practical skills acquisition of undergraduate dental students.	Additional procedure-specific educational videos and other resources. Future research should investigate students' levels of competency in restoring teeth.
A18	Kartimi, et al. [42]	Quasi-experimental.	Second-year biology teacher education students.	IV: H5P interactive video. DV: Understanding of stereoisomers.	Learning style questionnaire, stereochemistry understanding test.	Descriptive statistics, two-way ANOVA.	H5P interactive videos and learning styles influenced stereoisomer understanding. No interaction between H5P use and learning styles on understanding.	Include more interactive video features, measure other cognitive topics, increase the intensity and optimize the use of all H5P interaction features .
A19	Kim, et al. [19]	Mixed methods (Qualitative & Quantitative).	Kidney-transplant patients for interviews and satisfaction assessment (n=10).	IV: Video-based educational materials. DV: Educational needs, satisfaction with video materials, content validity.	Semi-structured interviews, content validity index, satisfaction questionnaire.	Descriptive statistics.	Video-based educational materials were highly rated for content validity and patient satisfaction; key topics identified include rejection management, medication adherence, and dietary guidelines.	Develop more video-based educational materials, consider variation in health literacy. Evaluate the influence of video on patient behavior and long-term understanding; Develop videos in multiple languages; Assess the use and effectiveness for older adults.
A20	Koo, et al. [34]	Mixed-methods (quantitative and qualitative); Quasi-experimental design.	Nursing students (case video development) (n=27); Nursing students (n=51).	IV: Case video-based debriefing. DV: Self-efficacy, critical thinking, state anxiety, satisfaction with practice.	Questionnaires, focus group interviews.	Quantitative: Chi-square test, t-test, repeated measures ANOVA. Qualitative: Inductive content analysis.	Case video-based debriefing improved critical thinking and satisfaction with practice more in the experimental group than in the control group. Qualitative data revealed themes related to learning facilitation, expanded learning, a safe learning environment, and efficient utilization of case videos.	The study recommends using case video-based debriefing to improve nursing students' competency in high-risk neonatal care. It suggests future research should include a randomized controlled design, a broader range of video content, and long-term follow-up assessments.

A21	Krüger and Bodemer [50]	Quantitative.	Study 1: (n=80). Study 2: (n=130).	IV: Spatial contiguity in Study 1; Virtual sound in Study 2. DV: Cognitive load, task load, knowledge.	Questionnaires: Cognitive load, Task Load, Knowledge test, Ability belief sub-scale of the expectancy-value questionnaire.	Descriptive statistics, independent t-tests, One-way ANOVAs with a-priori contrasts.	Study 1: Integration of visual elements had a significant effect on temporal demand and perceived performance. Study 2: No significant advantages were found by coherence principle. Overall results were had some descriptive effect in AR.	Future research should: Use more complex materials, use real AR applications, explore affective/motivational factors, use objective cognitive load measures, use a location-based AR environment.
A22	Linders, et al. [7]	Quasi-experimental.	Nursing students (n=108).	IV: Teaching method DV: Students' ability scores in assessing and managing neonatal asphyxia.	Neonatal Asphyxia Assessment and Management Evaluation Form.	Descriptive statistics, Chi-square test, independent t-test	Video-based simulation teaching improved learning outcomes.	Nursing education should incorporate video-based simulation to enhance students' clinical judgment and emergency response skills. Suggest expanding the sample size, including students from different regions or levels, and evaluating long-term learning outcomes.
A23	Mitrovic, et al. [13]	Quasi-experimental study with elements of causal modeling.	Second-year software engineering students.	IV: Nudges in AVW-Space (video-based learning platform). DV: Student engagement, learning, quality of comments.	AVW-Space platform, surveys, logged student actions.	Statistical analysis; causal modeling.	Nudges significantly increase engagement and learning.	Evidence of a causal effect of nudges on engagement and learning. Future work will explore other soft skills, as well as providing explanations for the decisions made by AVW-Space.
A24	Ohlenburg, et al. [15]	Cluster-randomized controlled study.	Final-year medical students (n=114).	IV: Pre-course e-learning (iMuVi). DV: Team performance, CPR quality.	sessment Measure (TEAM) checklist, simulator data.Team Emergency As	Generalized estimating equations.	Flipped classroom can improve team performance.	Further investigation into additional aspects of flipped classroom learning with a look in the potentiality of new devices
A25	Poyade, et al. [24]	Quantitative.	Participants (n=28).	IV: Training method. DV: Task-specific learning, perception of learning confidence, sense of presence, usability, sentiment analysis of feedback.	Questionnaires, interviews.	Descriptive statistics, Mann-Whitney U tests, sentiment analysis.	Task-specific learning was statistically equivalent between VR and video slide training. Significant improvement in trainees' perception of learning and their sense of presence.	The authors recommend further exploration of the training validity involving a digitally literate cohort. They suggest extending the research into related chemical safety application domains.

A26	Pozo-Sánchez, et al. [51]	Quantitative; quasi-experimental, pre-post design.	Spanish secondary education students (n=52).	IV: Instructional action. DV: Level of motivation.	Motivated Strategies for Learning Questionnaire (MSLQ).	Descriptive statistics, Student's t-test, Cohen's d, biserial correlation.	Integration of Twitch with flipped learning increases intrinsic motivation, shifts student interest from quantitative to qualitative aspects, and enhances the learning environment.	Explore Twitch as a tool to sustain education during academic uncertainty and plan future studies with larger, representative samples across multiple educational centers for generalization.
A27	Shikino, et al. [28]	Quantitative, Cross-sectional study.	Resident physicians (n=4677).	IV: Physician-level and Hospital-level. DV: Correct diagnosis on the CSV-IE.	Clinical Simulation Video "innovative examination" (CSV-IE), Questionnaires.	Descriptive statistics; Discrimination indices (DI); Multilevel logistic regression.	CSV-IE has high discriminatory power. CSV-IE modules may provide an integrative and realistic evaluation of clinical competence and uniformity of educational standards.	Refine CSV-IE, balance feasibility with authenticity, explore automated scoring and incorporate real patient interactions and explore integrating real patient interactions within CSV-IE modules.
A28	Sjöberg, et al. [52]	Case study (mixed methods: qualitative and quantitative).	Police students in a Swedish police education program.	IV: In secondary roles within scenarios. DV: Learning experiences, perceptions, and actions of students.	Participant observation, questionnaires.	Qualitative data analysis and theoretical constructs. Descriptive statistics.	Students in secondary roles learn from scenario training. Learning occurs through embodying the "other," sensory experiences, and knowledge reconstruction	Suggests design of scenario training to enhance learning for students in secondary roles, including activities before and after scenarios.
A29	Wu, et al. [31]	Quasi-experimental.	Middle school students (12-13 years old) (N=60).	IV: Teaching method. DV: Learning achievements, learning model satisfaction, technology acceptance, flow experience, learning attitudes.	Pre-tests, Post-tests, Questionnaires.	Cronbach's alpha, ANCOVA, Shapiro-Wilk test, Levene test.	The multisensory SV-IVR learning system group showed significantly better performance in learning achievements, learning model satisfaction, technology acceptance, flow experience, and learning attitudes compared to the traditional teaching group.	Integration of SV-IVR technology with landscape architecture conservation courses. Long-term experiments, larger sample sizes, consideration of student learning styles, exploration of different teaching resources, and solutions for problems related to new technology adoption.

A30	Yang, et al. [32]	Quantitative.	First-year medical residents (n=81).	IV: Spot the Difference Teaching Method (SDTM) vs. Traditional Flipped Learning (FL) DV: Clinical skill performance, subjective evaluations.	Validated clinical skill scoring criteria, skill examinations, (CMLE), questionnaires, checklist for skill evaluation.	T-tests, Mann-Whitney-Wilcoxon tests, Chi-square tests, Cohen's d effect size.	SDTM group showed significant improvement in departmental skill examination scores, and CMLE performance on practical skills. SDTM group also rated the curriculum more interesting and participatory.	Refine DPs (Difference Points) design, develop clinical teaching observational software, measure learning effect at multiple time points.
A31	Yoosoof, et al. [33]	Mixed methods, quasi-experimental study.	Final year medical students (n=41).	IV: Demonstration videos (DVs) or PowerPoint presentations (PPs). DV: Encompassed knowledge acquisition, skills performance, and emotional response.	Knowledge test. Integrated simulated scenario assessment. Self-reported impressions collected.	A mix of Mann-Whitney U tests, T tests, and Wilcoxon Signed Rank tests.	Flipping the skills lab with pre-skill conceptualization combining text-based and video-based knowledge followed by simulation-based hands-on practice improves knowledge and skills.	Future studies should investigate the application of DVs in this setting. Studies using objective measures would have more impact.
A32	Zhao, et al. [45]	Quantitative.	Clinical medical students (interns) (n=50).	IV: Teaching method. DV: Scores on tests, critical thinking, evaluation of teaching methods, teaching satisfaction.	Theory and Skill Tests, Self-Administered Questionnaires, Critical Thinking Scale, Anonymous Survey on Satisfaction.	Descriptive statistics, t-tests, chi-square test.	PBL combined with micro-video teaching group showed higher scores in theory and skill tests, greater critical thinking ability, higher evaluation of teaching methods, and more satisfaction compared to the traditional teaching group.	The application of PBL combined with micro-video teaching can improve students' thinking ability and satisfaction with teaching. More in-depth research is needed to explore the effect of PBL teaching combined with micro-video teaching.