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Identification of Learning Theories in Learning Videos: A Case Study of Prospective Chemistry Teacher Students

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Abstract
This study investigates the ability of prospective chemistry teachers to identify learning theories embedded in instructional videos. A descriptive qualitative case study was conducted involving 48 students enrolled in the Foundations of Science Education course at Universitas Negeri Makassar. Three chemistry instructional videos were deliberately designed to incorporate elements of behaviorist, cognitivist, constructivist, humanistic, and cybernetic theories. Students analyzed the videos using an identification sheet to document their observations. The findings reveal varying levels of recognition across the learning theories. Constructivist theory was most frequently identified in Video 1, while behaviorist principles dominated Videos 2 and 3, particularly in segments emphasizing drill, repetition, and stimulus–response reinforcement. Cognitivist theory appeared consistently, though less prominently, across all videos. In contrast, humanistic and cybernetic perspectives were recognized to a lesser extent, suggesting that affective, motivational, and systemic components were less explicitly represented. These results underscore the importance of integrating diverse learning theories in video-based instruction to promote not only conceptual understanding but also motivation, empathy, and systemic thinking. The novelty of this research lies in positioning instructional videos as pedagogical representations that reveal prospective teachers' reasoning about learning theories, rather than merely treating them as delivery tools. This approach provides a new lens for evaluating theoretical literacy in teacher education and emphasizes the need for reflective engagement with instructional media during teacher preparation.

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INTRODUCTION

The development of information and communication technology has significantly influenced learning innovation, particularly through the use of digital-based media. One medium widely used in higher education contexts is instructional video, which combines visual, audio, and narrative elements (Nadia, 2025). According to research by Navarette (2025) and Seery (2020), the integration of these three elements is considered capable of enhancing students' understanding of abstract and complex concepts, particularly in chemistry learning, which requires representation. This allows for maximizing the quality of the material and providing a more meaningful learning experience.

Theoretically, instructional videos can present verbal and visual information designed according to learning theory principles, thereby strengthening attention, supporting cognitive processing, and facilitating the transfer of knowledge to new contexts (Mayer, 2021). However, their effectiveness is strongly influenced by design characteristics. Research by Gritz (2025) shows that visual complexity, text integration, and interactivity influence student interaction

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patterns, such as the tendency to rewatch videos, which ultimately strengthens cognitive aspects and conceptual understanding.

Although instructional videos are often considered automatically pedagogical, several studies report that prospective teachers are often unable to explicitly recognize the theoretical foundations of learning contained in instructional media, even when these elements are intentionally inserted (Caneva, 2021). This suggests that the ability to interpret the pedagogical dimensions of media is not developed through exposure alone.

In the context of prospective teacher education, the ability to interpret recorded or video-based learning exercises is a crucial competency. Prospective teachers need to identify key learning moments and relate them to learning theories such as behaviorism, cognitive science, constructivism, or humanism (Bitzenbauer, 2024). However, to date, there is limited empirical evidence regarding the extent to which prospective chemistry teachers are able to identify learning theories represented in instructional videos and which theories are most frequently and least frequently recognized.

Therefore, this study aims to analyze variations in prospective chemistry teachers' identification of learning theories and to reveal which theories are easiest and most difficult to recognize in instructional videos.

METHOD

This research employs a descriptive qualitative approach with a case study design, which is considered suitable for capturing the depth of participants' interpretative abilities in real contexts (Creswell & Poth, 2018). This approach was chosen because the study aimed to explore in detail how prospective chemistry teachers identify learning theories embedded within instructional videos, an ability that requires interpretative judgment rather than numerical measurement (Yin, 2019). The research subjects were students of the Chemistry Education Study Program at Makassar State University enrolled in the Foundations of Mathematics and Natural Sciences Education course. Participant selection was conducted using purposive sampling, targeting students who had completed coursework related to major learning theories behavioristic, cognitive, constructivist, humanistic, and cybernetic as commonly applied in teacher education research (Shaheen, 2019). A total of 48 students were involved to obtain sufficiently representative data.

The instruments used in this study consisted of:

1. Three chemistry instructional videos selected according to the lecture topics and deliberately designed to incorporate elements representing specific learning theories, as recommended in multimedia-based pedagogical design research (Hwang & Tu, 2019).
2. A Learning Theory Identification Sheet functioning as an observation guide that enabled students to map specific scenes in the video to corresponding theoretical principles (Bitzenbauer, 2024). Each student was instructed to independently analyze the videos and record their identification results.

The procedure of this research starting from subject selection and instrument development to data collection and analysis is visually summarized in the following flowchart:

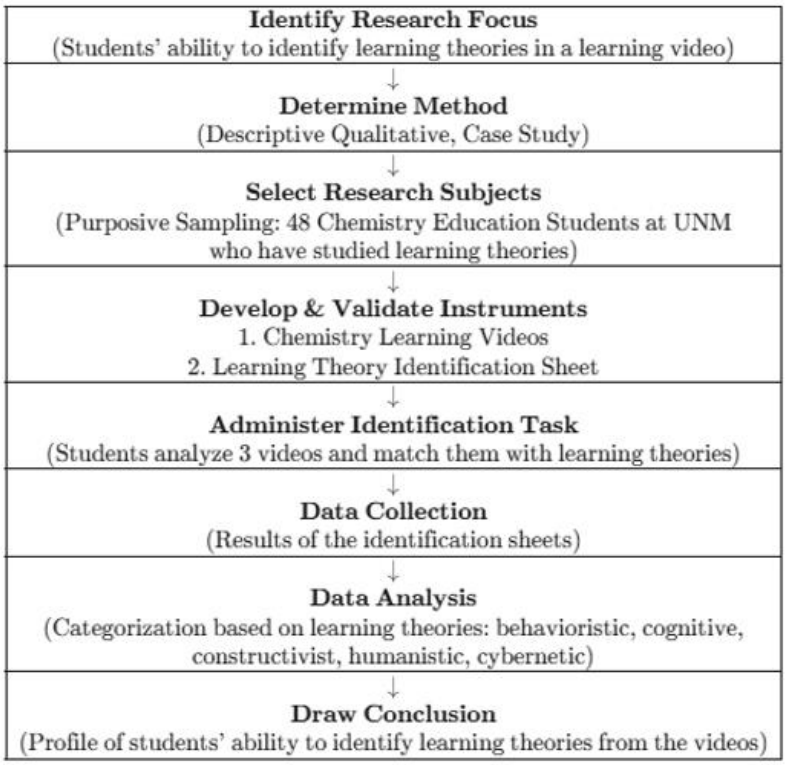

Figure 1: Research Flowchart for Identifying Learning Theories in Chemistry Learning Videos

RESULTS AND DISCUSSION

Learning videos can reflect various learning theories, such as constructivism and behaviorism, which influence how student chemistry teachers understand the material (Salutri, 2023). Behaviorism focuses on how environmental stimuli and consequences shape observable behavior, cognitivism emphasizes internal mental processes and representations, constructivism highlights learners actively constructing their own understanding, and humanism emphasizes personal experiences, values, and motivations (Giannoukos, 2024). Based on the data analysis obtained, it was found that students' abilities in identifying learning theories in learning videos varied. From the three learning videos presented, students were asked to identify learning theories relevant to chemistry learning, as shown in the figure 2.

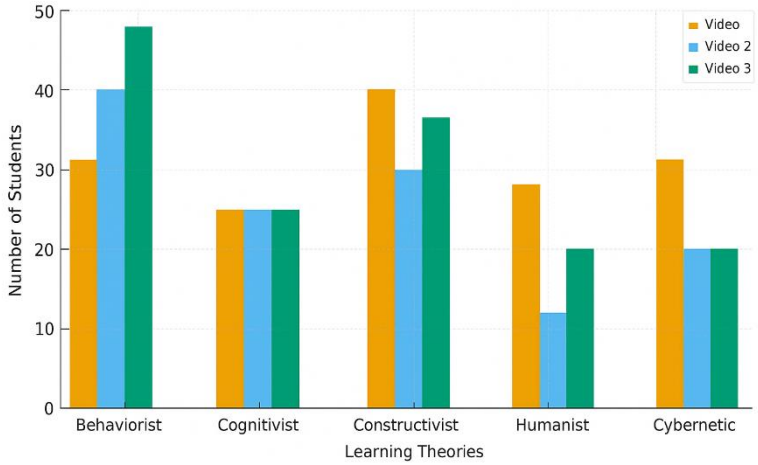

Figure 2. Frequency of Learning Theories Recognition Within Chemistry Instructional Videos by Student

Research findings indicate that behaviorist theory was more frequently identified than other learning theories, particularly in Video 3 (48 students). This indicates that the video is characterized by strong stimulus-response elements, such as examples, repetition, and clear feedback. The emphasis on positive reinforcement makes it easier for students to recognize behaviorist elements (Sari, 2021). This finding aligns with research by Dela and Villanueva (2021), which states that video-based drill and practice can improve student academic performance through external reinforcement.

Videos designed with positive reinforcement, such as the use of direct feedback, repetition of core material, and the provision of examples and repeated practice, are representative of behaviorist learning theory (Aljaraideh, 2021). This finding is relevant for the education of prospective chemistry teachers, because through direct experience with behaviorist-based media, they not only gain conceptual mastery but also an understanding of how the theory can be implemented in technology-based learning practices.

Identification of cognitive theory was relatively stable across the three videos (approximately 24–25 students). This indicates that students are able to recognize elements of information processing, such as the use of diagrams, concise text, and an emphasis on material structure. This pattern suggests that students' understanding of internal cognitive processes, such as information processing and knowledge restructuring, is still limited and therefore not a primary focus in their analysis (Mayer, 2021). However, the number of students is not very high, indicating that only a small proportion of students are able to link multimedia strategies to cognitive principles.

Research by Candido (2025) confirms that applying Cognitive Theory of Multimedia Learning (CTML) principles in videos has been shown to be effective in reducing cognitive load and improving understanding. Therefore, this aspect needs to be more explicitly emphasized in chemistry video design in the future. For prospective teachers, the use of videos that stimulate active processing, such as contextual problem presentations and animated visualizations of chemical reactions, supports the formation of more structured knowledge schemas, making it easier to re-explain the material to students (Herrington, 2025). Furthermore, recent research confirms that cognitive feedback through interactive videos strengthens the connection between new knowledge and existing knowledge, in line with the main tenets of cognitive theory regarding the construction and organization of information in long-term memory (Taxipulati, 2021).

Constructivist theory also emerged, particularly in Video 1 (40 students). Students assessed that the video facilitated problem-based learning, exploration, and active engagement in constructing understanding. The decrease in identification in Video 2 (27 students) may indicate that not all videos provide sufficient space for interaction or reflection. Herrington (2025) found that chemistry videos emphasizing conceptual explanation, reasoning, and argumentation were more effective in encouraging student knowledge construction, in line with constructivist principles.

A study of prospective chemistry teachers (Bıçak, 2021) and an analysis of chemistry instructional videos (Herrington, 2025) showed that effective videos often incorporate elements of inquiry, problem-solving, and conceptual reasoning, which are hallmarks of constructivist learning. According to constructivist theory, knowledge is not passively transmitted but actively constructed by students through engagement in tasks that require exploration, inquiry, and reflection (Schunk, 2020). When videos encourage students to explain, reason, and engage in argumentation, they stimulate the process of meaning-making and knowledge construction, leading to a deeper conceptual understanding of chemical phenomena.

Humanistic learning theory was identified by students with relatively low variation. This finding indicates that not all videos optimally emphasize affective aspects, intrinsic motivation, or the development of students' self-potential. Humanistic theory emphasizes the importance of learner-centered learning, providing space for self-expression, and encouraging independent learning (Ceylan, 2020). In the context of chemistry learning videos, the low identification of humanistic theory in Video 2 may indicate that the presentation of the material focuses more on knowledge transfer than on developing students' emotional and personal aspects. Furthermore, recent research confirms that a humanistic approach to science learning contributes to increased learning motivation and self-confidence in student teachers (Mullen, 2021;Nugroho, 2022).

CONCLUSION

This study concludes that the identification of learning theories in chemistry instructional videos by student teachers shows a variety of tendencies according to the characteristics of the video presentation. Constructivist and cognitive theories are most dominant because they are closely related to reasoning, problem-solving, and information processing, while behaviorist theories remain strong through structured practice and reinforcement. Humanistic and cybernetic theories appear in smaller proportions, but remain important in fostering intrinsic motivation, empathy, and systemic thinking skills. Overall, these results confirm that effective chemistry instructional videos need to integrate various learning theories to support the professional competence of prospective teachers comprehensively.

In addition, the findings of this study imply that video-based learning materials should be designed more consciously with theoretical alignment to ensure balanced exposure not only to behaviorist and cognitive structures but also to constructivist, humanistic, and cybernetic dimensions. For prospective chemistry teachers, the ability to analyze and recognize embedded learning theories through media can serve as a pedagogical indicator of digital literacy and theoretical awareness, suggesting the need for curriculum enhancement that bridges learning theory courses with practical media evaluation and production. Thus, theory-driven instructional video development can be positioned as both a learning tool and a reflective pedagogical exercise for future chemistry educators.

RECOMMENDATIONS

Pre-service student teachers need to be trained to identify and evaluate the application of learning theories in instructional media. This will strengthen their pedagogical competency, enabling them to select and design media tailored to students' needs. Further research with a broader scope is needed, for example, testing the effectiveness of specific theory-based videos on the learning outcomes, motivation, or 21st-century skills of pre-service chemistry students.

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