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Original Paper

Strategies for Improving College Students' Learning Effectiveness under Knowledge-based Short Video Learning

Baiyan Du[1], Yuge Lai[1*], Yuemin Fang[1], Xin Xu[2], Miao Tian[3]

[1] College of Teacher Education, Quzhou University, Quzhou 324003, Zhejiang, China

[2] College of Music ,Lishui University, Lishui 323000, Zhejiang, China

[3] School of Literature and Media,Tongren University, Tongren 554300, Guizhou, China

[*] Corresponding author: Yuege Lai, 32073@qzc.edu.cn

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Abstract

This study investigates the impact of knowledge-based short video learning on university students' autonomous learning abilities, time management behaviors, learning strategies, and cognitive academic achievements. A questionnaire survey was administered to 322 students, and in-depth interviews with 4 students were conducted for detailed case analysis. The results indicate that autonomous learning abilities are at a moderate level, with female and senior students demonstrating higher capacities for self-directed learning; students who prefer watching longer short videos tend to perform better in autonomous learning. Time management behaviors are generally weak, with only some data and student performances showing improvement, but overall differences are minimal. Learning strategies are moderately developed but stronger than time management; senior students and those who favor longer short videos excel more in learning strategies. Cognitive academic achievements are also close to moderate levels, just below autonomous learning abilities, with female students, senior students, and those who watch longer short videos showing superior performance. There are no significant differences across professional fields and institutions. Finally, based on the research findings, recommendations to enhance the effectiveness of short video learning are proposed, focusing on improving autonomous learning abilities, time management behaviors, learning strategies, and cognitive academic achievements. The study provides theoretical and practical guidance for educators and students, aiming to optimize the application of short videos as a learning tool.

Keywords

Short Video Learners, Self-Directed Learning Skills, Time Management Behavior, Learning Strategies, Cognitive Academic Achievement

1. Introduction

Under the current development of information technology, short videos have emerged as a novel medium for information dissemination. Due to their diverse formats, rapid transmission speed, and high user engagement, they have become one of the primary channels through which people acquire information (Wang, 2021). Short videos are also extensively used for sharing educational content; for learners, they serve not only as a tool to assist in information transmission but also as a platform for autonomous exploration and learning (Zou, 2022). Kinnari (2015) posits that the learning approach facilitated by short videos can enhance the characteristics of online education, offering greater flexibility in terms of time and place, while presenting content in a concise and concentrated manner. Ren (2023) found through a three-month experiment with college students that groups utilizing short videos on English knowledge for speaking practice demonstrated superior autonomous learning abilities and English speaking proficiency compared to those using traditional methods. Furthermore, there were notable improvements in students' comprehension, objectives, help-seeking, content management, process evaluation, as well as accuracy and fluency in English. Shan (2023) notes that short videos inherently assist learners in saving study time, optimizing personal time management, and providing a convenient platform for self-directed learning. Zhang, Lucas, and Pedro (2022) explored how short videos, as open educational resources for students, contribute to the learning of creative knowledge.

However, some researchers argue that learning through short videos presents certain challenges. Wang (2021) posits that the fragmented nature of knowledge transmission in short videos may struggle to support complex and in-depth learning needs. Students, lacking sufficient background knowledge, may find it difficult to establish connections between pieces of information, thus impacting the systematic and profound nature of their learning. Zhou, Zhang, and Wu (2021) highlight that educational short videos, constrained by time limitations, tend to focus on rapid, concentrated explanations of key points. This may result in students receiving information without adequate reflection and judgment. Moreover, like general online courses, viewing short videos constitutes a passive learning behavior, offering fewer opportunities for active exploration and in-depth research. Li (2023) asserts that although short videos provide a wealth of knowledge, learners may struggle to maintain sustained focus and engage in deep learning amidst an overwhelming influx of information, with distractions from entertainment content or other factors making it challenging to concentrate on primary learning objectives for extended periods.

To this end, researchers have proposed strategies tailored to these conditions, suggesting that enhancing the learning success of short video learners requires first assessing their autonomous learning abilities. Ren (2023) underscores the central role of self-directed learning capacity in the success of short video learning. Tabassum and Hanan (2016) describe self-directed learning capability as the ability of learners to self-motivate, self-regulate, and self-assess, which is particularly crucial in fragmented and highly autonomous learning environments. Therefore, accurately measuring learners' autonomous learning abilities is the initial step towards improving the effectiveness of short video learning.

Other researchers argue that as learners often need to swiftly sift through and absorb knowledge from rapidly changing streams of information, short videos, with their convenient, concise, and focused dissemination, align with contemporary demands for knowledge acquisition in a fast-paced lifestyle. However, this convenience also imposes higher demands on learners' behavioral processes (Ren, 2023). Wang and Xiang (2022) note that learning through short videos necessitates managing and monitoring one's own behaviors to avoid excessive time investment and procrastination. Bora (2020) posits that online learners need to frequently manage their learning behaviors, integrating information efficiently to form a coherent knowledge structure, and avoiding fragmented learning that leads to ineffective exploratory behavior. Havva, Hale, Deniz, and Hülya (2021) recommend that online learners should employ appropriate learning strategies to execute their learning plans and maintain a sense of direction towards their learning goals. Herrera and Gonzalez (2019) argue that learners must flexibly apply various learning strategies to handle different types or difficulties of learning materials, thereby enhancing adaptability and overall learning performance.

Moreover, cognitive academic achievement serves as an intuitive indicator for measuring whether learners achieve educational outcomes through learning tools. Unlike traditional methods of assessing academic achievement, cognitive academic achievement encompasses a wide array of learning outcomes through self-reported metrics, including improvements in abilities, psychological and cognitive gains, and both intellectual and non-intellectual domains (Zeineb, 2024). In contrast, academic achievement measurements rely on actual performance outcomes (Zheng, Akaliyski, Ma, Xu, 2024). Generally, the results from both measurements can demonstrate consistency (Hyo, 2021; Nisbett, Aronson, Blair, Dickens, Flynn, Halpern, Turkheimer, 2012). Considering the richness, diversity, and convenience of short video content, evaluating multiple facets of learning outcomes, and the challenges associated with acquiring actual academic performance through online content, cognitive academic achievement is more aligned with assessing the effectiveness of learning through knowledge-based short videos, and can also serve as an analytical factor in evaluating learning outcomes.

Thus, the current challenge in online education research is to address how learners can effectively develop autonomous learning abilities, manage their study time, cultivate adaptive learning strategies, and enhance their cognitive academic achievements within this novel learning paradigm. These factors can also represent the learners' prerequisites for knowledge-based short video learning, as well as their control over the learning process and outcomes. Observing the efficacy of short video learning among university students from this comprehensive perspective is beneficial in analyzing which segment of the learning process is most impacted by this mode of learning. Furthermore, there is currently a lack of research on knowledge-based short video learning; existing studies predominantly focus on evaluating the overall learning effectiveness of short video learners (Miyamoto, 2021; Zou, 2022; Wang, 2021), or examining its application in English language learning (Shan, 2023; Ren, 2023). While these studies provide foundational support for the effectiveness of short videos as a learning tool, the specific impact on autonomous learning capabilities, time management, learning strategies, and cognitive academic

achievements remains underexplored. Therefore, this research aims to fill this gap by delving into and analyzing these factors within the context of knowledge-based short video learning. It seeks to offer insights for learners on self-adjustment and optimization during future learning processes, and to provide directional guidance for educators on crafting knowledge-based short video content to enhance learner outcomes.

Research Question 1: What is the status of college students' self-directed learning ability, time management behaviors, learning strategies, and cognitive academic achievement under the influence of educational short videos?

Research Question 2: How can college students enhance the effectiveness of learning through educational short videos?

2. Theoretical Context

2.1 Knowledge-based Short Videos

Short videos, characterized by their brief duration, have surged in popularity due to the widespread adoption of mobile internet and smartphones. Their rapid, intuitive, and easily consumable nature has contributed to their swift ascent (Miyamoto, 2021). These videos encompass a broad spectrum of content, including entertainment, education, information dissemination, and advertising, and come in various formats such as music videos, tutorials, reviews, and comedic snippets. With their potent visual impact and succinct delivery of information, short videos capture attention within moments, catering to the fast-paced rhythm of modern life and the fragmented time of younger audiences (Shan, 2023). Platforms like TikTok, WeChat Channels, Bilibili, YouTube Shorts, and X have lowered the barriers to content creation and sharing by offering user-friendly video editing tools and algorithm-driven recommendation systems, enabling a wider array of individuals to swiftly produce and disseminate short video content (Zou, 2022).

Knowledge-based short videos, as a subcategory of short video content, are dedicated to the dissemination of knowledge and educational material. Leveraging the extensive reach and efficient communication capabilities of short video platforms, they swiftly impart knowledge or provide learning information. The content spans popular science, historical explanations, language instruction, and skills training, with the aim of conveying valuable and practical knowledge while maintaining engagement and appeal (Ren, 2023). Educational short videos place a premium on the accuracy and organization of content; creators, while ensuring the quality and reliability of information, utilize creativity and technical means to render the content both educational and visually engaging. This necessitates that creators distill content into a concise format, clearly articulating complex concepts or information, and adapting to the operational dynamics and user habits of short video platforms (Jing, Xiaoli, 2022). As a novel medium for knowledge acquisition, short videos have revolutionized traditional learning methods, especially during the COVID-19 pandemic, when the online dissemination of knowledge became increasingly open, flexible, and diverse. This shift has facilitated

the widespread distribution of educational content on short video platforms (Wang, Zeng, 2022). Numerous researchers have affirmed that short videos are an effective tool for enhancing learning outcomes (Ting, Lai, Yong, Subramaniam, Dollery, 2020; Ren, 2023; Zou, 2022). Conversely, some scholars have highlighted that frequent consumption of short videos may lead to an over-reliance on video content, diminishing opportunities for active exploration and critical thinking (Gao, Xiao, 2022). The quality of educational short video content is often uneven, which may challenge learners' ability to engage in deep learning and sustained attention (Gao, 2023). Short videos frequently present isolated knowledge points, lacking systemic structure, which can impede learners' efforts to construct a comprehensive knowledge framework (Siyu, Xinchen, Jingtong, Jiahao, Zhen, 2020). Some educational short videos might also present misleading information, affecting learners' cognitive processes (Peng, Li, Tan, Wang, 2024). These issues pose varying degrees of challenges to learners. Given these circumstances, this study posits that learners' engagement with short videos for knowledge acquisition must consider their self-directed learning capabilities, time management, learning strategies, and cognitive academic achievements.

2.2 Self-Directed Learning Ability

The capacity for self-directed learning refers to an individual's ability to achieve learning objectives through self-decision and proactive control during the learning process (Brockett, Hiemstra, 1991). This capability enables individuals to independently set learning goals, design learning pathways, select suitable learning methods, and continuously enhance their learning efficiency through reflection in an ever-evolving educational environment. In the self-directed learning process, learners are not merely passive recipients of knowledge but actively engage in and steer their own learning journey (Garrison, 1997). Tang (2024) posits that self-directed learning ability is the skill to flexibly adjust learning plans and methods based on one's own learning needs and progress, adapting to various learning contexts and tasks. Victoria, Unni, and Kari (2024) argue that self-directed learning emphasizes the need for individuals to exhibit initiative and proactivity in learning to ensure its continuity and efficacy, which necessitates a positive learning attitude and effective learning habits, along with timely information acquisition to solve problems.

In the realm of online learning, self-directed learning is a factor frequently highlighted by researchers. As students manage their learning process without direct supervision, individuals engaging in online education must set their own learning goals, select appropriate resources, schedule their study time, monitor their progress, and evaluate their achievements (Riad, Samia, Yacine, 2024; Widjanarko, Khumaedi, Roziqin, Kurniawan, 2022). Online learning environments offer flexibility in terms of time and place and a wealth of resources, allowing students to study according to their schedules. However, this also demands that students independently organize and optimize their learning process and time, and effectively identify and choose the materials and tools that will benefit their learning most. Short videos, as a tool within the online learning environment, inherit the convenience, flexibility, and rich resources of online education, while also embodying features of condensed and simplified knowledge

content. Individuals learning through short videos often possess a certain level of intrinsic motivation (Li, 2023). Nonetheless, they face similar challenges to those encountered in online learning, such as the reliance on self-regulation of learning pace, supplementary in-depth materials, and practical application. A lack of maintenance of learning progress, review, or preview could hinder effective learning outcomes (Wang, Xiang, 2022). Additionally, the predominance of entertainment content on short video platforms may lead to distractions from educational materials, impacting learning effectiveness (Jing, Xiaoli, 2022). Thus, further investigation is needed to determine whether self-directed learning capabilities significantly impact the effectiveness of learning through knowledge-based short videos.

2.3 Time Management Behavior

Time is an inherent, non-human resource intrinsic to human existence. Learners, in pursuit of educational goals, autonomously select and implement effective strategies to judiciously utilize and control their time (Zheng, Bai, Guo, 2022). As Kirby (1997) posits, time management pertains to the ability of individuals to perform appropriate tasks at the right moments to smoothly execute planned procedures and achieve desired objectives, thereby optimizing time usage, which may also encompass the overall management and regulation of one's life and work. Hae and Eun (2013) describe time management in a broad sense as the endeavor to maximize the effectiveness of all allocated time to manage one's life optimally, while in a narrower sense, it refers to the reduction of time wastage and meticulous planning to enhance efficiency. Consequently, time management can be regarded as a series of controlling processes, including planning, practice, and information utilization, to manage time effectively, reduce wastage, and achieve objectives efficiently (Zheng, Bai, Guo, 2022). The value of study time varies with an individual's management capabilities but is correlated with learning outcomes (Hwang, 2016). Cooper, Robinson, and Patall (2006) assert that in the realm of learning, time refers to the duration invested in study, with longer study times generally yielding better learning outcomes. Conversely, Cho (2015) views study time as the management of resources, aiming to achieve the highest learning efficiency with minimal study time, which pertains to the effectiveness of completing high-quality learning tasks.

For learners engaging with knowledge-based short videos, effective management of study time can similarly enhance learning outcomes, as short videos, being a rapid and concentrated learning tool, are best implemented within a well-structured learning plan (Wang, Zeng, 2022). Wang (2023) posits that short video learners must clearly define daily learning objectives and expectations, and establish fixed study periods to ensure the continuity and coherence of information, thereby maintaining good learning habits. Ma (2021) suggests that the abundance of entertainment content in short videos might lead to increased time costs if learners cannot manage their time effectively, necessitating continuous self-monitoring and minimizing distractions to optimize the use of short videos for knowledge acquisition. This study asserts that while short videos inherently offer brevity and flexibility, careful management of time is required to avoid issues like information overload and wasted time, and further

investigation is needed into how different learners utilize these tools for time management.

2.4 Learning Strategies

Learning strategies refer to the methods and techniques an individual employs to achieve learning objectives with optimal efficiency given specific circumstances (Nam, 2024). Learning transcends mere acquisition and comprehension of information; it necessitates the ability to master and apply existing knowledge to generate new insights. In other words, it involves utilizing current theories or concepts in various practical scenarios to address real-world problems and create novel knowledge or technologies (Cho, 2015). Unlike traditional learning, online learners are characterized by a certain degree of self-motivation to seek out the educational content they require. However, online learning environments can be hindered by limitations such as restricted bidirectional interaction and a singular input of knowledge information, which may lead learners to experience monotony and passivity in their subsequent learning endeavors (Oliver & Reeves, 1999). In some cases, validating learning outcomes in online environments can be more challenging than in traditional settings, particularly in courses requiring practical application. This necessitates that online learners develop and choose learning strategies that take into account frequent feedback on learning effectiveness (Tzimas & Demetriadis, 2024). Individuals engaging in short video learning may encounter similar constraints. Researchers suggest that short video learners should clearly define their learning objectives, select videos pertinent to those goals, and incorporate strategies such as previewing, reviewing, and self-testing to maintain focus and actively absorb content. Gao and Xiao (2022) note that effective short video learning requires learners to actively seek and evaluate high-quality resources, using video ratings, reviews, and view counts, or by sampling courses, to assess video quality and its relevance to their learning needs. Evidently, well-designed learning strategies are crucial for achieving desirable learning outcomes. Likewise, learners who achieve learning success tend to employ strategies aligned with their personal learning habits, frequently tracking their learning goals and plans (Anique, Ellen, Jill, & Andries, 2017). In summary, effective learning strategies not only aid learners in the successful execution of their educational plans but also exert a sustained influence on their behaviors both before and after the learning process. The challenges associated with learning through knowledge-based short videos bear resemblance to those encountered in online environments, such as interaction and the validation of learning outcomes. While existing research provides insights into how learners can optimize their learning effectiveness through short videos, there remains considerable scope for exploration regarding the role of learning strategies within this demographic, particularly concerning the adaptation of these strategies for different learners and the optimization of personal learning strategies within short video learning tools.

2.5 Perceived Academic Achievement

Academic achievement, in a narrow sense, refers to academic performance; in a broader context, it encompasses students' personal abilities, psychological and cognitive development, and the outcomes of intellectual and non-intellectual learning domains (Zeineb, 2024). Broadly interpreted, academic

achievement, also known as cognitive academic achievement, serves as a key indicator in educational effectiveness assessment (Tao, Meng, Gao, Yang, 2022). Research indicates that cognitive academic achievement and academic performance measurement yield equivalent results; for instance, Hyo (2021) demonstrated the feasibility of substituting cognitive academic achievement for actual academic performance. Nisbett, Aronson, Blair, Dickens, Flynn, Halpern, and Turkheimer (2012) assert that an individual's cognition is directly related to the competencies required in standardized testing.

Cognitive academic achievement is influenced not only by students' inherent abilities and motivation but also by the learning methods they employ. For instance, Heidig, Julia, and Reichelt (2015) discovered that the effective integration of visual and auditory information in video learning can significantly enhance students' comprehension and memory, thereby fostering cognitive achievement. Furthermore, Mayer (2014) in his multimedia learning theory emphasized that by thoughtfully designing learning materials—such as appropriately controlling video length and incorporating interactive elements—cognitive load on students can be reduced, consequently improving learning efficiency. Anghel, Matei, and Lincă (2023) stated that online learners need to consider variations in foundational abilities and learning habits to elevate academic achievement. These findings suggest the potential for learners to enhance cognitive academic success through online learning methods. Within the realm of online learning, short video tools, inheriting the internet’s rich and diverse resources, also amplify convenience. Conversely, learners may face challenges due to the fragmented nature of short video content, entertainment-focused material, and information misdirection, affecting their cognition (Zou, 2022). Thus, the impact of short video tools on learners' cognitive academic achievement warrants further exploration, offering insights into how learners might effectively utilize these tools to enhance educational outcomes.

3. Research Methods

3.1 Survey Respondents and Questionnaire Composition

Table 1. Characteristics of the Study Population Surveyed

Category		Number	Percentage
Gender	Male	188	58.4%
	Female	134	41.6%
Grade	Lower grades (Grades 1 and 2)	190	59.0%
	Upper grades (Grades 3 and 4)	132	41.0%
Field of Study	Humanities and Social Sciences	131	40.7%
	Natural Sciences	191	59.3%
Type of Institution	Vocational Colleges	128	39.8%
	Undergraduate Institutions	194	60.2%

Preferred Duration for Watching Educational Short Videos	<5 minutes	111	34.5%
	5-10 minutes	116	36.0%
	>10 minutes	95	29.5%
Total Time Spent Watching Educational Short Videos Daily	<1 hour	111	34.5%
	1-2 hours	133	41.3%
	>2 hours	78	24.2%
Total		322	100%

The study collected questionnaires using the Questionnaire Star app during July 2024, with the research objectives and subjects clearly outlined prior to the respondents' participation. The 322 collected questionnaires were analyzed using SPSS 25.0, with demographic details presented in Table 1. Among the participants, 188 were male (58.4%) and 134 were female (41.6%). By grade level, 190 were from lower years (59.0%) and 132 from upper years (41.0%). In terms of academic discipline, 131 students were from the humanities and social sciences (40.7%), while 191 were from the natural sciences (59.3%). Regarding institution type, 128 students were from vocational colleges (39.8%) and 194 from undergraduate institutions (60.2%). The duration of preferred knowledge-based short videos was within 5 minutes for 111 respondents (34.5%), 5-10 minutes for 116 (36.0%), and over 10 minutes for 95 (29.5%). The total daily viewing time of knowledge-based short videos was under 1 hour for 111 respondents (34.5%), between 1 and 2 hours for 133 (41.3%), and over 2 hours for 78 (24.2%).

This study also assessed the confidence in measuring key variables, as detailed in Table 2. Given that the tools employed in this research are established scales from prior studies, to prevent the complexity of measurement analysis due to an excessive number of examined factors, this study followed the approach of Mathieu and Farr (1991). It synthesized the sub-factors of self-directed learning ability, time management behavior, learning strategies, and cognitive academic achievement to investigate the comprehensive levels of these factors and their variations across demographic variables. In this study, self-directed learning ability was measured using the scale from Hyo (2021), employing a 5-point Likert scale. The self-directed learning ability scale comprises 12 items, with a Cronbach's α of 0.875. Items include "I plan what to do before studying" and "I actively collect knowledge and materials required for exams or assignments." Time management behavior was measured using the scale from Cho (2021), with a Cronbach's α of 0.725 and a total of 19 items. Items include "I have long-term goals for using short video tools for learning" and "I set goals for using short video tools throughout the semester." Learning strategies were assessed with Cho’s (2015) scale, encompassing 48 items and a Cronbach's α of 0.926. Items include "I enjoy learning" and "Even when encountering problems while learning, I find ways to solve them." Cognitive academic achievement was measured using Ji’s (2018) tool, which includes 5 items and has a Cronbach's α of 0.990. Items include "I believe I will learn more through knowledge-based short video courses" and "Short video courses make the knowledge and

understanding of some subjects clearer."

Table 2. Composition of Survey Research Instruments

Factors	Number of projects	Cronbach α
Self-directed Learning Abilities	12	0.875
Time Management Practices	19	0.725
Learning Strategies	48	0.926
Cognitive Academic Achievement	5	0.990

3.2 Case Interview Subjects and Content Composition

In order to delve more profoundly into the learning efficacy of educational knowledge-based short videos, the present study also conducted four in-depth interviews. With considerations towards a broad representation of the study's participants, four students, each distinct in their grade, major, institution, and gender, were selected from amongst the survey respondents for case-oriented intensive interviews, as outlined in Table 3. Throughout the interviews, content and key points were recorded in real-time using a mobile device and Microsoft Word, facilitating ease of subsequent collation. The case analysis interviews for this study were conducted between June and July 2024. The interviewees comprised 1 male and 3 females; across grades, one student from each of the first through fourth years was selected; in terms of academic disciplines, 3 were from the humanities and social sciences, with 1 being from the natural sciences; and among the institutions, 3 were from undergraduate universities, with 1 being from a vocational school.

Table 3. Characteristics of Case Interview Study Participants

Student	Grade	Professional	Female	Types of Institutions	Number of Interviews:
A	Third Grade	Humanities and Social Sciences	Female	Undergraduate Institutions	4
B	Second Grade	Humanities and Social Sciences	Female	Vocational Institutions	4
C	Fourth Grade	Humanities and Social Sciences	Male	Undergraduate Institutions	4
D	First Grade	Natural Sciences	Female	Undergraduate Institutions	4

In the four interviews, the key factors explored in the themes of autonomous learning ability, time management, learning strategies, and cognitive academic achievement are derived from various studies.

The autonomous learning ability scale from Hyo (2021) includes self-learning planning and implementation, as well as self-learning evaluation as critical factors. Time management behavior is measured using the scale from Cho (2021), which encompasses goal setting, time planning, execution, and evaluation. The learning strategies are assessed using Cho (2015)'s tool, which covers motivation, resource strategies, self-efficacy, and cognitive and metacognitive strategies. Cognitive academic achievement is evaluated with Ji (2018)'s tool, focusing on the key factor of cognitive academic achievement itself.

Table 4. Composition of Case Interview Content

Target Students	Occurrences	Interview Topics	Central Issue	The Crucial Factors to Explore
Student A Student B Student C Student D	Initial Interview	Self-Directed Learning Ability	1. How do you devise your study plan? In what ways does this plan assist you in effectively learning when utilizing general knowledge short videos? 2. After completing your studies, how do you assess the effectiveness of your learning? What tools or criteria do you use for evaluation?	Self-directed learning plans and implementation, self-assessment of learning
	Second Interview	Time Management	1. When you choose to engage in learning through general knowledge short videos, how do you prioritize time between your studies and other daily activities? 2. Please describe how you formulate and implement your study schedule, particularly when watching short videos. 3. How do you assess the effectiveness of your time management? How do these evaluations assist you in refining your future study plans?	Goal setting, time management planning, execution, evaluation
	Third Interview	Learning Strategies	1. When engaging with general knowledge short videos for learning, which motivational factors are most crucial to you? How do you cultivate these motivations? 2. What resources do you typically utilize to support your learning strategies? In what ways do these resources enhance your learning	Motivation, resource strategies, self-efficacy, cognitive and metacognitive strategies

		efficiency? 3. Please share some cognitive and metacognitive strategies you employ during your studies. How do these strategies contribute to achieving better outcomes in your learning process?	
Fourth Interview	Cognitive Academic Achievement	1. How do you assess the academic achievements attained through learning via general knowledge short videos? In what ways has this method of learning assisted you in overcoming academic challenges? 2. In your academic journey, how have short video learning resources integrated with traditional learning resources? What impact has this integration had on your academic performance?	Cognitive academic achievement

The first interview centers on autonomous learning ability, with Core Issue 1 focusing on how students develop learning plans based on their needs and resources, and how they implement these plans to achieve their learning goals. This issue addresses the formulation and practical execution of learning plans, directly relating to the critical factor of “self-learning planning and implementation.” Core Issue 2 investigates how students evaluate their learning outcomes, including the tools and methods used. This is crucial for understanding how students self-assess their learning effectiveness, directly involving the key factor of “self-learning evaluation.” The design of these questions not only aids researchers in comprehending students' autonomous learning abilities but also reveals how students enhance their learning outcomes through specific implementation and evaluation mechanisms.

The core issue of the second interview focuses on time management. Core Question 1 directly inquires how students set specific goals before their studies and how these goals are reflected in their time management plans, covering the essential elements of goal setting. It also asks how students plan their study time to meet the established goals, exploring the specifics of scheduling time to achieve these objectives, and addresses the elements of time planning. Core Question 2 emphasizes the practical execution of time management plans, asking how students ensure adherence to their plans and exploring potential problems and their solutions during plan execution, addressing the critical factors of implementation. Core Question 3 examines how students assess the effectiveness of their time management practices and how these evaluations assist them in optimizing future time management strategies, encompassing the essential elements of assessment. The design of the questions ensures that each critical factor is thoroughly explored in the interview, thus aiding the researcher in gaining a

comprehensive understanding of students' strategies and challenges in time management and how they refine this process to support more effective learning.

In the third interview, the central issues are as follows: Core Issue 1 investigates the factors that stimulate motivation, aiding in the understanding of why students choose particular learning content and methods, which is directly linked to motivation as a critical factor. Core Issue 2 explores the strategies students employ in selecting and utilizing learning resources, and how these resources are integrated into their learning process, encompassing key elements of resource strategies. Core Issue 3 inquires into how students maintain confidence and a sense of control while learning through short videos, addressing essential aspects of self-efficacy. Core Issue 4 examines how students use cognitive and learning strategies to enhance information processing and memory, which is directly related to cognitive and metacognitive strategies.

The fourth interview focuses on two core issues. Core issue 1 is to have students reflect comprehensively on the specific impact of short video learning on their academic achievement, including its assistance in understanding complex concepts or completing academic tasks. Core issue 2 explores how students integrate short videos with other learning resources (such as textbooks and lectures) and evaluates the effect of this blended learning approach on their academic performance.

4. Results of the Study

4.1 An Analysis of the Basic Situation and Differences in Independent Learning Ability, Time Management Behavior, Learning Strategies, and Cognitive Academic Achievement of the Study Participants in the Investigation Study

Examine whether the self-directed learning ability, time management behavior, learning strategies, and cognitive academic achievement in this study conform to the conditions of normal distribution by deriving the mean, standard deviation, kurtosis, and skewness through descriptive statistics. Self-directed learning ability M=3.00. Time management behavior M=2.32. Learning strategies M=2.62. Cognitive academic achievement M=2.84, as detailed in Table 5. The kurtosis and skewness of this study are within the range of -2 to 2, indicating a normal distribution (Nadarajah, 2011).

Table 5. Descriptive statistics of survey study participants on each variable

Factors	Mean	Standard Deviation	Kurtosis	Skewness
Autonomous learning ability	3.00	0.59	-0.828	0.565
Time management practices	2.32	0.51	0.931	1.034
Learning strategies	2.62	0.48	-0.285	-0.255
Cognitive academic achievement	2.84	0.95	-0.344	-0.582
N=322				

An analysis of variance was conducted to examine the differences in demographic characteristics of university students concerning their self-directed learning abilities, time management behaviors, learning strategies, and cognitive academic achievements, as detailed in Table 4. The t-test analysis method was employed to assess the variability in these variables based on gender, grade level, major category, and type of institution, while the ANOVA method was used to analyze the differences in the duration of watching educational short videos and the total daily viewing time across these variables.

The differences related to gender are summarized in Table 4. Significant statistical differences were observed in self-directed learning ability (t=-8.562), time management behavior (t=-2.266), and cognitive academic achievement (t=-9.297), with female students exhibiting higher levels in self-directed learning ability (M=3.28), time management behavior (M=2.39), and cognitive academic achievement (M=3.33) compared to male students (self-directed learning ability M=2.79, time management behavior M=2.26, cognitive academic achievement M=2.49). Learning strategies (t=-0.265) did not show statistical significance.

In the grade level, both self-directed learning ability (t=-8.928) and cognitive academic achievement (t=-9.559) demonstrate statistical significance. The self-directed learning ability for lower grades is M=2.79, while cognitive academic achievement stands at M=2.49. In contrast, the self-directed learning ability for higher grades is M=3.29, with cognitive academic achievement at M=3.35. This indicates that higher-grade students exhibit superior levels of self-directed learning ability and cognitive academic achievement compared to their lower-grade counterparts. Time management behaviors and learning strategies (P>0.05) do not present significant results.

Table 6. Differences in Independent Learning Skills, Time Management Behaviors, Learning Strategies, and Cognitive Academic Achievement

Ingredient	Type t/F value	Self-directed learning skills	Time Management Behavior	Learning Strategies	Cognitive Academic Achievement
Gender	Male(N=188)	2.79±0.61	2.26±0.54	2.61±0.52	2.49±0.95
(M±SD)	Female(N=134)	3.28±0.42	2.39±0.44	2.62±0.43	3.33±0.68
t		-8.562	-2.266	-0.265	-9.297
p		<0.001	0.024	0.791	<0.001
Grade (M±SD)	Lower grades (N=190)	2.79±0.62	2.28±0.55	2.6±0.53	2.49±0.96
	Senior grades (N=132)	3.29±0.4	2.38±0.43	2.63±0.42	3.35±0.65
t		-8.928	-1.817	-0.511	-9.559
p		<0.001	0.070	0.609	<0.001

Professional category (M±SD)	Major in Natural Sciences(N=191)	2.99±0.61	2.31±0.51	2.57±0.47	2.75±0.95
	Humanities and Social Sciences(N=131)	3.00±0.59	2.32±0.51	2.64±0.49	2.90±0.94
t		-0.182	-0.330	-1.225	-1.367
p		0.856	0.741	0.221	0.173
Type of institution (M±SD)	Vocational colleges(N=128)	3.01±0.6	2.29±0.51	2.58±0.47	2.76±0.96
	Undergraduate colleges(N=194)	2.99±0.59	2.33±0.51	2.63±0.49	2.89±0.94
t		0.261	-0.627	-0.902	-1.187
p		0.794	0.531	0.368	0.236
Preferences for the Duration of Educational Video Content(M±SD)	<5minutes (N=111)	2.37±0.51	2.6±0.62	2.41±0.48	2.38±0.99
	5-10minutes (N=116)	3.11±0.15	2.14±0.38	2.68±0.46	2.95±0.75
	>10minutes (N=95)	3.59±0.17	2.2±0.32	2.78±0.43	3.24±0.88
F		377.260	33.383	18.631	25.592
p		<0.001	<0.001	<0.001	<0.001
The cumulative daily time spent watching educational short videos(M±SD)	<1hour(N=111)	2.94±0.18	2.19±0.44	2.60±0.47	2.89±0.78
	1 to 2 hours(N=133)	3.5±0.21	2.19±0.32	2.76±0.43	3.14±0.89
	>2hours (N=78)	2.22±0.54	2.72±0.63	2.38±0.5	2.27±1
F		410.983	41.333	16.482	24.034
p		<0.001	<0.001	<0.001	<0.001

In terms of professional categories and institutional types, no significant statistical results were observed. However, regarding the duration of viewing educational short videos, differences emerged in self-directed learning ability (F=377.26), time management behaviors (F=33.383), learning strategies (F=18.631), and cognitive academic achievement (F=25.592). Among students who watch educational short videos for less than 5 minutes, the self-directed learning ability is M=2.37, time management behavior M=2.6, learning strategies M=2.41, and cognitive academic achievement M=2.38. For those watching for 5 to 10 minutes, the self-directed learning ability is M=3.11, time management behavior

M=2.14, learning strategies M=2.68, and cognitive academic achievement M=2.95. For students who watch for more than 10 minutes, the self-directed learning ability is M=3.59, time management behavior M=2.2, learning strategies M=2.78, and cognitive academic achievement M=3.24. These findings suggest that students who engage in watching educational short videos for more than 10 minutes exhibit superior self-directed learning abilities, learning strategies, and cognitive academic achievements compared to other groups; conversely, those who watch for less than 5 minutes demonstrate the highest levels of time management behavior.

Among the total time spent daily watching educational short videos, there are distinctions in autonomous learning ability (F=410.983), time management behaviors (F=41.333), learning strategies (F=16.482), and cognitive academic achievement (F=24.034). For students watching for less than one hour, the mean scores are as follows: autonomous learning ability M=2.94, time management behaviors M=2.19, learning strategies M=2.60, and cognitive academic achievement M=2.89. For students watching between one to two hours, the mean scores are: autonomous learning ability M=3.50, time management behaviors M=2.19, learning strategies M=2.76, and cognitive academic achievement M=3.14. For students watching more than two hours, the mean scores are: autonomous learning ability M=2.22, time management behaviors M=2.72, learning strategies M=2.38, and cognitive academic achievement M=2.27. This result indicates that students who watch educational short videos for one to two hours daily exhibit better autonomous learning ability, learning strategies, and cognitive academic achievement compared to other groups, while those watching more than two hours display the highest level of time management behaviors.

4.2 In-depth Interview Analysis of Case Interviewees on Independent Study Skills, Time Management Behaviors, Learning Strategies, and Cognitive Academic Achievement

Table 7. Coding Table

Initial Interview				
Student	A	B	C	D
Autonomous Learning Ability	“I use short videos to set and adjust my study plans, which helps me grasp difficult content more quickly and improve learning	“I usually use short videos for focused review before exams and don’t often set long-term study plans.”	“At the start of each semester, I create a detailed study plan based on the course content, and short videos help me understand	“I occasionally watch short videos to help understand classroom difficulties

	efficiency. I conduct self-assessments of my learning effectiveness every week."		abstract concepts more quickly."	but don't often set study plans."
Self-Study Plan and Implementation	Strong ability to adjust plans autonomously	Mainly ad-hoc learning	Detailed and systematic plan	Frequent performance evaluation
Self-Evaluation	Regular self-assessment	Rare self-assessment	Inadequate systematization of study plans	Rare evaluation of learning outcomes

Second Interview				
Student	A	B	C	D
Time Management	"I incorporate watching short videos into my daily study routine, scheduling a fixed time each day."	"I generally watch short videos only when needed, rarely planning study time in advance."	"I schedule time for watching short videos based on the learning content, which helps me better control my study progress."	"I usually watch short videos during spare time without a fixed plan."
Goal Setting	Clear learning goals	Unclear goal setting	Clear long-term goals	Lack of specific goals

Time Planning	Systematic time planning	Lack of detailed planning	Detailed time planning	Time management is more casual
Execution	Strict execution	Inconsistent execution	High efficiency	Weak execution
Evaluation	Regular evaluation	Rarely evaluates	Regular reflection	Rarely evaluates outcomes

Third Interview				
Student	A	B	C	D
Learning Strategies	"Short videos help me preview and review, making it easier to remember information through visual and auditory stimulation."	"I use short videos to quickly understand new knowledge, especially effective during review before exams."	"Combining short videos with other learning materials like textbooks and notes helps me understand course content more comprehensively."	"I prefer using videos to learn new concepts but don't often combine them with other resources, mainly for understanding basic knowledge."
Motivation	Increased interest in learning	Diverse learning resources	Confidence in learning outcomes	Application of diverse learning techniques
Resource Strategy	Pursues efficiency	Mainly relies on videos	Confident in outcomes	Short-term memory strategies
Self-Efficacy	Deep learning	Integrates	Strong self-efficacy	Uses critical

	motivation	different learning tools		thinking
Cognitive and Metacognitive Strategies	Quick learning of new knowledge	Reliance on video content	Average confidence	Primarily uses repetitive viewing strategies

Fourth Interview				
Student	A	B	C	D
Cognitive Academic Achievement	"Short videos have been very helpful in understanding complex concepts and preparing for exams."	"Using short videos helps me quickly grasp exam content, but I need more time to consolidate this knowledge."	"Combining short videos with traditional learning methods enhances learning efficiency and helps me achieve good grades in courses."	"Although short videos help me understand new knowledge, I need to use other methods to deepen my understanding and application."
Cognitive Academic Achievement	Improved academic achievement	Improved exam scores	Enhanced learning performance	Helps with understanding, needs further learning depth

To gain a deeper understanding of the variances among the research subjects across four interviews, the data was organized into four distinct coding tables. During the data analysis phase, detailed coding was performed on the content from the initial, second, third, and fourth interviews to extract key information regarding autonomous learning abilities, time management behaviors, learning strategies, and cognitive academic achievements. The coding tables illustrate the specific performances and differences among students under various factors. Refer to Coding Table 7. These tables clearly reveal

that Students A and C excel in autonomous learning and time management, demonstrating the ability to allocate time effectively and employ efficient learning strategies, which significantly enhance their academic achievements. In contrast, although Students B and D also actively utilize short videos for learning, their learning strategies and time management still exhibit deficiencies, impacting their learning outcomes. The comprehensive analysis of the coding tables and interview data suggests that short videos have potential as a learning tool in improving autonomous learning capabilities and cognitive academic achievements.

5. Conclusions, Discussion and Limitations

This study aims to examine autonomous learning capabilities, time management behaviors, learning strategies, and cognitive academic achievements under short video learning conditions, and it poses two research questions. A self-reported survey was administered to 322 college students, and case studies involving interviews with 4 students were conducted.

The first research question, "What is the status of college students' autonomous learning capabilities, time management behaviors, learning strategies, and cognitive academic achievements under knowledge-based short video learning?" was addressed through questionnaires and in-depth interviews. The study explored the state of students' autonomous learning capabilities, time management behaviors, learning strategies, and cognitive academic achievements in the context of general knowledge short video learning. The results indicate that autonomous learning capabilities, time management behaviors, and learning strategies have a significant impact on cognitive academic achievements. Female students and those in higher grades exhibited superior autonomous learning capabilities and cognitive academic achievements; students who preferred watching longer short videos demonstrated better autonomous learning capabilities and learning strategies. Interview data further supported these findings, revealing individual differences among students in learning plans, time management, and learning strategies.

In the comprehensive analysis of the survey and its variance, the questionnaire data reveals that the autonomous learning ability of female students is significantly superior to that of their male counterparts (female $M=3.28$, male $M=2.79$, $t=-8.562$, $p<0.001$). Furthermore, students in higher grades demonstrate a greater capacity for self-directed learning compared to those in lower grades (higher grades $M=3.29$, lower grades $M=2.79$, $t=-8.928$, $p<0.001$). Students who favor watching short videos exceeding ten minutes in duration exhibit the highest performance in autonomous learning ability ($M=3.59$, $F=377.26$, $p<0.001$). Interview data indicates that Students A and C possess a pronounced capacity for self-regulated learning planning and evaluation, enabling them to effectively leverage short video resources. Student A meticulously devises a plan prior to learning and actively gathers relevant materials; Student C formulates detailed study plans aligned with course content, with short videos facilitating a more rapid comprehension of abstract concepts. Conversely, Students B and D lack systematic learning plans and self-evaluation mechanisms, which adversely affects their learning outcomes. This alignment between the questionnaire and interview data indicates a consistent finding that female students and

those in higher grades demonstrate enhanced autonomous learning abilities, while students who engage with longer short videos exhibit superior self-directed learning skills, corroborating Ren's (2023) conclusion that short videos can enhance autonomous learning capacity.

The questionnaire data on time management behaviors revealed that students who enjoyed watching videos under five minutes in duration demonstrated the most optimal performance in managing their time ($M=2.6$, $F=33.383$, $p<0.001$). The overall level of time management behavior exhibited was found to be suboptimal ($M=2.32$), with females ($M=2.39$) displaying marginally higher scores than males ($M=2.26$) although the difference was not substantial ($t=-2.266$, $p=0.024$); similarly, there was no significant disparity noted between upperclassmen ($M=2.38$) and underclassmen ($M=2.28$). Interview data showcased Students A and C, who were able to systematically plan their study times and rigorously adhered to their schedules, prioritizing other learning objectives before turning to their learning through short videos; conversely, Students B and D lacked a definitive strategy for managing their time, possessing a weaker sense of implementation. Student A was found to establish academic goals for the entire semester, allocating study time in accordance with the importance and urgency of tasks; Student C, in turn, rigorously followed his plan, viewing short videos judiciously based on need, thereby demonstrating a more consistent effect in managing time. This evidence suggests that both the questionnaire data and the interview data converge, indicating a general lack of proficiency in time management behaviors, despite certain students displaying commendable abilities; however, the overall disparity was minimal. Though short video learning offers flexibility, the fragmented nature of the content and its substantial information content can lead to students encountering difficulties in managing their time, a perspective that aligns with the views of Wang (2021), Zhou, Zhang, and Wu (2021), and Li (2023), suggesting that greater emphasis on guiding effective time management behaviors is necessary for learning through short videos.

The data from the learning strategies questionnaire reveals that senior students perform better in learning strategies compared to their junior counterparts (seniors $M=2.63$, juniors $M=2.6$), though the difference is not statistically significant. Students who prefer watching videos longer than ten minutes exhibit superior performance in learning strategies ($M=2.78$, $F=18.631$, $p<0.001$). Interview data indicate that Students A and C effectively integrate a variety of learning resources and employ diverse cognitive and metacognitive strategies to enhance their learning efficiency. Student A engages in deep learning by combining short videos, books, and class notes, while Student C combines videos, books, and online discussions, enjoying complex challenges and proactive thinking. Students B and D primarily rely on short video content and lack in-depth learning strategies. This suggests that both the questionnaire and interview data are consistent, showing that senior students and those who prefer longer videos exhibit intermediate levels of learning strategies. Senior students, having accumulated certain strategies and experience, are better equipped to utilize short videos for learning. The requirement for integrating multiple learning resources and strategies to enhance learning efficiency aligns with the findings of Cho (2015) and Anique (2017).

The data from the cognitive academic achievement questionnaire indicate that females and senior students perform better in cognitive academic achievement (females M=3.33, males M=2.49, t=-9.297, p<0.001; senior students M=3.35, junior students M=2.49, t=-9.559, p<0.001). Students who prefer to watch short videos longer than ten minutes exhibit the highest cognitive academic achievement (M=3.24, F=25.592, p<0.001). Interview data reveal that Students A and C have enhanced their overall learning abilities by combining short videos with traditional learning methods, while Students B and D exhibit relatively weaker cognitive academic achievements. Student A believes that short video learning improves her understanding of knowledge and academic performance, whereas Student C has seen improvements in study habits through short video learning. This suggests that both the questionnaire and interview data align, indicating that females, senior students, and those who prefer longer short videos demonstrate superior cognitive academic achievement. Short videos, with their multi-sensory stimulation, can enhance students' understanding and retention of complex concepts. Therefore, short video learning contributes to improved cognitive academic achievement, consistent with the theories of Mayer (2014) and Anghel (2014).

Moreover, no significant differences were observed across professional and institutional categories, which may be attributed to the widespread proliferation and accessibility of short video learning resources. This ensures that students from various institutions and fields can equally access high-quality educational content. Most short video learning platforms and tools feature standardized interfaces and functionalities, offering similar learning experiences.

In light of the findings of this study and the existing research, how can university students enhance the efficacy of educational short video learning?

Firstly, to enhance students' autonomous learning abilities in the realm of knowledge-based short videos, it is essential for them to establish clear long-term and short-term goals. Breaking these short-term goals into smaller tasks to be completed progressively will foster a sense of accomplishment. This approach aligns with the findings from the questionnaire data, which indicate that students who prefer to watch videos longer than 10 minutes exhibit the highest levels of autonomous learning ability (M=3.59, F=377.26, p<0.001). In addition to viewing short videos, it is advisable for students to utilize supplementary tools such as textbooks and notes to aid in the deep memorization and reflection on knowledge structures. Interviews with students A and C revealed their strong abilities in self-directed learning planning and evaluation, as they actively gathered relevant materials and developed detailed study plans. It is recommended that students schedule their study time daily and weekly, opting for short videos longer than 10 minutes and maintaining a study period of 1-2 hours each day. This recommendation is consistent with the observation that students who watch knowledge-based short videos for 1-2 hours daily demonstrate superior autonomous learning capabilities (M=3.5, F=410.983, p<0.001).

Secondly, time management behavior emerges as the weakest among the four factors, necessitating immediate attention. Enhancing time management behavior involves categorizing tasks according to

their priority, distinguishing learning priorities based on the importance and urgency of educational content, ensuring that time is dedicated to the most valuable academic pursuits. The survey data indicates a generally low level of time management behavior (M=2.32), with females (M=2.39) demonstrating slightly higher proficiency than males (M=2.26) (t=-2.266, p=0.024). It is recommended that students establish daily study sessions of 1-2 hours to avoid the inefficiencies associated with multitasking. During interviews, students A and C demonstrated an ability to organize their study time systematically and strictly adhere to their plans, corroborating the findings of the survey data.

Thirdly, the study strategies observed in this research are also found to be at a lower level. The improvement of study strategies requires students to incorporate a variety of learning modes, including video, audio, reading, and practical applications, to enhance understanding and memory of knowledge. The survey data reveals that students who prefer watching videos exceeding 10 minutes in duration exhibit better proficiency in study strategies (M=2.78, F=18.631, p<0.001). It is advised that students cultivate a sense of critical thinking, continually questioning and evaluating the accuracy and reliability of the material they study. During interviews, students A and C demonstrated an ability to combine various learning resources and employ a range of cognitive and metacognitive strategies to enhance their learning efficiency.

Fourthly, the enhancement of cognitive academic achievement necessitates that students assess their own learning outcomes post-study, or engage in discussions and peer evaluations with classmates or teachers to understand their learning efficacy and areas for improvement. Survey data reveals that female students and those in higher grades perform better in cognitive academic achievement (females M=3.33, males M=2.49, t=-9.297, p<0.001; higher grades M=3.35, lower grades M=2.49, t=-9.559, p<0.001). It is recommended that educators guide students who use short videos for learning to aid them in enhancing their cognitive academic achievement.

This study validates the support of some researchers for the efficacy of short video as a novel learning method for learners, while further elucidating the challenges and concerns highlighted by previous research regarding short video learning. The capacity for autonomous learning appears relatively positive in comprehensive statistical analyses, indicating that learners engaging with educational short videos possess a solid foundational ability, and that such videos can enhance their autonomous learning skills. However, the emphasis should be placed on controlling the learning process and improving learning outcomes, particularly in time management behaviors and learning strategies. Although certain groups have demonstrated better performance in the analysis of cognitive academic achievements, overall performance remains somewhat inadequate. Consequently, learners should be mindful of both the process and outcomes of short video learning, leveraging their autonomous learning capabilities to their fullest. This includes actively establishing connections between pieces of knowledge, seeking personalized learning strategies, engaging in deep thinking and judgment during short video learning, adjusting learning strategies based on feedback, and ultimately enhancing various aspects of learning effectiveness through this medium.

This study is not without its limitations. Firstly, the sample predominantly derives from specific regions and institutions, with a relatively small scale, which may not fully represent the entire population of university students. Consequently, future research should broaden the sample size and include students from diverse geographical areas and types of institutions to enhance the generalizability of the findings. Secondly, the study relies heavily on self-reported data, which introduces a degree of subjectivity and potential bias. Future investigations could incorporate a variety of data collection methods, such as observational and experimental approaches, to improve the objectivity and reliability of the data. Lastly, the content and quality of short videos may vary significantly, and this study has not thoroughly examined the impact of different types of short videos on learning outcomes. Future research should delve deeper into the classification of educational short videos to offer more targeted recommendations.

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