

Developing Digital Citizenship through Digital Multi-Modal Composing in College English Course

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Abstract

To investigate the effectiveness of bringing digital multi-modal composing practices into college English courses to enhance students' digital citizenship, A four-month empirical research was conducted with students from a private university in China. The research was done with an experimental and a control group. Data was collected through pre- and post-intervention surveys assessing five dimensions of digital citizenship. Results indicated significant improvements in digital citizenship in experimental group, whereas no significant changes were observed in control group. Among significant predictors, males and students with higher socioeconomic status tended to score higher in digital citizenship awareness, highlighting potential gender and socioeconomic disparities that need to be addressed in future interventions. Additionally, the interview results suggested that students held a positive attitude towards the multi-modal composing practices.

Keywords

Digital Citizenship, DMC, Ideological and Political Teaching

1. Introduction

In the era of rapid information technology advancement, college students, frequently referred to as “digital natives,” find themselves concurrently inhabiting roles as social citizens within the digital realm. Digital citizenship is of great importance to individuals aiming to become competent members of a digital society. For instance, understanding online etiquette, respecting intellectual property, and participating responsibly in social media discussions are crucial skills for navigating the digital landscape effectively. These competencies not only enhance

personal digital proficiency but also contribute to building a strong, digitally capable nation with increasing national strength and international competitiveness (Ribble, 2004). The Central Committee for Cyber Security and Informatization issued the “Outline for Action to Enhance Digital Literacy and Skills of the Entire Population” in 2021, which emphasized fostering digital citizens with digital awareness, computational thinking, lifelong learning ability, and social responsibility. Thus, English language learning in colleges must transcend mere linguistic proficiency and encompass personal development domains such as social engagement, moral values, social skills, and civic awareness (Huang, 2015). However, at the crucial moment of digital transformation and intelligent upgrading, researchers suggest that college students’ digital citizenship levels are moderate at best, with incidents of cyberbullying, addiction, fraud, and violence posing significant threats to individuals, families, and society (Chen & Li, 2019).

Since the 21st century, digital citizenship has been heavily stressed in educational changes across the world. In recent years, integrating digital citizenship education into language studies has proven effective in addressing these issues globally. In the school systems of the United States and Europe, digital citizenship is primarily integrated with language study (Livingstone, 2008; Ribble, 2004). In China, the integration of digital citizenship education with university English courses presents unique advantages, including large enrollment, frequent use of multi-modal teaching methods, and the employment of up-to-date materials. This integration is crucial for national curriculum requirements and fostering Chinese college students’ digital citizenship.

2. Literature Review

2.1. Digital Citizenship

Digital citizenship, defined as appropriate and responsible behavior in the digital realm, is crucial for contemporary college students (Ribble, 2004; UNESCO, 2017). As the primary digital natives, college students’ engagement in digital activities is pervasive, making their digital citizenship a matter of significant concern. Previous studies have emphasized the importance of digital citizenship education in addressing various issues, such as cyberbullying, digital fraud, and online privacy concerns (Zhou & Wang, 2016). However, despite this recognition, research on the integration of digital citizenship education into foreign language learning, particularly in college English courses, remains limited.

Mike Ribble, the father of digital citizenship education in the U.S., proposed a framework that the content of digital citizenship education included nine elements, including digital access, digital communication, digital etiquette, digital law, etc., which had gained widespread acceptance within the field (Ribble, 2004). In June 2018, UNESCO proposed a more simplified framework for digital citizenship education, which consisted of four basic domains: digital literacy, digital security, digital engagement and digital emotional intelligence (UNESCO, 2017). Digital citizenship has begun to be referenced in conjunction with the advancement of digital

citizenship study and teaching. Chinese scholars have also contributed to the discourse on digital citizenship. Ruan & Zhang et al. (2016) argued that digital civic literacy encompassed four dimensions: digital security, normative engagement, digital survival, and digital learning. According to Zhou & Wang (2016), digital civic literacy was defined as the capacity to utilize technology correctly and responsibly while adhering to related standards and following particular norms.

To summarize, digital citizenship literacy incorporates a sort of comprehensive literacy, which is the basic literacy required for individuals to live, grow, and engage in digital social activities. The fundamental tenets of digital citizenship include using all digital devices and technology in a responsible and safe manner, as well as engaging in social activities that support the peaceful and orderly growth of digital society. Based on current findings, this study defines digital citizenship as follows: Digital citizenship encompasses the five dimensions of digital safety, digital communication, digital emotional intelligence, digital rights and obligations, and digital citizenship identity. It is the set of rights, obligations, ethical concepts, emotional intelligence, communication skills, and behavioral habits of citizens in the digital era who use various digital technologies safely, legally, and responsibly.

2.2. Digital Citizenship and Language Teaching

In China, research on digital citizenship has primarily focused on the concept, rule of law and moral education for the youth, policies related to digital citizenship, and digital citizenship education response. (Zhai & Wang, 2020; Jiang & Lu, 2019; Sun, 2019) However, these researches tended to be more theoretical, lacking localization and practical application, particularly in the context of language teaching (Yang, Xu, & Zheng, 2016). There weren't many papers examining the connection between language instruction and digital literacy, and even fewer focusing on dealing with teaching foreign languages. Hui et al. (2015) investigated the connection between students' development of digital citizenship and higher vocational English instruction, suggesting that one of the objectives of teaching in English should be the development of digital citizenship. In addition, Zou and Yang (2023) investigated how political and ideological classes integrated young students' development of digital citizenship. More recently, Sun & Tang (2020) carried out a one-year teaching experiment to investigate the viability and impact of confirming the integration of digital citizenship education and college English flipped classroom. However, the study lacked specific reform content and its findings lacked persuasive power.

In summary, researches on digital citizenship including its definition and dimensions have been conducted both domestically and internationally, adopting both qualitative and quantitative methods. However, the focus of these studies lies more in the area of digital citizenship education for teenagers, with less attention given to college students. Even more scarcely explored is the relationship between foreign language learning and the education for digital citizenship. Furthermore,

the development of digital citizenship within domestic language instruction, particularly its application to international language learners in colleges and universities through targeted pedagogies and digital tools, remains an area for exploration. In light of this, the localization of digital citizenship education as well as the unique challenges and issues faced by college students should be addressed. Its integration into language teaching, especially in the Chinese education context, remains under-explored. This gap in research highlights the need for further investigation into how digital citizenship education can be effectively incorporated into college English courses to foster well-rounded digital citizens

2.3. Multi-modal Composing and Ideological and Political Education

Multi-modal writing refers to students' using digital tools to integrate various modalities such as text, images, sound, and music in the process of communication and creation. Multi-modal writing advocates the teaching philosophy of "learning by doing" and enables learners to generate value insights through practice. Some researches have demonstrated the effectiveness of multi-modal composing in enhancing students' reading and writing abilities across various domains (Lee & McLoughlin, 2007; Kress, 2010). However, there is still a lack of comprehensive understanding on whether multi-modal writing can contribute to the ideological and political goals of college English courses, which aims to cultivate students' ideological and political awareness, social responsibility, and ethical values apart from its linguistic goals. Multi-modal composing, with its emphasis on creating multi-modal texts that can convey complex ideas and values, presents a potential avenue for achieving these goals. Yet, to date, there has been limited investigation into how multi-modal composing can be applied to effectively promote ideological and political education within the college English curriculum. Therefore, further research should address this gap and aim to explore the potential of multi-modal composing as a tool for ideological and political education in college English courses and identify effective strategies for integrating this approach into college English instruction.

3. Research Design

3.1. Research Questions

This study seeks to answer the following questions:

- 1) Does students' digital citizenship change after participating in the study, and is it possible to develop digital citizenship through digital multi-modal composing in college English courses?
- 2) What factors affect the development of the four aspects of digital citizenship respectively?

3.2. Participants

The participants consisted of 70 freshmen (35 in the experimental group and 35

in the control group) majoring in business management at a private university in China. All of them took *An Integrated Skills Course* for study. To ensure comparability between the two groups, participants were selected based on their intermediate English competence, as determined by their CET 3 performance scores. This ensured that both groups had similar linguistic proficiency levels. Additionally, efforts were made to balance other demographic factors, such as age, gender, and academic background, between the control and experimental groups. The data of the study were collected during the 2023-2024 academic year spring term over a span of 4 months (practical constraints related to the academic calendar and course requirements). Prior to the session, none of the participants had any experience producing videos required in an English writing assignment. The detailed demographic information of participants is demonstrated in **Table 1**.

Table 1. Demographic information of participants.

		Experiment Group		Control Group	
		Number	Percent	Number	Percent
Gender	Male	17	48.6	15	42.9
	Female	18	51.4	20	57.1
Volunteer Participation For a Semester	<20 hours	4	11.4	5	14.3
	20-50 hours	10	28.6	12	34.3
	50-100 hours	15	42.9	15	42.9
	>100 hours	6	17.1	3	8.6
Digital Device Use	Frequently	16	45.7	12	34.3
	Sometimes	16	45.7	19	54.3
	Seldom	3	8.6	4	11.4
Residential Area	Urban	17	48.6	16	45.7
	Rural	18	51.4	19	54.3
Monthly Living Expense	<1500 RMB	3	8.6	3	8.6
	1500 - 2500 RMB	21	60	21	60
	>2500RMB	11	31.4	11	31.4
Daily Internet Use	<3 hours	5	14.3	10	28.6
	3 - 5 hours	19	54.3	15	42.9
	>5 hours	11	31.4	10	28.6

3.3. Instruments

Questionnaires

In this study, questionnaires about students' understanding of digital citizenship based on literature survey (Xu, 2019) were repeated twice to assess the variation between the pre-test and post-test. A total of 24 questions were adopted measuring five dimensions of digital citizenship (digital security, digital communication, digital rights and obligations, digital emotional intelligence, and digital citizenship identity). The questionnaire is measured on a five-point Likert scale. There are

five-degree scales that range from “totally inconsistent” at a score of 1 to “very consistent” at a score of 5. The specific structure information of the questionnaire is shown in **Table 2**.

Table 2. Questionnaire dimensions and items.

Primary Theme	Secondary Theme	Question Items
Digital Security	Passwords and Authentication	3
	Antivirus and Anti-Hacking Measures	3
	Data Protection and Privacy	2
Digital Communication	Use of Email and Instant Messaging Tools	3
	Communication Skills and Etiquette on Social Media Platforms	2
	Remote Meetings and Online Collaboration	2
Digital Rights and Obligation	Copyright and Intellectual Property	2
	Responsibility and Ethics in Online Behavior	2
	Digital Divide and Right to Equal Information Access	1
Digital Emotional Intelligence	Recognizing and Understanding Online Emotions	2
	Managing Personal Online Emotional Expression	2
	Coping with Cyberbullying and Negative Emotions	1
Digital Citizenship Identity	Building a Positive Online Personal Image	2
	Participation in Digital Communities and Civic Responsibility	2
	Cross-Cultural Communication and Global Digital Citizenship Awareness	1

3.4. Writing Tests

In this study, the participants from the EG and CG were asked to complete the same writing task twice respectively in the pre-test and post-test. The topic of the writing tests was about AI and its use in English learning. Two English teachers were invited to score the submitted writings respectively and the final scores were based on the average ones from these two teachers. The scoring standards were based on CET-4 writing standards, which was shown in **Table 3**.

Table 3. Standards of scoring.

14 - 15	The essay is fully relevant to the topic, with clear ideas, coherent and fluent language, virtually no language errors, and only minor mistakes.
11 - 13	The essay is relevant to the topic, with clear ideas and coherent language, but contains a few language errors that do not affect the overall understanding.
8 - 10	The essay is generally relevant to the topic, with some unclear expression, barely coherent language, and numerous language errors, including some serious ones.
5 - 7	The essay is basically on-topic but lacks clarity in ideas and coherence in language, with many serious language errors that affect reading and understanding.

Continued

1 - 4	The essay is disorganized, with unclear and confused thoughts, language that is fragmented or contains errors in most sentences, and most of these errors are serious.
0	No response.

3.5. Semi-Structured Interview

As additional proof, Semi-structured interviews were conducted to have an in-depth understanding of multi-modal composing, as well as their emotional stance towards digital citizenship. 5 students from the EG were interviewed respectively for 30 min. Interviews were done in Chinese and recorded. The interview consisted of 5 questions to get further information about students' attitudes and perspectives on digital citizenship and multi-modal composing tasks. The initial three questions were designed to elicit the participants' opinions and attitudes concerning multi-modal composing. The fourth and fifth questions sought to ascertain any changes in the participants' digital citizenship.

3.6. Research Procedures

Over a duration of 4 months, both the control group and experimental group took the same textbook and adhered to consistent teaching progress and materials. The control group received standard English instruction while digital multi-modal composing practices were integrated into their college English courses for the experimental group, which was executed as follows. Students in experimental group were divided into 5 groups, and each group was responsible for multi-modal composing task titled Digital Time and Digital Me on five themes related to digital citizenship with an average completion time of 4 weeks per task. Taking the topic of digital security as an example, there were four stages involved: stage 1: how much is known about digital security; stage 2: early stage of short video production for DTDM project; stage 3: short video production for DTDM project and stage 4: post DTDM project short video production—evaluation and reflection.

During stage 1, group discussions and sharing were conducted to get students to understand digital security knowledge; students were asked to watch three themed movies (“Tinder Scam King”, “All in One”, “Unfriended”) related to online fraud and bullying with a deeper depth of content that subtly enhanced language proficiency and examined digital security as a digital citizen. During stage 2, teachers carried out the following multi-modal reading and writing activities to prepare students for the subsequent video production stage: searching for news events, speeches, film and television works related to digital security; group sharing information on online fraud and bullying incidents and exchanging views; collecting relevant comments on “cyberbullying” from social media platforms and use critical thinking to organize viewpoints; trying writing a letter to the person who is seeking help; During stage 3, students organized and analyzed the information collected and analyzed in the early stage. They attempted to produce a video through the following steps: teacher demonstration, screenwriting, video

shooting, post production, and presentation; During stage 4, mutual evaluation, reflection, and interviews were done to provide feedback and examine the changes in students' digital empathy abilities, as well as their experiences and influencing factors in DTDM project learning. When compared with text-based learning tasks, multi-modal composing differed in terms of task focus, input and output methods, and ways of feedback. The teaching progress and materials of the two classes remained consistent.

However, the learning task for the students in the control class was text-based reading and writing, and there were no multi-modal writing tasks.

3.7. Data Collection

Data were gathered at two stages from questionnaires, tests, and interviews throughout the experiment. Before the teaching experiment, the teacher presented identical surveys and written assessments on the same topic to both the experimental and control classes. Following the four-month teaching experiment, the writing test and questionnaire assessments were repeated to determine variations in students' language competency and digital citizenship. The semi-structured interview was adopted to evaluate students' attitudes and opinions towards multi-modal composing and its effect on political and ideological education.

3.8. Data Analysis

This study carried out the reliability analysis which showed that the overall reliability and the reliability of each dimension in the experimental group were above 0.8 before the intervention, and above 0.7 after the intervention. Similarly, the overall reliability and the reliability of each dimension in the control group were above 0.8 both before and after the intervention. The high reliability observed in both groups before and after the intervention indicated that the data were highly reliable. Based on the validity analysis results, the validity for both the experimental group pre-intervention, the experimental group post-intervention, the control group pre-intervention, and the control group post-intervention was above 0.7, indicating good data quality. In conclusion, the questionnaire was valid and reliable.

This study employed SPSS 26.0 software to conduct comprehensive analyses of differences between the experimental and control groups both before and after the experiment with the T-test and paired T-test methods. The T-tests were selected due to their significance in assessing whether the observed differences between the two groups were statistically meaningful, thereby underpinning the validity and importance of the study findings. Prior to and following the intervention, multiple T-tests were administered to examine disparities across various parameters. These analyses aimed to rigorously evaluate the changes and differences that occurred within and between the experimental and control groups. Subsequently, an analysis of variance (ANOVA) was utilized to further delve into the post-experiment differences. Specifically, ANOVA was applied to analyze the impact of

gender, volunteer participation duration, digital device usage, residential area, monthly living expenses, and daily internet use on five critical dimensions: digital security, digital communication, digital rights and responsibilities, digital emotional intelligence, and digital citizenship identity. This approach allowed for a nuanced understanding of how these factors interacted and influenced the outcomes. Finally, a linear regression analysis was conducted, focusing on digital citizenship awareness post-intervention as the dependent variable. This regression model aimed to elucidate the relationships and predictive power of these variables on the outcome of digital citizenship awareness, providing deeper insights into the factors that shape this important construct.

In this study, qualitative data were analyzed using NVivo 12. thematic analysis to discover, code, and categorize themes that explained attitudes and opinions towards multi-modal composing and its effect on political and ideological education.

4. Results

4.1. Writing Assessment before and after Experiment

4.1.1. Independent Sample T-Test for Pre-Experiment Scores

This part compared the test scores between the two groups before the experiment in **Table 4**. The mean score of experimental group before experiment was 9.26 and the standard deviation was 1.578, while the mean score of control group was 9.20 with the standard deviation of 1.183. The $p = 0.864$ which was above 0.05 meant that there was no significant value of statistics and there was not much difference in the academic achievement between experimental group and control group. Students in the two groups had similar writing ability.

Table 4. Comparison of independent T-test of the test scores before experiment.

Group	Num	Mean	SD	t	p
EG	35	9.26	1.578	0.171	0.864
CG	35	9.20	1.183		

4.1.2. Independent Sample T-Test and Paired Sample T-Test for Post-Experiment Scores

The test scores between the two groups after the experiment were shown in **Table 5**. The higher the mean score was, the more academic achievement one had. The result ($P = 0.006$) meant the subjects in the experimental group achieved higher scores than the subjects in the control group after the experiment and there was significant differences in these two groups after the experiment. Paired sample T-test (**Table 6**) was conducted to see the changes in the writing performance after the experiment. The result indicated that there was significant differences in EG after the experiment ($p < 0.001$). In conclusion, writing scores in the post-test were significantly higher than those in the pre-test in the experiment group, while there was no significant changes in CG between pre-test and post-test.

Table 5. Comparison of independent T-test of the test scores after experiment.

Group	Num	Mean	SD	t	p
EG	35	10.14	1.478	2.827	0.006
CG	35	9.29	1.017		

Table 6. Paired sample T-test of the test scores in EG.

Group	Num	Mean	SD	t	p
EG (pre)	35	9.26	1.578	-7.295	<0.001
EG (post)	35	10.14	1.478		

4.2. Changes in Digital Citizenship before and after Intervention

According to the analysis of the differences between the experimental group and the control group before intervention, there were no significant differences in digital security, digital communication, digital rights and obligations, digital emotional intelligence, and digital citizenship identity with $p > 0.05$ in each domain shown in **Table 7**.

Table 7. Independent T-test of digital citizenship before experiment.

	Digital Security	Digital communication	Digital rights & obligations	Digital EQ	Digital citizenship identity
EG	3.034 ± 1.098	3.307 ± 1.013	3.157 ± 1.034	3.057 ± 1.182	3.139 ± 0.75
CG	3.051 ± 1.079	3.129 ± 1.109	2.9 ± 1.006	3.043 ± 1.067	3.031 ± 0.788
t	-0.066	0.703	1.054	0.053	0.589
p	0.948	0.484	0.295	0.958	0.558

According to the analysis of the differences between the experimental group and the control group after intervention in **Table 8**, there were significant differences in digital security ($t = 2.480$, $p < 0.05$), digital communication ($t = 2.453$, $p < 0.05$), digital rights and obligations ($t = 2.618$, $p < 0.05$), digital emotional intelligence ($t = 3.492$, $p < 0.05$), and digital citizenship awareness ($t = 3.951$, $p < 0.05$) between the experimental group and the control group, all of which were higher in the experimental group than in the control group.

Table 8. Independent T-test of digital citizenship before experiment.

	Digital security	Digital communication	Digital rights & obligations	Digital EQ	Digital citizenship identity
EG	3.72 ± 0.877	3.721 ± 0.73	3.65 ± 0.805	3.85 ± 0.748	3.682 ± 0.319
CG	3.12 ± 1.131	3.171 ± 1.108	3.05 ± 1.091	3.114 ± 0.997	3.114 ± 0.788
t	2.480	2.453	2.618	3.492	3.951
p	0.016	0.017	0.011	0.001	0.000

Based on the results of the difference analysis between pre-experiment and post-experiment in EG (**Table 9**), it was found that there were significant differences in digital security ($t = -3.721$, $p < 0.05$), digital communication ($t = -2.088$,

$p < 0.05$), digital rights and obligations ($t = -2.558$, $p < 0.05$), digital EQ ($t = -3.764$, $p < 0.05$), and digital citizenship identity ($t = -5.278$, $p < 0.05$) with all scores being higher after the intervention compared to those before the intervention. These findings underscored the positive impact of the intervention on the digital citizenship competencies of the EG.

Table 9. Differences in EG before and after intervention.

	Digital security	Digital communication	Digital rights & obligations	Digital EQ	Digital citizenship identity
Pre	3.034 ± 1.098	3.307 ± 1.013	3.157 ± 1.034	3.057 ± 1.182	3.139 ± 0.75
Post	3.72 ± 0.877	3.721 ± 0.73	3.65 ± 0.805	3.85 ± 0.748	3.682 ± 0.319
t	-3.721	-2.088	-2.558	-3.764	-5.278
p	0.001	0.044	0.015	0.001	0.000

Conversely, no significant differences were observed between pre- and post-intervention scores in the control group for any of the dimensions (Table 10). This lack of change indicated that the CG participants did not experience any improvement in their digital citizenship competencies over the study period, further emphasizing the efficacy of the intervention specifically for the EG.

Table 10. Differences in CG before and after intervention.

	Digital security	Digital communication	Digital rights & obligations	Digital EQ	Digital citizenship identity
pre	3.051 ± 1.079	3.129 ± 1.109	2.9 ± 1.006	3.043 ± 1.067	3.031 ± 0.788
post	3.12 ± 1.131	3.171 ± 1.108	3.05 ± 1.091	3.114 ± 0.997	3.114 ± 0.788
t	-0.297	-0.241	-0.874	-0.377	-0.788
p	0.768	0.811	0.388	0.709	0.436

In conclusion, the findings of this study demonstrate the effectiveness of the intervention in enhancing digital citizenship competencies among the EG participants. The significant improvements observed across all dimensions in the EG, coupled with the lack of change in the CG, underscored the importance of targeted interventions in fostering digital citizenship among college students. These findings have important implications for educational practices and policies aimed at promoting digital literacy and citizenship in higher education settings.

4.3. Analysis of Difference in Various Dimensions after the Intervention

The post-intervention analysis of data revealed statistically significant variations across multiple dimensions, highlighting the influence of various factors on digital citizenship presented in the following tables. These findings offered valuable insights into the complexities that shaped students' digital citizenship.

A gender-based analysis of the data in **Table 11** revealed significant disparities in all dimensions of digital citizenship in the table. Males scored significantly higher than females in digital security ($t = 2.185, p < 0.05$), digital communication ($t = 4.135, p < 0.05$), digital rights and obligations ($t = 4.172, p < 0.05$), digital emotional intelligence ($t = 3.119, p < 0.05$), and digital citizenship identity ($t = 5.330, p < 0.05$).

An analysis of volunteer participation hours in **Table 12** revealed a positive correlation with digital citizenship across all dimensions. Students who participated in more volunteering work scored significantly higher in digital security ($t = 4.145, p < 0.05$), digital communication ($t = 5.02, p < 0.05$), digital rights and obligations ($t = 4.808, p < 0.05$), digital emotional intelligence ($t = 7.144, p < 0.05$), and digital citizenship identity ($t = 15.548, p < 0.05$).

Variations in digital device use in **Table 13** also demonstrated significant differences in digital citizenship. Students who frequently or occasionally used digital devices scored significantly higher than those who rarely used them in digital security ($t = 3.793, p < 0.05$), digital communication ($t = 5.065, p < 0.05$), digital rights and obligations ($t = 3.535, p < 0.05$), digital emotional intelligence ($t = 4.933, p < 0.05$), and digital citizenship identity ($t = 10.193, p < 0.05$).

A comparison of residential areas in **Table 14** revealed significant disparities in digital citizenship among urban and rural residents. Urban residents scored significantly higher than rural residents in digital security ($t = 2.467, p < 0.05$), digital communication ($t = 2.035, p < 0.05$), digital rights and obligations ($t = 2.376, p < 0.05$), digital emotional intelligence ($t = 2.759, p < 0.05$), and digital citizenship identity ($t = 4.002, p < 0.05$).

Differences in monthly living expenses in **Table 15** also showed significant variations in digital citizenship. Students with higher monthly living expenses scored significantly higher in digital security ($t = 5.31, p < 0.05$), digital communication ($t = 6.924, p < 0.05$), digital rights and obligations ($t = 5.891, p < 0.05$), digital emotional intelligence ($t = 5.251, p < 0.05$), and digital citizenship identity ($t = 17.783, p < 0.05$).

Lastly, variations in daily internet use in **Table 16** exhibited significant differences in digital citizenship. Students who spent longer hours online scored significantly higher in digital security ($t = 8.924, p < 0.05$), digital communication ($t = 8.727, p < 0.05$), digital rights and obligations ($t = 7.429, p < 0.05$), digital emotional intelligence ($t = 12.082, p < 0.05$), and digital citizenship awareness ($t = 26.391, p < 0.05$).

In conclusion, the post-intervention analysis of general data revealed significant differences across multiple dimensions. These findings have important implications for educational practices and policies aimed at fostering digital citizenship among college students and underscore the need for tailored interventions that can address the specific challenges and disparities faced by different student groups.

Table 11. Analysis of differences in gender.

	Male	Female	t	p
Digital security	3.706 ± 0.912	3.179 ± 1.107	2.185	0.032
Digital communication	3.906 ± 0.701	3.059 ± 1.006	4.135	0.000
Digital rights & obligations	3.82 ± 0.613	2.954 ± 1.092	4.172	0.000
Digital EQ	3.844 ± 0.858	3.178 ± 0.926	3.119	0.003
Digital citizenship identity	3.778 ± 0.446	3.078 ± 0.648	5.330	0.000

Table 12. Analysis of differences in volunteer participation.

	<20	20 - 50	50-100	>100	F	p
Digital security	2.711 ± 1.03	3.164 ± 1.198	3.593 ± 0.917	4.178 ± 0.338	4.145	0.009
Digital communication	2.722 ± 1.114	3.125 ± 0.99	3.742 ± 0.808	3.972 ± 0.667	5.02	0.003
Digital rights & obligations	2.583 ± 0.935	3.057 ± 1.118	3.625 ± 0.883	3.917 ± 0.28	4.808	0.004
Digital EQ	2.556 ± 0.855	3.307 ± 0.932	3.642 ± 0.865	4.306 ± 0.391	7.144	0.000
Digital citizenship identity	2.643 ± 0.621	3.126 ± 0.594	3.615 ± 0.49	4.093 ± 0.182	15.548	0.000

Table 13. Analysis of differences in digital device use.

	Frequently	Sometimes	Seldom	F	p
Digital security	3.254 ± 1.115	3.714 ± 0.878	2.756 ± 1.17	3.793	0.028
Digital communication	3.365 ± 1.056	3.714 ± 0.786	2.639 ± 0.977	5.065	0.009
Digital rights & obligations	3.5 ± 1.025	3.443 ± 0.955	2.556 ± 0.788	3.535	0.035
Digital EQ	3.202 ± 0.972	3.814 ± 0.839	3 ± 0.919	4.933	0.01
Digital citizenship identity	3.258 ± 0.576	3.671 ± 0.571	2.738 ± 0.687	10.193	0

Table 14. Analysis of differences in residential area.

	Urban	Rural	t	p
Digital security	3.733 ± 0.923	3.141 ± 1.087	2.467	0.016
Digital communication	3.689 ± 0.882	3.23 ± 1.008	2.035	0.046
Digital rights & obligations	3.636 ± 0.818	3.095 ± 1.084	2.376	0.02
Digital EQ	3.796 ± 0.799	3.203 ± 0.996	2.759	0.007
Digital citizenship identity	3.698 ± 0.526	3.13 ± 0.661	4.002	0

Table 15. Analysis of differences in monthly living expense.

	<1500 yuan	1500 – 2500 yuan	>2500 yuan	F	p
Digital security	2.567 ± 1.015	3.286 ± 1.098	3.909 ± 0.722	5.31	0.007
Digital communication	2.5 ± 0.894	3.327 ± 0.982	3.932 ± 0.704	6.924	0.002
Digital rights & obligations	2.417 ± 0.701	3.244 ± 1.002	3.807 ± 0.841	5.891	0.004
Digital EQ	2.833 ± 0.931	3.327 ± 1.01	3.955 ± 0.606	5.251	0.008
Digital citizenship identity	2.579 ± 0.65	3.251 ± 0.595	3.901 ± 0.384	17.783	0

Table 16. Analysis of differences in daily internet use.

	<3 h	3 – 5 h	>5 h	F	p
Digital security	2.563 ± 1.036	3.582 ± 0.98	3.819 ± 0.81	8.924	0
Digital communication	2.688 ± 0.994	3.538 ± 0.897	3.881 ± 0.744	8.727	0
Digital rights & obligations	2.781 ± 1.004	3.258 ± 1.024	3.929 ± 0.618	7.429	0.001
Digital EQ	2.625 ± 0.822	3.614 ± 0.857	3.929 ± 0.779	12.082	0
Digital citizenship identity	2.664 ± 0.534	3.456 ± 0.561	3.865 ± 0.358	26.391	0

4.4. Regression Analysis

The regression analysis shown in **Table 17** provided further insights into the factors influencing digital citizenship awareness among college students. Using post-intervention digital citizenship awareness as the dependent variable, the analysis identified several significant predictors, including whether the intervention was received, gender, volunteer participation hours, monthly living expenses, and daily internet usage duration in a linear regression analysis. The results indicated that whether intervention was received ($B = -0.491$, $p < 0.05$), gender ($B = -0.22$, $p < 0.05$), volunteer participation hours ($B = 0.14$, $p < 0.05$), monthly living expenses ($B = 0.289$, $p < 0.05$), and daily internet usage duration ($B = 0.23$, $p < 0.05$) all significantly influence digital citizenship awareness. Specifically, higher levels of intervention, being male, greater volunteer participation hours, higher monthly living expenses, and longer daily internet usage duration are associated with higher levels of digital citizenship awareness. Note: The original text mentions “grade” and “major category” as independent variables, but they are not included in the results section of the translation because no coefficients or significance levels were provided for these variables in the original text. If these variables were also significant in the analysis, they should be included in the translation with their respective coefficients and significance levels.

Table 17. Regression analysis.

	Unstandardized		Standardized		t	Significance (p-value)	95.0% Confidence Interval for B		Collinearity
	B	Standard Error	Beta	Beta			Lower bound	Upper bound	VIF
(Constant)	3.179	0.429			7.413	0.000	2.321	4.036	
Intervention (Yes/No)	-0.491	0.086	-0.373		-5.703	0.000	-0.663	-0.319	1.026
Gender	-0.22	0.105	-0.167		-2.089	0.041	-0.431	-0.01	1.527
Volunteer Participation	0.14	0.069	0.186		2.032	0.046	0.002	0.278	2.012
Digital Device Use	0.051	0.067	0.051		0.761	0.45	-0.083	0.185	1.097
Residential Area	-0.178	0.095	-0.136		-1.888	0.064	-0.367	0.01	1.234
Monthly Living Expense	0.289	0.096	0.259		3.012	0.004	0.097	0.48	1.77
Daily Internet Use	0.23	0.077	0.253		2.987	0.004	0.076	0.384	1.718

Continued

R ²	0.741
F	25.338

4.5. Results of the Interview

Based on the results of the questionnaires, five students from the experimental group (EG) were randomly selected from five groups respectively to participate in the interview (3 males, 2 females, SD = 0.556). In the first question “Do you like the short video-producing tasks? Why?” and the second question “Do you think the short video-producing tasks can improve your English learning?” All students displayed a favorable attitude. “*I have never done this kind of writing before. It is so fascinating and I love it.*” One student said. “*This kind of English task sparked my learning interest.*” Another student noted. Others acknowledged that this writing allowed them to acquire knowledge in various domains, such as video editing and information processing, and offered to improve their cognitive skills and ability to articulate ideas, describe objects, or narrate events accurately and fluently through language, contributing to improved organization and expression in their writing, which could not be got in traditional writing tasks. Apart from the improvement in English learning, two students mentioned that the processing multi-modal information, which involved analyzing, evaluating, and integrating information to form independent opinions, fostered their critical thinking skills, allowing them to better understand and tackle difficult problems.

For the third question, “What are the difficulties in short video making?”, a range of challenges, including technological proficiency, multiple modalities integrating, technological access and resources, team working were displayed in the interview. The biggest difficulty was how to effectively integrate various kinds of modes, such as pictures, video and audio, with textual descriptions to produce a cohesive and meaningful whole. The second problem was technical, mainly the inadequacy of mastery of various tools and software required for multi-modal writing, such as graphic design programs, audio and video editing software. On top of that, one student highlighted the issue of collaboration saying “*We had trouble in allocating tasks. Students didn’t have equal access to the necessary technology for multi-modal writing, a barrier to participation.*” Two other students mentioned the difficulty in summarizing the ideas from the movies, views from platforms and discussions.

The fourth and fifth questions aimed to have an insight into the influence of multi-modal composing on students’ digital citizenship. All the participants agreed that they had a deeper understanding of digital etiquette and a clearer awareness of the digital security and identity. Here were some comments: “*I am surprised to see so many fraud cases online. As a digital user, I am more aware of the pitfalls and dangers online. It is more effective than the traditional political and ideological education alone.*” “*Before I post something online, I have to check whether my personal information will be exposed. I am more careful with the*

potential security risks. I will think twice before clicking the links.” “I have never tried writing a letter to others online. I learnt some digital etiquette and some digital communicating skills. They are very important in today’s interconnected world.”

In summary, multi-modal writing has a significant impact on student’s digital citizenship, enhancing their security consciousness, digital EQ, digital communication skills, awareness of digital rights and responsibilities, and a digital identity. These skills are crucial for students to become responsible and engaged digital citizens in today’s digital world.

While the interview responses were from a small sample of five students, they provided insights into the broader experimental group’s attitudes and experiences. The students’ responses were consistent with the quantitative findings, indicating that they generally held a positive attitude towards the multi-modal composing practices and recognized their benefits for digital citizenship development.

5. Discussion

The results of this study provided convincing evidence for integrating digital multimedia writing into college English courses to enhance students’ digital citizenship awareness. This finding reinforced the effectiveness of the intervention in enhancing students’ digital citizenship competencies. Compared with the control group, the experimental group showed significant improvements in various aspects of digital citizenship, highlighting the potential of this intervention in cultivating a more digital and responsible group of students. Students interviewed expressed their positive attitudes towards multi-modal writing and acknowledged the function of its integration into the English course and the impact on the digital citizenship education.

The analysis of various factors affecting digital citizenship revealed several noteworthy findings. Firstly, gender differences are evident, with males scoring higher in all dimensions. These findings suggest that gender-specific interventions may be necessary to address the challenges faced by female students in developing digital citizenship. Potential reasons could include differences in digital access, confidence and skills in using technology. Females may have less access to digital devices and resources compared to males, limiting their opportunities to develop digital skills. Females may be less confident in using technology and engaging in digital activities, which can hinder their digital citizenship development. Gendered socialization patterns may impact how females interact online, potentially leading to lower awareness of digital rights and responsibilities.

Secondly, the positive correlation between voluntary participation and digital citizenship highlighted the importance of volunteering activities. The more students participated in the volunteering work, the higher level of their awareness of digital citizenship was. Encouraging students to participate in volunteer work may be a valuable strategy for political and ideological education.

In addition, the frequency of digital devices use and daily use of the Internet are

important predictors of digital citizenship, which indicated that regular access to digital technology is critical to developing these capabilities. This emphasized the need for educational institutions to provide sufficient digital resources and promote responsible use of these resources by students.

Interestingly, living area and monthly living expenses have also become important factors, with urban residents and students with higher monthly living expenses scoring higher in digital citizenship. These findings suggested that socioeconomic and geographical differences may play a role in shaping students' digital citizenship abilities. Targeted interventions and fair access to resources are crucial for narrowing these gaps and ensuring that all students have the opportunity to develop their digital citizenship.

Regression analysis further strengthened this finding, and identified intervention, gender, volunteer participation, monthly living expenses and daily Internet use as important predictors of digital citizenship. This highlighted the multifaceted aspects of developing digital citizenship and the need for comprehensive intervention measures to address these different factors.

6. Conclusion

In conclusion, this study demonstrated the effectiveness of integrating digital multi-modal composing into college English courses in enhancing students' digital citizenship, revealing that engaging students in activities that integrate multimedia elements not only enhanced their digital literacy skills but also promoted responsible digital behaviors, ethical considerations, and active participation in online communities. The significant improvements observed across all dimensions of digital citizenship among the experimental group showed the potential of this intervention to foster more digitally competent and responsible students.

The analysis of various factors influencing digital citizenship provided valuable insights into the challenges and disparities faced by different student groups. Gender-specific interventions, encouragement of volunteer work, adequate access to digital resources are essential strategies for fostering digital citizenship among college students. Furthermore, the study identified potential challenges and limitations in promoting digital citizenship through digital multi-modal composing, such as variations in students' prior digital experiences and differences in instructional approaches.

The findings of this study had important implications for educational practices and policies aimed at promoting digital literacy and citizenship in higher education settings. First, it underscores the importance of integrating digital multi-modal composing practices into college English courses to enhance students' digital citizenship. Second, it highlights the need for tailored interventions that can address gender and socioeconomic disparities in digital citizenship development. Third, it emphasizes the role of extracurricular activities and online engagement in fostering digital citizenship among college students. Finally, the study points to several avenues for future research. Future studies could explore the long-term

effects of digital multi-modal composing practices on students' digital citizenship and investigate other potential predictors of digital citizenship awareness. Additionally, research could focus on developing and evaluating tailored interventions aimed at addressing gender and socioeconomic disparities in digital citizenship development among college students.

In conclusion, the findings of this study provided valuable insights into the effectiveness of digital multi-modal composing practices in enhancing college students' digital citizenship and highlighted the importance of addressing potential disparities in digital citizenship development. While this study was conducted at a private university with business management students, the findings have broader implications for public universities and students in other fields. Integrating digital multi-modal composing into college English courses can benefit students across different educational settings and disciplines by enhancing their digital citizenship competencies. Future research should continue to explore this evolving field, building on the findings presented here to further refine and enhance our understanding of digital citizenship in the context of digital multi-modal composing.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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