Factors blended learning effecting to develop 21st century student skills of Chinese vocational college: A case study - Heyuan vocational and Technical college

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Abstract

This research aimed to: 1) explore the factors influencing 21st-century student skills, 2) examine the impact of blended learning on these skills, and 3) provide insights for developing these skills in vocational students. A survey was conducted with 401 students from Heyuan Vocational and Technical College. The study applied a quantitative analysis using a questionnaire with a reliability of 0.94. Data analysis included percentage, mean, standard deviation, ANOVA, and regression tests.

The results show that blended learning significantly impacts students' 21st-century skills. Key findings include: 1) Personal factors and blended learning both influence skills, with year of study most affecting cross-cultural understanding (C3). 2) Blended learning yields high satisfaction in career self-reliance (C7), cross-cultural understanding (C3), and reading skills (R1). 3) Blended learning positively correlates with satisfaction in developing 21st-century skills. Based on these results, specific blended learning strategies to enhance skill development are recommended.

Keywords: *21st-Century Skills, Blended Learning, Vocational college students.*

Introduction

Since entering the 21st century, China has been affected by the reform of education policy, the popularization of Internet technology and the increasing demand for high-quality skills, and vocational education is facing new opportunities and challenges. In recent years, blended learning (BL) has grown to occupy an important space in Chinese educational practice (Ashraf, 2022). Rahim (2019). conducted research suggesting that blended learning offers a flexible learning platform and enhances practical motivation among learners. Novalinda (2020). 21st Century learning is a multi-faceted learning model that includes mobile learning, cloud computing, collaborative learning, mentorship, blended learning and student-centered education.

Blended learning has been found to have a positive impact on the development of students' 21st-century skills. Purwasih, Rahimullaily, & Suryani (2021). observed that the implementation of blended learning effectively improved students' critical thinking, creativity, communication, and collaboration abilities. Similarly, Chaiyama (2019). highlighted that integrating active learning activities with various digital resources can enhance learning skills in the 21st century, providing students with more study time and flexibility. Additio nally, Hadiyanto, Failasofah, Armiwati, Abrar, & Thabran (2021). emphasized that blended learning contributes to the practice of 21st-century skills by providing students with increased opportunities to practice and explore ideas, engage in discussions, utilize learning strategies, and receive feedback through the use of ICTs.

Research Objectives

1. To explore the influencing factors of 21st-century student skills at Heyuan Vocational and Technical College.

2. To examine the impact of blended learning on the development of 21st-century student skills at Heyuan Vocational and Technical College.

3. To provide valuable insights into the development of 21st-century student skills for vocational students by conducting a survey and data analysis of Heyuan Vocational and Technical College students.

Literature Reviews

Blended learning is an innovative approach that integrates traditional face-to-face instruction with online learning, creating a more personalized and flexible educational experience. It combines both physical and digital learning environments to enhance student engagement and learning outcomes (Graham, 2006; Graham, 2013). According to Hrastinski (2019), there are several conceptualizations of blended learning: 1) Inclusive Conceptualization: Focuses on using blended learning in an inclusive way to cater to diverse student needs and learning styles. 2) Quality Conceptualization: Emphasizes enhancing the quality of learning experiences and improving educational outcomes through the blended approach. 3) Quantity Conceptualization: Highlights the balance and proportion of face-to-face teaching compared to online learning in the blended model. 4) Synchronous Conceptualization: Stresses the importance of synchronizing teaching and learning activities in terms of time and location, providing real-time interactions. And 5) Digital Classroom Conceptualization: Focuses on the integration of digital technology in classrooms, using online tools and resources to facilitate learning.

Within blended learning, various teaching methods are applied:

Lecture: Traditional instructional method where information is delivered by the instructor, often supplemented with online materials (Bates, 2019).

Demonstration Method: Involves showing concepts or skills through videos or simulations, enhancing understanding (Sharma & Barrett, 2018).

Learning by Doing: Students engage in hands-on activities to apply theoretical concepts in real-world contexts (Schlechty, 2002).

Learning Facilitator: A facilitator creates a positive learning environment, guiding activities and providing support (Garrison & Vaughan, 2013).

Report: A written document or presentation demonstrating students' understanding of topics (Mouza & Herring, 2012).

Presentation: Students create and deliver presentations, using online tools for content delivery (Ally, 2008).

Self-Directed Learning: Learners take responsibility for planning, monitoring, and evaluating their learning, using both online and offline resources (Knowles, Holton, & Swanson, 2014).

Blended learning also incorporates E-learning, which refers to acquiring knowledge through digital platforms, enhancing education with a variety of online resources, including courses, multimedia materials, and virtual classrooms (Rosenberg, 2001). MOOCs (Massive Open Online Courses) offer large-scale online learning with interactive features like discussions and quizzes (Koller, Ng, Do, & Chen, 2013). Additionally, Online Meetings provide synchronous platforms for real-time learning, discussions, and collaboration (Salmon, 2013).

The development of 21st-century skills is critical in modern education. These skills are categorized into learning skills, literacy skills, and life skills (Geisinger, 2016). Key skills include problem-solving, communication, cooperation, critical thinking, and proficiency in information and communication technologies (Tican & Deniz, 2019). Akgunduz et al. (2015) identify creativity, critical thinking, problem-solving, and cooperation as essential "universal literacy" for success in higher education and career pathways.

Additional relevant 21st-century skills include:

Reading: The ability to comprehend, interpret, and critically evaluate written texts (Norris & Phillips, 2003).

Writing: Communicating effectively in writing, ensuring clarity and coherence (Graham & Perin, 2007).

Arithmetic: Applying mathematical concepts to real-life situations (National Research Council & Up, 2001).

Critical Thinking and Problem Solving: Analyzing and solving complex problems through logical reasoning and evidence-based decision-making (Abrami et al., 2008).

Creativity and Innovation: Generating original ideas and applying imaginative approaches (Sternberg, 2003).

Cross-Cultural Understanding: Engaging with diverse cultural perspectives to promote global awareness (Deardorff, 2009).

Collaboration, Teamwork, and Leadership: Working effectively in teams and demonstrating leadership (West, 2012).

Communication, Information, and Media Literacy: Proficiency in accessing, evaluating, and responsibly using communication and media sources (Livingstone & Helsper, 2007).

Computing and ICT Literacy: Competence in using digital technologies (Martin & Ertzberger, 2013).

Career and Learning Self-Reliance: Navigating career changes and engaging in lifelong learning (Hirschi, 2009). Blended learning is particularly effective in cultivating these skills. Chaiyama (2019) notes that blended learning improves digital literacy, systematic thinking, and knowledge acquisition through meaningful interactions with peers. Research suggests that blended learning enhances critical thinking and problem-solving by encouraging active learning and inquiry-based approaches (Johnson, Becker, Estrada, & Freeman, 2014). The integration of technology in blended learning environments fosters digital and information literacy (Pegrum, 2009), while collaborative learning opportunities enhance communication and teamwork skills, which are essential in the 21st-century workplace (Hadiyanto et al., 2021).

To develop 21st-century skills effectively, learning must adopt a student-centered approach, emphasize team collaboration, and be relevant to students' daily lives (Novalinda, Giatman, & FAJRA, 2020). This involves designing learning experiences that engage students in problem-solving, critical thinking, and decision-making processes. Hadiyanto et al. (2021) emphasize that designing appropriate blended learning materials and methods can provide students with practical opportunities to improve their performance in 21st-century skills. Chaiyama (2019) further suggests that integrated learning and active learning activities can enhance skills such as collaboration, teamwork, leadership, critical thinking, and problem-solving, fostering autonomy and learning-by-doing. Therefore, blended learning plays a crucial role in preparing students for the challenges and opportunities of the 21st century.

Research methodology

The study used a 5-point Likert scale questionnaire, with an overall reliability (IOC) of 0.94.

Target Population:

The population consists of 2,600 students from the Mechanical and Electrical Engineering College of Heyuan Vocational and Technical College. A sample of 401 students, including freshmen, sophomores, and juniors, was selected using convenience sampling.

Data Analysis:

Data was collected via an online survey using the Questionnaire Star platform. The survey was distributed on social media platforms like WeChat, Facebook, Twitter, and Instagram. The questionnaire contained 48 questions: 3 general questions, 10 related to Blended Learning, and 30 regarding 21st-Century Skills for vocational students. Respondents who failed screening questions were excluded, leaving 401 valid responses for analysis.

Descriptive statistics and multiple linear regression were used for data analysis, with statistical values evaluated using criteria such as:

4.51-5.00: Highest level

3.51-4.50: Very high

2.51-3.50: Moderate

1.51-2.50: Relatively low

1.01-1.50: Minimum value

Research Results

Table1 Comparative Analysis of Skills and Abilities of 21st Century Learners (3Rsx7Cs) by Gender

Skills and abilities of 21st century learners	Gender	n	□□	SD.	t	p
1.R1: Reading	Male	202	3.78	.771	1.156	.248
	Female	199	3.69	.740		
2.R2:(W)Riting	Male	202	3.75	.867	-.248	.805
	Female	199	3.77	.862		
3.R3:(A)Rithmetic	Male	202	3.80	.819	1.279	.201
	Female	199	3.70	.825		
4.C1:Critical thinking and problem solving	Male	202	3.74	.799	.596	.552
	Female	199	3.69	.796		
5.C2:Creativity and Innovation	Male	202	3.87	.766	1.312	.190
	Female	199	3.77	.745		
6.C3: Cross-cultural understanding	Male	202	3.91	.732	-.119	.905
	Female	199	3.92	.747		
	Male	202	3.84	.690	.427	.670

7.C4: Collaboration, Teamwork, and Leadership	Female	199	3.81	.737		
8.C5: Communication, Information, and Medial Literacy	Male	202	3.83	.777	-.442	.659
	Female	199	3.87	.855		
9.C6: Computing and ICT literacy	Male	202	3.87	.700	-.168	.866
	Female	199	3.89	.674		
10.C7: Career and learning self-reliance	Male	202	3.97	.691	-.019	.985
	Female	199	3.97	.652		
Overview of Skills and Abilities 21st Century Learners			3.82	0.762	0.377	0.608

This table analyzes the differences in 21st-century skill levels between male and female students. The results show that no significant differences were found across the various skills, as indicated by the following t-test results:

Reading Skills (R1): No significant difference in skill levels between genders (t = 1.156, P = .248). Writing Skills (R2): No significant difference in skill levels between genders (t = -0.248, P = .805). Arithmetic Skills (R3): No significant difference in skill levels between genders (t = 1.279, P = .201). Critical Thinking and Problem-solving (C1): No significant difference in skill levels between genders (t = 0.596, P = .552). Creativity and Innovation (C2): No significant difference in skill levels between genders (t = 1.312, P = .190). Cross-Cultural Understanding (C3): No significant difference in skill levels between genders (t = -0.119, P = .905). Collaboration, Teamwork, and Leadership (C4): No significant difference in skill levels between genders (t = 0.427, P = .670). Communication, Information, and Media Literacy (C5): No significant difference in skill levels between genders (t = -0.442, P = .659). Computing and ICT Literacy (C6): No significant difference in skill levels between genders (t = -0.168, P = .866). Career and Learning Self-Reliance (C7): No significant difference in skill levels between genders (t = -0.019, P = .985). In conclusion, gender does not appear to influence the 21st-century skill levels of students at Heyuan Vocational and Technical College across the skills measured in this study.

Table 2 Display a comparison of skills and abilities of 21st century learners categorized by age range

Skills and abilities of 21st century learners	**Age range**	**n**	□□	**SD.**	**F**	**P**
R1: Reading	Less than 19years	155	3.74	.756	.245	.783
	20 – 22 years	202	3.75	.766		
	Over 22 years old	44	3.67	.722		

Total		401	3.74	.756		
R2:(W)Riting	Less than 19years	155	3.75	.855	.720	.488
	20 – 22 years	202	3.79	.858		
	Over 22 years old	44	3.62	.922		
Total		401	3.76	.863		
R3:(A)Rithmetic	Less than 19years	155	3.74	.812	.364	.695
	20 – 22 years	202	3.74	.834		
	Over 22 years old	44	3.85	.817		
Total		401	3.75	.823		
C1:Critical thinking and problem solving	Less than 19years	155	3.71	.802	.005	.995
	20 – 22 years	202	3.71	.785		
	Over 22 years old	44	3.72	.848		
Total		401	3.71	.797		
C2:Creativity and Innovation	Less than 19years	155	3.83	.792	.199	.819
	20 – 22 years	202	3.82	.747		
	Over 22 years old	44	3.85	.679		
Total		401	3.82	.756		
C3:Cross-cultural understanding	Less than 19years	155	3.91	.702	.112	.894
	20 – 22 years	202	3.93	.776		
	Over 22 years old	44	3.88	.704		
Total		401	3.92	.739		
C4: Collaboration, Teamwork, and Leadership	Less than 19years	155	3.86	.678	.527	.591
	20 – 22 years	202	3.82	.732		
	Over 22 years old	44	3.75	.749		
Total		401	3.83	.713		
C5:Communication, Information, and Medial Literacy	Less than 19years	155	3.89	.828	.379	.685
	20 – 22 years	202	3.83	.805		
	Over 22 years old	44	3.79	.835		
Total		401	3.85	.816		
C6: Computing and ICT literacy	Less than 19years	155	3.90	.690	.180	.836
	20 – 22 years	202	3.88	.684		
	Over 22 years old	44	3.82	.695		
Total		401	3.88	.686		
C7: Career and learning self-reliance	Less than 19years	155	3.95	.641	.162	.851
	20 – 22 years	202	3.98	.697		
	Over 22 years old	44	4.00	.668		

Total		401	3.97	.671		

This table analyzes the differences in 21st-century skill levels among students based on their age range. The following results were observed: Reading Skills (R1): No significant difference in skill levels across age groups (F = 0.245, P = .783). Writing Skills (R2): No significant difference in skill levels across age groups (F = 0.720, P = .488) Arithmetic Skills (R3): No significant difference in skill levels across age groups (F = 0.364, P = .695). Critical Thinking and Problem-solving (C1): No significant difference in skill levels across age groups (F = 0.005, P = .995). Creativity and Innovation (C2): No significant difference in skill levels across age groups (F = 0.199, P = .819). Cross-Cultural Understanding (C3): No significant difference in skill levels across age groups (F = 0.112, P = .894). Collaboration, Teamwork, and Leadership (C4): No significant difference in skill levels across age groups (F = 0.527, P = .591). Communication, Information, and Media Literacy (C5): No significant difference in skill levels across age groups (F = 0.379, P = .685). Computing and ICT Literacy (C6): No significant difference in skill levels across age groups (F = 0.180, P = .836). Career and Learning Self-Reliance (C7): No significant difference in skill levels across age groups (F = 0.162, P = .851). In conclusion, there are no significant differences in the 21st-century skill levels of students based on their age range. The skill levels are consistent across the different age groups in this study.

Table 3 Display a comparison of 21st century learners' skills and abilities by year of study.

Skills and abilities of 21st century learners	**Year of study**	**n**	□□	**SD.**	**F**	**P**
R1: Reading	Freshman	130	3.69	.792	.580	.560
	Sophomore	138	3.78	.727		
	Junior	133	3.74	.753		
Total		401	3.74	.756		
R2:(W)Riting	Freshman	130	3.68	.894	1.479	.229
	Sophomore	138	3.86	.809		
	Junior	133	3.73	.884		
Total		401	3.76	.863		
R3:(A)Rithmetic	Freshman	130	3.66	.875	1.311	.271
	Sophomore	138	3.78	.795		
	Junior	133	3.81	.796		
Total		401	3.75	.823		
	Freshman	130	3.65	.819	.665	.515

C1:Critical thinking and problem solving	Sophomore	138	3.75	.778		
	Junior	133	3.74	.796		
Total		401	3.71	.797		
C2:Creativity and Innovation	Freshman	130	3.76	.801	1.321	.268
	Sophomore	138	3.90	.758		
	Junior	133	3.79	.705		
total		401	3.82	.756		
C3:Cross-cultural understanding	Freshman	130	3.77	.740	5.118	.006*
	Sophomore	138	4.06	.682		
	Junior	133	3.92	.771		
total		401	3.92	.739		
C4: Collaboration, Teamwork, and Leadership	Freshman	130	3.79	.721	1.072	.343
	Sophomore	138	3.90	.670		
	Junior	133	3.79	.746		
total		401	3.83	.713		
C5:Communication, Information, and Medial Literacy	Freshman	130	3.81	.852	.371	.690
	Sophomore	138	3.89	.802		
	Junior	133	3.84	.799		
total		401	3.85	.816		
C6: Computing and ICT literacy	Freshman	130	3.83	.700	.410	.664
	Sophomore	138	3.90	.693		
	Junior	133	3.90	.669		
total		401	3.88	.686		
C7: Career and learning self-reliance	Freshman	130	3.82	.656	2.905	.056
	Sophomore	138	4.02	.704		
	Junior	133	4.03	.641		
total		401	3.97	.671		

According to this analysis, the differences in 21st-century skill levels among students based on individual learning grades were examined for various skills. The results are as follows:

Cross-Cultural Understanding (C3): There is a significant difference in skill levels based on learning grades (F = 5.118, P = .006*), indicating that the level of cross-cultural understanding varies significantly across different learning grades.

Collaboration, Teamwork, and Leadership (C4): No significant difference in skill levels based on learning grades (F = 1.072, P = .343).

Communication, Information, and Media Literacy (C5): No significant difference in skill levels based on learning grades (F = 3.71, P = .690).

Computing and ICT Literacy (C6): No significant difference in skill levels based on learning grades (F = 0.410, P = .664).

Career and Learning Self-Reliance (C7): There is a marginally significant difference in skill levels based on learning grades (F = 2.905, P = .056), which may require further investigation to determine if this difference holds at a more stringent significance level.

Cross-Cultural Understanding (C3)

The statistical significance (F = 5.118, P = .006) indicates that cross-cultural understanding skills vary significantly based on learning grades. A post-hoc Scheffé test was conducted to further investigate these differences and determine where the specific differences lie between the groups.

Table 4 Comparison Table of Cross-cultural understanding Ability in the 21st Century Classification by Grade and Senior Exam

Year of study	**Freshman (□□ =3.77)**	**Sophomore (□□ =4.06)**	**Junior (□□ =3.92)**
Freshman (□□ =3.77)		.006*	.239
Sophomore (□□ =4.06)			.327
Junior (□□ =3.92)			

From the table, it can be seen that there are paired differences between Freshman and Sophomore. Different classes have the skill levels of learners of this century. 21 Different Cross-cultural understanding Skills: Sophomore Students average level of Cross-cultural understanding skills is higher than Freshman's (□□ = 4.06 and □□ = 3.77 respectively).

In the analysis of variables, researchers defined the following meanings and symbols:

Table 5 Analyzing the relationship between supportive factors that affect students' 21st century skills

Predictive variables	**B**	**beta**	**t**	**p**
Constant	.691		9.117	0.00
Learning by doing (X1)	.112	.181	6.316	0.00
Learning Facilitator (X2)	.134	.186	7.513	0.00
Online Meeting (X3)	.108	.173	6.595	0.00
Lecture (X4)	.083	.136	5.413	0.00
Report (X5)	.089	.144	5.427	0.00
Presentation (X6)	.081	.127	4.925	0.00
e-Learning (X7)	.072	.093	3.924	0.00

Self directed Learning (X8)	.064	.080	3.614	0.00
Demonstration Method (X9)	.053	.078	3.467	0.00
MOOCs (X10)	.030	.045	2.021	0.00

The statistical analysis at the 0.05 significance level reveals that all ten teaching methods—on-site learning, learning facilitators, online meetings, lectures, reports, presentations, e-learning, self-directed learning, demonstration methods, and MOOCs—effectively predict 21st-century skills. The regression models show significant predictive power for all variables.

Regression Model (Raw Scores): Y = 0.691 + 0.112X1 + 0.134X2 + 0.134X3 + 0.108X4 + 0.083X5 + 0.089X6 + 0.072X7 + 0.064X8 + 0.053X9 + 0.030X10

Regression Model (Standard Scores): Y = 0.181X1 + 0.186X2 + 0.173X3 + 0.136X4 + 0.144X5 + 0.127X6 + 0.093X7 + 0.080X8 + 0.078X9 + 0.045X10

Key findings include:

Personal factors significantly influence 21st-century skills, especially cross-cultural understanding, where Sophomores showed higher levels than Freshmen ($\bar{x}$ = 4.06 vs. $\bar{x}$ = 3.77). Blended learning methods such as learning by doing, facilitator presence, and online meetings positively impacted students' skills, supporting findings from previous studies (Chaiyama, 2019; Hadiyanto et al., 2021).

In conclusion, blended learning significantly enhances 21st-century skills, preparing students for success in both academic and professional spheres.

Recommendations

Cross-cultural understanding improves as students progress through the learning process. Educators should incorporate experiential learning, social activities, and other strategies to enhance students' cross-cultural awareness within blended learning environments.

Based on the findings, it is recommended to design educational interventions that combine effective learning methods, such as online meetings, lectures, presentations, and e-learning platforms, with traditional classroom settings. Creating a supportive learning environment that encourages active learning, self-directed learning, collaboration, and technology integration is key to optimizing skill development. Fostering cross-cultural understanding and literacy will further enhance students' 21st-century competencies.

Future Research

This study focuses on the impact of blended learning on developing 21st-century skills. Future research could explore the influence of learner and teacher factors on skill development. Additionally, comparing the effectiveness of blended learning across different

vocational colleges, such as Heyuan Vocational and Technical College, would provide valuable insights into its impact in various educational contexts.

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