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A Study on the Integration of Series-Parallel Educational Paths and Triggered Teaching Behaviour with ChatGPT

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Abstract
ChatGPT, a highly versatile tool offered free of charge by OpenAI, has garnered significant attention worldwide. However, its integration into teaching and learning environments has been met with apprehension among educators. At Mianyang Teacher's College, an institution dedicated to preparing future educators in China, lecturers have actively incorporated and refined series-parallel educational processes since 2022, leveraging ChatGPT to enhance teaching methodologies. This study aims to explore effective strategies for integrating ChatGPT into educational practices to improve teaching strategies and behaviours. Employing a mixed-methods approach

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combining quantitative and qualitative data, the research involved 1,000 university students across six diverse disciplines. The findings reveal that the integration of ChatGPT has positively influenced series-parallel educational trajectories, enhancing teaching efficiency, fostering innovation, and increasing productivity. These results indicate that ChatGPT has the potential to facilitate transformative changes within educational contexts. Furthermore, the study provides evidence supporting the adoption of ChatGPT as a tool to drive positive developments in education, emphasising the need for educators to explore technology integration models that effectively incorporate ChatGPT into teaching and learning frameworks.

Keywords: ChatGPT; Integration; Series-Parallel Educational Paths; Technology-Enhanced Learning and Teaching; Triggered Teaching Behaviour; Educational Settings

Introduction

The advancement of artificial intelligence (AI) technology has introduced both opportunities and challenges to technology-enhanced teaching and learning, while simultaneously driving significant progress in educational environments (Ardi & Rianita, 2022). ChatGPT, an innovative AI platform launched in 2022, has garnered considerable attention due to its advanced capabilities (Rosli et al., 2022). Recognised as one of the most sophisticated natural language processing tools developed to date, ChatGPT excels in performing dialogue tasks with greater naturalness, accuracy, and coherence compared to other AI technologies. Within two months of its public release in November 2022, the platform achieved remarkable traction, with over one million users registering accounts and engaging with its features. Despite its rapid adoption, educators have expressed diverse concerns regarding its integration into educational contexts (Aljuaid, 2024). This raises critical questions for educational researchers about whether ChatGPT will serve as a constructive tool to enhance learning environments or pose challenges that may disrupt traditional pedagogical practices.

Public schools in the United States have opted to block access to ChatGPT to prevent students from engaging in plagiarism. Similarly, at RV University in India, students are prohibited from using ChatGPT for assignments due to concerns that it could be exploited to automatically generate coursework. The New York City Department of Education has expressed apprehensions that the tool could impede the development of critical thinking and problem-solving skills among students (Nadiah & Tristy Kartika, 2023). In China, the editors-in-chief of Philosophy and Social Sciences (Journals of Jinan University) and Basic Education (published by Tianjin Normal University) have announced a policy rejecting submissions written with assistance from AI tools like ChatGPT. Despite these restrictions, some university professors maintain that AI technology can be utilised in educational contexts, provided it is employed responsibly and within legal boundaries.

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Despite varying perspectives on ChatGPT, the tool holds potential for integration into educational contexts. Since 2020, staff at Mianyang Teacher's College, a leading educational institution in China, have undertaken efforts to incorporate ChatGPT into their teaching practices (Md Yunus et al., 2019; Rao, 2020). This initiative has been implemented with 1,000 students across six disciplines: digital media technology, radio and television, broadcasting and hosting, as well as visual communication, interior design, and clothing design. The proposed research seeks to address the following questions:

1. What is the level of effectiveness and innovation associated with using series-parallel interactive strategies in teaching activities?
2. How can series-parallel teaching paths be integrated and innovated with the support of ChatGPT?
3. How can triggered teaching behaviours be integrated and innovated through the utilisation of ChatGPT?

Literature Review

A. Technology-Enhanced Education

Technology-enhanced education has become a significant area of research, with studies highlighting its potential to improve student performance and engagement (Ibarra, 2024). Research by Hwang and Tsai (2011); Ibarra (2024) underscores the pivotal role of technology in enhancing teaching and learning. Notably, Zhou et al. (2023) emphasised the effectiveness of mobile learning in providing tailored and flexible educational experiences.

B. ChatGPT in Education

ChatGPT, an artificial intelligence tool, generates text in response to user inputs and shows significant potential in higher education, particularly for enhancing students' writing skills (Zhang et al., 2011). It enables text creation, summarisation, grammar correction, and translation, improving both efficiency and output quality (Namaziandost & Nasri, 2019). Furthermore, ChatGPT aids research by providing extensive resources, introducing unexplored aspects, and fostering a deeper understanding of topics (Kasneci et al., 2023). However, concerns persist regarding its misuse for assignments and potential plagiarism. Khalil and Er (2023) found that 40 out of 50 essays generated by ChatGPT showed similarity scores of 20% or below, indicating originality. Nonetheless, in February 2023, Turnitin claimed its AI tool could detect 97% of ChatGPT-generated texts. Despite these concerns, ChatGPT demonstrates promise in educational settings when used with appropriate teaching strategies. It has proven particularly valuable in language education, offering coherent text generation and support for various language tasks (Kohnke et al., 2023). Chatbots

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like ChatGPT also provide interactive and personalised learning experiences, making them beneficial tools for language teachers (Lee, Yang, Shin & Kim, 2020).

C. ChatGPT in Mianyang Teacher's College

Mianyang Teacher's College, a public institution in Sichuan province, southwest China, is dedicated to training future educators and hosts over 19,000 local and international students across 51 majors. As Sichuan's leading teacher education and training academy, the college has implemented various strategies since 2016 to drive educational reform. Following the public release of ChatGPT in 2022, the college actively encouraged its integration into teaching and learning activities. During the December 2022 conference of the Teaching and Research Department of Digital Media Technology at the School of Media and Communication, several professors expressed support for incorporating AI, including ChatGPT, into college curricula (Adamopoulou & Moussiades, 2020). Since then, the innovation and integration of ChatGPT into teaching practices have been continuously advanced in local educational settings (Heredia Ponce et al., 2022).

D. The Origin and Development of Series-Parallel Educational Paths and Triggered Teaching Behaviour

Between 2014 and 2018, the Department of Science and Technology in Sichuan province supported the Seedling Project, which focused on the application of technology in education and underscored its significance in college curricula. In the 2019–2020 academic year, María Gabriela (2022) introduced innovative thinking practices into an educational reform project using an interactional teaching approach, primarily in the context of subject competitions. This approach, combined with critique and activity-based methods, aimed to develop students' skills in innovative thinking, competition awareness, and output values. In 2022, Zhou and Zhang (2022) proposed the series-parallel triggered mode and interactive strategies, which were applied for nearly a year with positive outcomes, engaging students in subject competitions, innovation, entrepreneurship, and scientific research. These strategies required critical, creative, and reporting thinking processes to develop an interactive teaching plan, aiming to improve teaching efficiency, student interactions, and the effectiveness of assessment systems. The advancement of ChatGPT technology has led to the evolution of the series-parallel triggered interactive strategy, requiring attributes such as intelligence, multidimensionality, and adaptability. This has prompted further upgrades to the teaching approach. In December 2022, the strategy was refined into series-parallel education paths and triggered teaching behaviours. As a result, the integration of ChatGPT into teaching practices has been revisited and enhanced, with ongoing research aimed at extending and optimising this new approach (Gu, 2024; Gurcan et al., 2020).

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E. Series-Parallel Teaching Educational Paths

According to Zhou and Zhang (2022), the series-parallel teaching strategy is a concept derived from physics, which was adapted to education through the integration of various elements of the curriculum, such as content, goals, methods, evaluation, extracurricular activities, learning environment, implicit curriculum, and culture. This strategy begins with a serial path (A), which is connected to path (B) through teaching methods and further linked to path (C) through evaluation, forming an effective teaching trajectory known as the serial teaching path. The parallel path, within the ABC serial teaching framework, involves the integration of additional paths, such as competitions (a), innovation and entrepreneurship (b), and scientific research projects (c). The combination of these ABC and abc paths creates an effective series-parallel teaching pathway (see Figure 1).

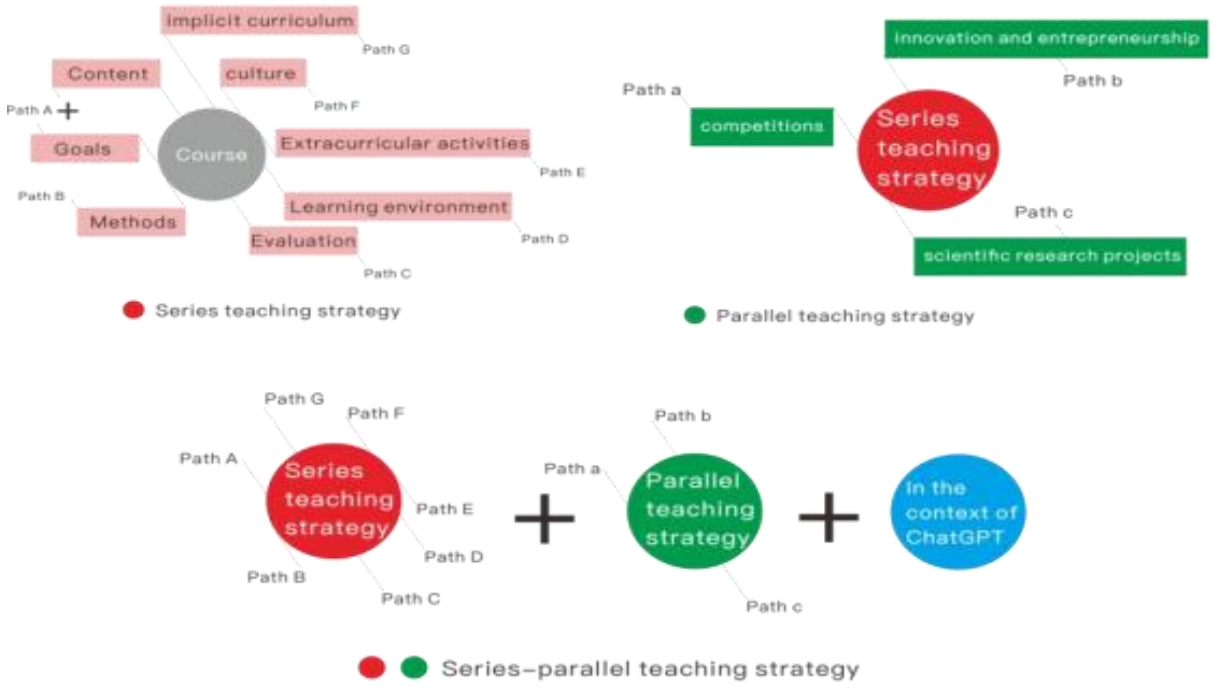

Figure 1: Series–Parallel Teaching Educational Paths.

In the context of ChatGPT's integration into education, it is essential to purposefully design and implement each teaching path within the series-parallel teaching framework, ensuring that each path is systematically verified and tested. The effects and experiences of each path should be integrated with a supervisory mechanism to optimise outcomes and assess the fairness of the results (Strzelecki, 2024). However, the selection of series-parallel teaching paths can differ across groups, with varying effect variables. In the parallel teaching path, it is particularly important to integrate and innovate with ChatGPT, with a focus on fostering innovation. The emphasis should be on supervising the innovation process and the generation of outputs. Additionally, in the parallel path, trigger-based teaching-behaviour integration is necessary, with ChatGPT serving to complement and enhance this behavioural process (Rasul, 2023).

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F. Triggered Teaching Behaviour

The term "trigger" originally refers to the process of creating effective conditions and generating responses that align with specific goals and requirements. In the series-parallel teaching strategy (Budiman, 2020), triggers are applied to the effective paths, such as ABC and abc, through collective or individual actions. These triggers include behaviour-based elements like critical thinking, innovative thinking, and reporting thinking. Together, these elements are referred to as triggered teaching behaviour (see Figure 2).

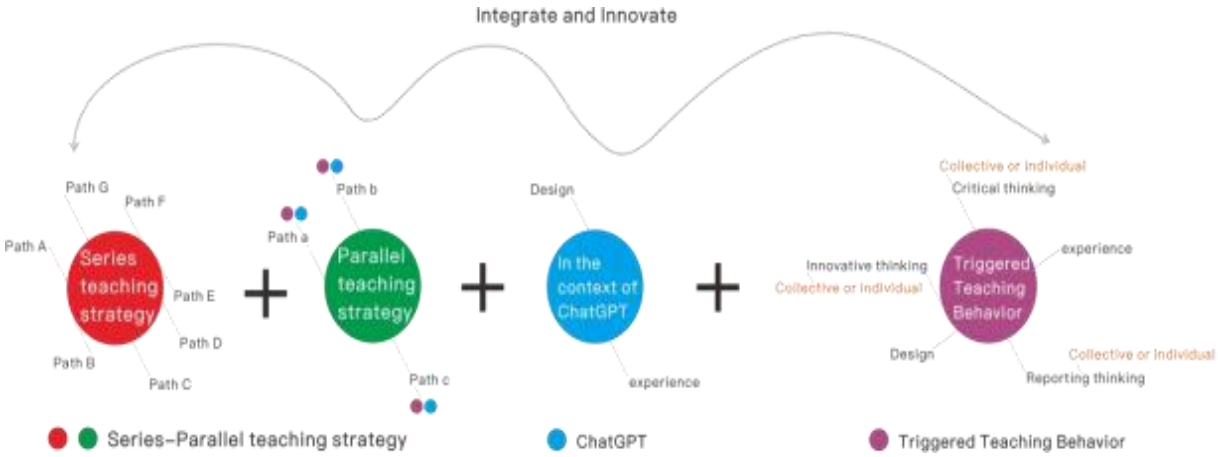

Figure 2: Triggered Teaching Behaviour.

In the context of ChatGPT, integrating trigger-based teaching behaviour with ChatGPT technology is crucial for achieving teaching goals and ensuring effectiveness (Alotaibi & Alzu'bi, 2021). The sequence of trigger-based teaching and ChatGPT behaviour must be carefully managed. To maximise the triggering effect, it is essential not only to apply trigger-based teaching behaviours but also to leverage ChatGPT's capabilities to maintain innovation and fairness during the evaluation process. When initiating teaching behaviours, critical thinking (B1), innovative thinking (B2), and reporting thinking (B3) are selected as triggers, alongside other behaviours (H). Teachers' behaviour (B-t) and students' behaviour (B-s) are key factors in the behaviour trigger selection and switching. Using the parallel teaching path as a framework, Path a can be launched as a competition project, with various sub-paths (a1 to a6) for different stages, such as strategy analysis (Path a3) or creative association (Path a4). Path a1-H1-H1-H1-H-s is used for behaviour fusion. The commonly employed methods for triggering behaviours include direct (D), indirect (I), guidance (G), inquiry (A), suggestion (PR), tone (T), real-time student status (SRS), criticism (C), summary (S), assessment (AS), performance (P), and group discussion (D). These behaviours are recorded (RE) and tracked (TR) throughout the teaching process, with predictions made based on environmental (EN) and effect conditions (EF). Ultimately, integrating these triggers with ChatGPT (CHT) facilitates the innovation and enhancement of serial and parallel educational paths and teaching behaviours (see Table 1).

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Table 1: Triggered Behaviour Code Summary.

Category	Code	Description
Critical Thinking	B1	
Innovative Thinking	B2	
Reporting Thinking	B3	
Teacher Behaviour	B-t	
Student Behaviour	B-s	
Direct	D	Teacher asks, positive tone, real-time status of students
Indirect	I	Student asks, student proposes, low status, high status
Guide	G	Teacher proposes, criticizes, teacher criticizes, student criticizes
Ask	A	Teacher asks, tone negative, summary, teacher summary, student summary
Tone	T	Positive tone, negative tone
Student Real-Time Status	SRS	High status, low status
Assessment	AS	Teacher assessed, student assessed
Performance	P	Performance good, performance bad
Discussion	D	Group discussion, teacher participation in discussion
Tracks	TR	Tracks
Environment	EN	Environment
Effect	EF	Effect
ChatGPT	CHT	Integration with ChatGPT

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Methodology

The study used exploratory, quantitative, and qualitative research methods, with data collected through both quantitative and qualitative approaches. Quantitative data were gathered from experimental data during the teaching and learning process at Mianyang Teacher's College, while qualitative data were obtained through semi-structured interviews conducted via telephone, e-mail, or face-to-face.

A. Quantitative Research

a) Time Dimension

Data collection took place from July 2020 to the present, with updates and reflections on the research content occurring at several intervals: July 2020, March 2021, August 2022, September 2022, January 2023, and the current period, as shown in Figure 3.

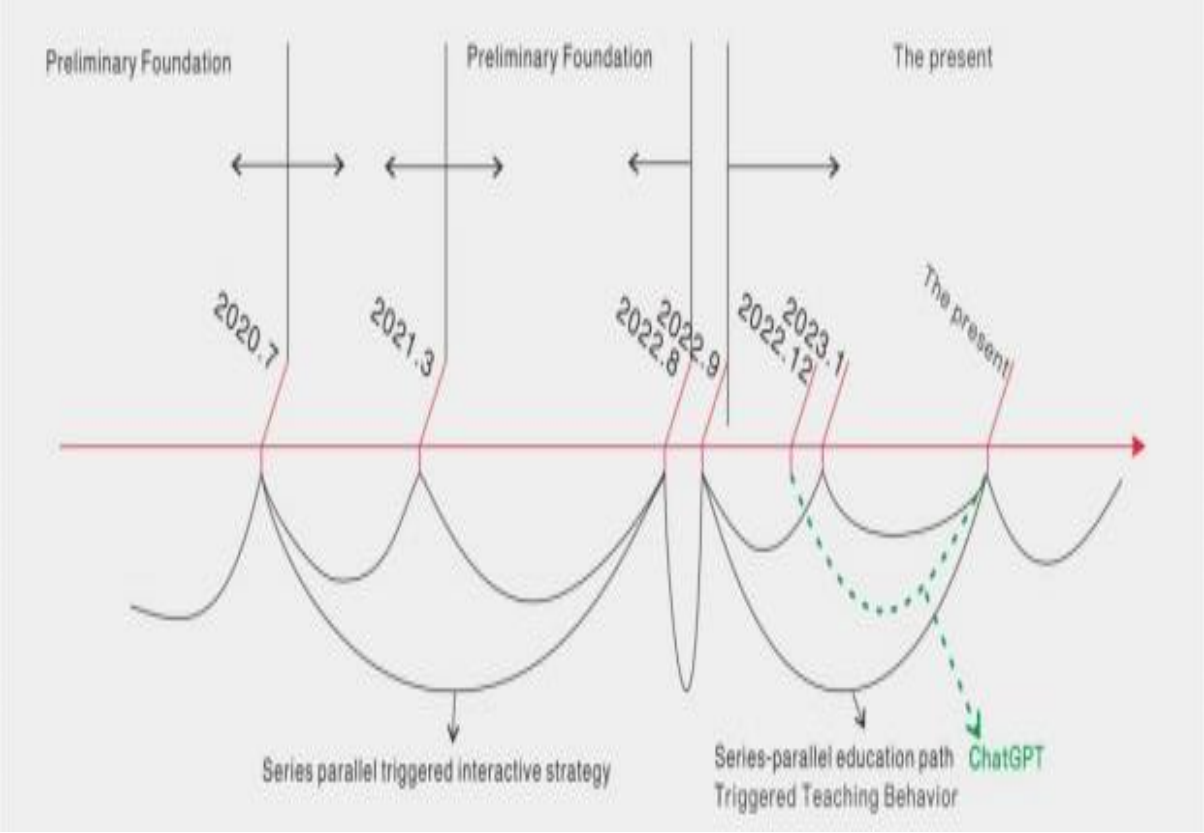

Figure 3: Time Dimension

b) Scope of Research Objects

The survey was initially completed by 794 students from the humanities, engineering, and art faculties before September 2022, with 504 responses compiled. Following September 2022, 443 students participated in the follow-up, of which 239 were tracked, as shown in Table 2.

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Table 2: Scope of Research Objects.

Semester	Course	Teacher	Student	Track	Result	Profession	Subject
2020.7-2021.1	Human-Computer Interaction Design	GuoLi Zhou	36	Y	Y	Digital Media Technology	Engineering Course
2020.7-2021.1	Animation Production	GuoLi Zhou	86	\	Y	Radio and Television	Liberal Arts
2020.7-2021.1	Digital Colours and Applications	GuoLi Zhou	42	Y	Y	Radio and Television	Liberal Arts
2021.3-12	Film and Television Special Effects and Production	GuoLi Zhou	40	\	Y	Broadcasting and Hosting	Art
2021.3-12	Computer Graphic Design	GuoLi Zhou	48	Y	Y	Digital Media Technology	Engineering Course
2021.3-12	Computer-Aided Design	GuoLi Zhou	36	\	N	Digital Media Technology	Engineering Course
2021.3-12	Digital Colours and Applications	GuoLi Zhou	83	Y	Y	Radio and Television	Liberal Arts
2021.3-12	Human-Computer Interaction Design	GuoLi Zhou	47	Y	Y	Digital Media Technology	Engineering Course
2021.3-12	Photoshop	GuoLi Zhou	38	Y	Y	Visual Communication Design	Art
2021.3-12	CorelDraw	GuoLi Zhou	30	\	Y	Interior design, Clothing design	Art
2021.3-12	Creative Graphic Design	GuoLi Zhou	47	\	Y	Digital Media Technology	Engineering Course

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2022.1-2022.8	Film and Television Special Effects and Production	GuoLi Zhou	22	\	Y	Broadcasting and Hosting	Art
2022.1-2022.8	Computer Graphic Design	GuoLi Zhou	48	Y	Y	Digital Media Technology	Engineering Course
2022.1-2022.8	E-commerce Visual Design	GuoLi Zhou	71	\	Y	Visual Communication Design	Art
2022.9-2023.1	Digital Colours and Applications	GuoLi Zhou	96	Y	Y	Radio and Television	Liberal Arts
2023.1	Creative Graphic Design	GuoLi Zhou	46	Y	Y	Digital Media Technology	Engineering Course
2023.1	Human-Computer Interaction Design	GuoLi Zhou	46	Y	In Progress	Digital Media Technology	Engineering Course
2023.1	E-Commerce Visual Design	GuoLi Zhou	91	\	In Progress	Visual Communication Design	Art
2023.1-Present	Film and Television Special Effects and Production	GuoLi Zhou	96	\	In Progress	Radio and Television	Liberal Arts
2023.1-Present	Creative Graphic Design	GuoLi Zhou	17	\	In Progress	Radio and Television	Liberal Arts
2023.1-Present	Computer Graphic Design	GuoLi Zhou	51	Y	In Progress	Digital Media Technology	Engineering Course
Total			443	239			

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c) Integrating the Interactive Strategy of Series–Parallel Triggering into the Teaching Process

The series-parallel triggered interactive strategy was implemented in teaching practices from July 2020 to August 2022. The integration aimed to improve teaching efficiency, and enhancements were applied to courses with high teaching impact, as shown in Table 3.

Table 3: Integrating Series–Parallel Trigger Interactive Strategies into Teaching

Semester	Course	Student	Track	Series	Parallel	Triggered	Result Effect
2020	Human-Computer Interaction Design	36	Y	Y	Y-path abc	B1-B2-B3	Y
2020	Animation Production	86	N	Y	Y-path a	B1-B2-B3	Y
2020	Digital Colours and Applications	42	Y	Y	Y-path a	B1-B2-B3	Y
2021	Film and Television Special Effects and Production	40	N	Y	Y-path a	B1-B2	Y
2021	Computer Graphic Design	48	Y	Y	Y-path a	B1-B2-B3	Y
2021	Computer-Aided Design	36	N	Y	N	B3	N
2021	Digital Colours and Applications	83	Y	Y	Y-path a	B1-B2-B3	Y
2021	Human-Computer Interaction Design	47	Y	Y	Y-path abc	B1-B2-B3	Y
2021	Photoshop	38	Y	Y	Y-path a	B1-B2	Y
2021	CorelDraw	30	N	Y	Y-path a	B1-B2	Y
2021	Creative Graphic Design	47	N	Y	Y-path ab	B1-B2	Y
2022	Film and Television Special Effects and Production	22	N	Y	Y-path a	B1-B2-B3	Y
2022	Computer Graphic Design	48	Y	Y	Y-path a	B1-B2-B3	Y
2022	Comprehensive Course Design	36	Y	Y	Y-path abc	B1-B2-B3	Y
2022	Film and Television Special Effects and Production	84	Y	Y	Y-path a	B1-B2-B3	Y
2022	E-Commerce Visual Design	71	N	Y	Y-path abc	B1-B2-B3	Y
Total		794	462				

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d) Integrating Touch-Style Interactive Strategies into the Course

Between July 2020 and August 2022, the specific trigger interaction strategy activated critical thinking (B1), innovative thinking (B2), and reporting thinking (B3) in effective courses. The triggered codes and integration process are detailed in the following section (see Table 4).

Table 4: Integration of Interactive Strategies into the Course.

Semester	Course	Parallel	Triggered	Guide	Ask	Tone	Propose
2020	Human Computer Interaction Design	Y-Path abc	B1-B2-B3	G	A T	TP	PRT
2020	Animation Production	Y-Path a	B1-B2-B3	G	A T	TP	PRT
2020	Digital Colours and Applications	Y-Path a	B1-B2-B3	G	A T	TP	PRT
2021	Film and Television Special Effects and Production	Y-Path a	B1-B2	G	A T	TP	PRT
2021	Computer Graphic Design	Y-Path a	B1-B2-B3	G	A T	TP	PRT
2021	Computer-Aided Design	N	B3	G	A T	T	PRT
2021	Digital Colours and Applications	Y-Path a	B1-B2-B3	G	A T	TP	PRT
2021	Human Computer Interaction Design	Y-Path abc	B1-B2-B3	G	A T	C S	PR S
2021	Photoshop	Y-Path a	B1-B2	G	A T	T W	PRT
2021	CorelDraw	Y-Path a	B1-B2	G	A	T	PRT
2021	Creative Graphic Design	Y-Path ab	B1-B2	G	A T	S R	PR
2022	Film and Television Special Effects and Production	Y-Path a	B1-B2-B3	G	A T	T P	PRT
2022	Computer Graphic Design	Y-Path a	B1-B2-B3	G	A T	T P	PRT
2022	Comprehensive Course Design	Y-Path abc	B1-B2-B3	G	A T	C S	PR S
2022	Film and Television Special Effects and Production	Y-Path a	B1-B2-B3	G	A T	T P	PRT
2022	E-Commerce Visual Design	Y-Path abc	B1-B2-B3	G	A T	C S	PR S
2022	Film and Television Special Effects and Production	Y-Path a	B1-B2-B3	G	A T	T P	PRT

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e) Integration of Series -Parallel Education Path and ChatGPT

From December 2022 to the present, the goal has been to integrate the serial and parallel approach with ChatGPT's education paths to enhance the multidimensionality and effectiveness of the teaching process. Path A introduced course content, Path B focused on teaching methods, and Path C addressed course assessment. This integration contributed to making the teaching process more intelligent and streamlined (see Tables 5, 6, 7, and 8).

Table 5: Integration of Serial–Parallel Education Paths with ChatGPT.

Semester	Course	Teacher	Path A	Path B	Path C	Path D	Path a	Path b	Path c
2022.12-2023.1	Digital Colours and Applications	GuoLi Zhou	GPT	GPT	GPT	GPT	GPT	\	\
2022.12-2023.1	Creative Graphic Design	GuoLi Zhou	GPT	GPT	GPT	GPT	GPT	GPT	\
2023.3-Present	Human-Computer Interaction	GuoLi Zhou	GPT	GPT	GPT	GPT	GPT	GPT	GPT
2023.3-Present	E-commerce Visual Design	GuoLi Zhou	\	\	\	\	GPT	GPT	GPT
2023.3-Present	Film and Television Special Effects Production	GuoLi Zhou	\	\	\	\	GPT	\	\
2023.3-Present	Creative Graphic Design	GuoLi Zhou	\	\	\	\	GPT	GPT	\
2023.3-Present	Computer Graphic Design	GuoLi Zhou	GPT	GPT	GPT	GPT	GPT	\	\

Table 6: Integration of Parallel Path a and ChatGPT.

Semester	Course	Category	Publish Path a1	Require Path a2	Analyse Path a3	Associate Path a4	Expression Path a5	Output Path a6
2022.12-2023.1	Digital Colours and Applications	C3	\	\	GPT	GPT	GPT	\
2022.12-2023.1	Creative Graphic Design	C3	\	\	GPT	GPT	GPT	\
2023.3-present	Human-Computer Interaction	C4	\	\	GPT	GPT	GPT	\
2023.3-present	E-commerce Visual Design	C4	\	\	GPT	GPT	GPT	\
2023.3-present	Film and Television Special Effects Production	C1	\	\	GPT	GPT	GPT	\
2023.3-present	Creative Graphic Design	C1	\	\	GPT	GPT	GPT	\

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Table 7: Integration of Parallel Path b and ChatGPT.

Semester	Course	Category	Publish Path b1	Require Path b2	Analyse Path b3	Associate Path b4	Write Path b5	Roadshow Path b6	Output Path b7
2023.3-Present	Human-Computer Interaction	IE1-2-3	\	\	GPT	GPT	GPT	\	\
2023.3-Present	E-Commerce Visual Design	IE1-2-3	\	\	GPT	GPT	GPT	\	\

Table 8: Integration of Parallel Path c and ChatGPT

Semester	Course	Category	Publish Path c1	Require Path c2	Analyse Path c3	Associate Path c4	Mind Mapping Path c5	Write Path c6	Output Path c7
2022.12-2023.1	Creative Graphic Design	SRP2	\	GPT	GPT	GPT	GPT	GPT	\
2023.3-Present	Human-Computer Interaction	SRP1, SRP3	\	GPT	GPT	GPT	GPT	GPT	\
2023.3-Present	E-Commerce Visual Design	SRP1, SRP3	\	GPT	GPT	GPT	GPT	GPT	\

Table 9: Integration of Stylus Teaching Behaviour and ChatGPT.

Semester	Course	Category	Associate Path a4
2022.12-2023.1	Digital Colours and Applications	C3	GPT \ \ GPT \ GPT \
2022.12-2023.1	Creative Graphic Design	C3	GPT \ \ GPT \ GPT \ GPT \
2023.3-Present	Human-Computer Interaction	C4	GPT \ \ GPT \ GPT \ GPT \
2023.3-Present	E-commerce Visual Design	C4	GPT \ \ GPT \ GPT \ GPT \
2023.3-Present	Film and Television Special Effects and Production	C1	GPT \ \ GPT \ GPT \ GPT \
2023.3-Present	Creative Graphic Design	C1	GPT \ \ GPT \ GPT \ GPT \
2023.3-Present	Computer Graphic Design	C1	GPT \ \ GPT \ GPT \ GPT \

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B. Qualitative Research

Due to the potential risks associated with ChatGPT in education, several interviews were conducted with experienced teachers from various universities. The feedback highlighted several concerns: the importance of emphasising the process, developing values, and improving students' skills in analysis and summarising. Several interviewees pointed out that, while ChatGPT can assist in education, it cannot replace human creativity and initiative (Table 10).

Table 10: ChatGPT Interviewee's Profile

Mr. Qiu Guanghong	Mianyang Teacher's College	Deputy Dean	Prof.	Radio and Television Studies
Ms. Pan Honglian	Mianyang Teacher's College	Director of Faculty of Art and Design	Prof.	Visual Communication
Mr. Zhang Bin	Mianyang Teacher's College	Director of Research Centre	Lecturer	Digital Media Technology
Mr. Huang Li	Mianyang Teacher's College	Teacher	Lecturer	Digital Media Technology
Mr. Rao Guangxiang	Mianyang Teacher's College	Deputy Secretary	Lecturer	Advertising
Mr. Zheng Yi	Sichuan University	Director of Research Centre	Ass. Prof.	Animation
Ms. Zhou Hongya	Sichuan Normal University	Director of Research Centre	Ass. Prof.	Animation
Ms. Wang Juan	Xihua University	Lecturer	Lecturer	English
Mr. Ning Dapeng	Chaohu University	Teacher	Lecturer	Photo Graphing
Sichuan University of Media and Communications	Lecturer	Lecturer	Photo Graphing	
Mr. Qiu Guanghong	Mianyang Teacher's College	Deputy Dean	Prof.	Radio and Television Studies

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Research Results

A. Research Results of Series–Parallel Triggered Interactive Strategies in Teaching Activities

1. Enhanced Teaching Effectiveness: The integration of this strategy resulted in the development of a new approach to lessons, which fundamentally transformed the traditional teaching model. This shift enabled the adoption of a more promotive and dynamic teaching model (see Figures 4 and 5).

Figure 4: Result Date Comparison from Path a, b, c.

2. Improved Teaching Achievements: There was a noticeable improvement in student interest, interaction, participation, and professionalism, leading to an overall enhancement in the quality of outcomes.

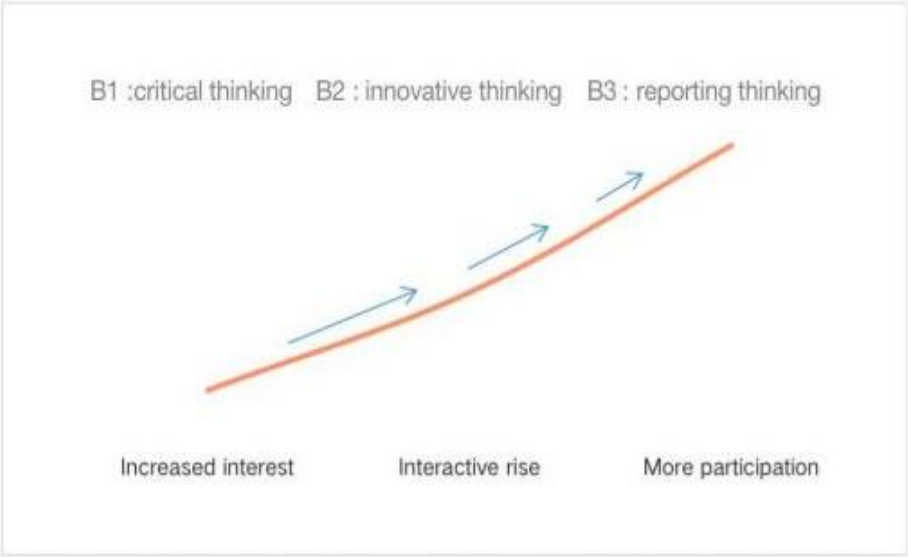

Figure 5: Interactive Effects

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C. The Integration of Touch-Based Teaching Behaviour and ChatGPT Innovation Results

1. Optimized Teaching Process: The integration made teaching more intelligent and efficient, allowing teachers to develop materials more effectively while alleviating some of their workloads (see Figure 6).

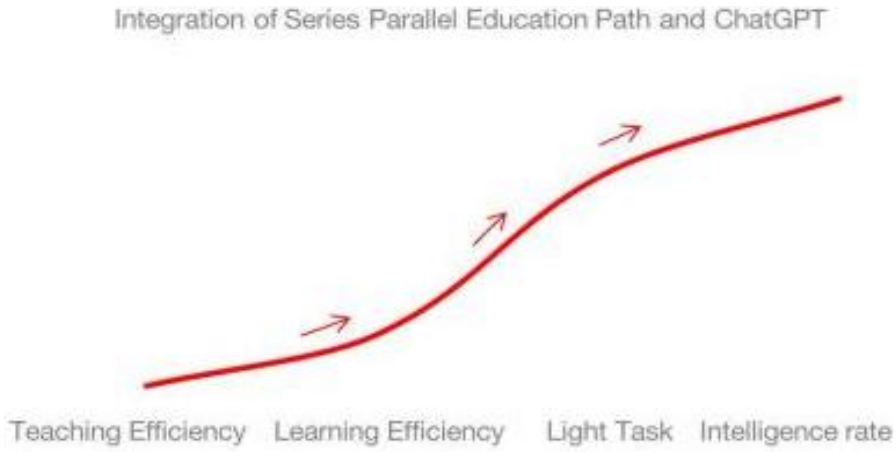

Figure 6: Integration of Series–Parallel Education Path and ChatGPT.

2. Enhanced Educational Mechanisms: The new syllabus, integrated with ChatGPT, enhanced the teaching monitoring and evaluation process, contributing to the participants' development of intelligent literacy (see Figure 7).

Figure 7: New Teaching System.

3. Tailored Teaching: Procedures related to the students varied depending on their level of achievement. Since the program encouraged creativity and individuality, every student, whether excelling or struggling, benefited accordingly (see Figure 8).

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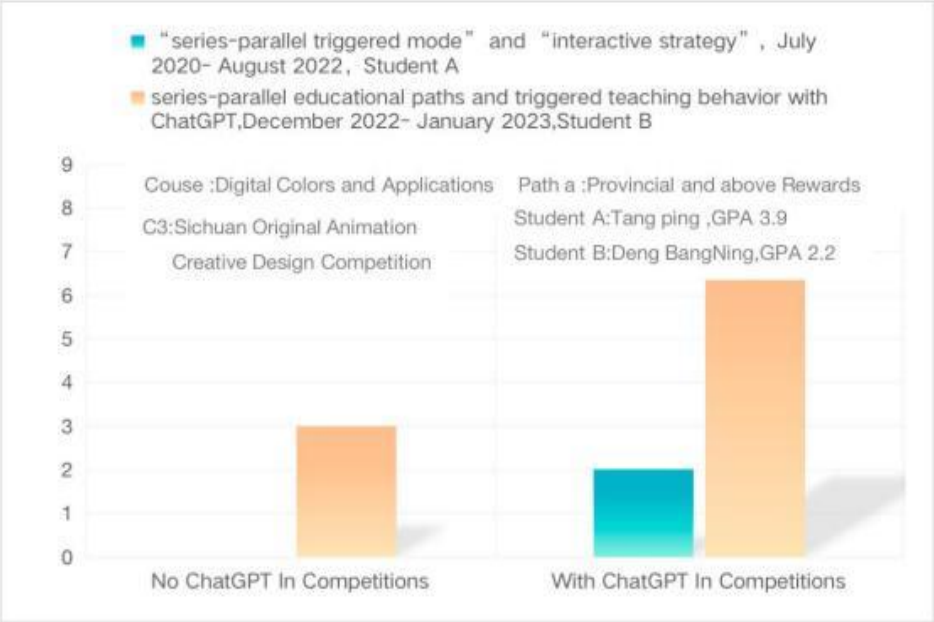

Figure 8: Comparison of Data from High-Quality and Underperforming Students with ChatGPT.

Teachers' Touch-Based Teaching Behaviour and ChatGPT Adoption

1. Development of Thinking Skills: The integration of ChatGPT, combined with targeted teaching behaviors, supported the development of critical, innovative, and reporting thinking skills, enhancing students' imagination, creativity, and collaboration (see Figure 9).

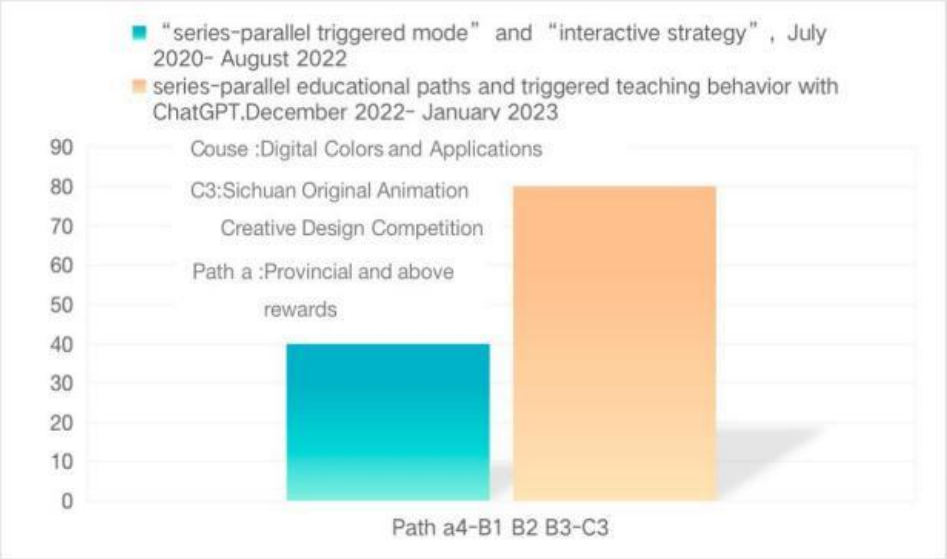

Figure 9: C3 Data in Course Digital Colour and Application.

2. Supervised Learning Process: The use of project-based learning alongside ChatGPT improved the fairness of assessment and addressed challenges such as the potential over-reliance on ChatGPT, ensuring the integrity of the learning process.

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In summary, the integration of ChatGPT into education is feasible and beneficial. It enhances teaching, strengthens educational processes, and promotes individualized approaches, leading to a smarter education system.

Discussion

Traditional teaching methods have strayed from the student-centered ideology, leading to reduced educational effectiveness. To implement the Outcome-Based Education (OBE) concept, a focus on student-centered approaches is essential. Between July 2020 and August 2022, a study on the application of series-parallel triggered interactive strategies in teaching reform was conducted at Mianyang Normal University, involving students from various majors (see Tables 2–4). This research provides valuable insights into AI-assisted education reform, particularly in relation to ChatGPT. Hammer (2024) examined teachers' response strategies to ChatGPT, highlighting its practical implications and the importance of adaptability in the evolving educational landscape. The results of this study revealed that the series-parallel triggered interactive strategies in education were optimized, improving the teacher-student relationship, interactivity, and creativity. Teaching effectiveness was quantifiable and evaluable, with high levels of course satisfaction and the ability to transform and output results (see Figures 4 and 5).

During the implementation of ChatGPT in education, we found that both teachers and students need to remain focused, and the teaching process needs to be more efficient. Despite the rapid development of ChatGPT, there is no consensus on its role in education, especially considering its challenges and negative impacts. The goal is to optimize ChatGPT technology and explore integration models that enhance teaching efficiency, student engagement, and learning outcomes, while addressing its potential drawbacks. Fryer et al. (2019) highlighted how AI, such as chatbots, can personalize learning and foster student interest. Ongoing research on integrating series-parallel educational paths and triggered teaching behaviors with ChatGPT builds on previous findings and continues to evolve (see Tables 5–8, 10 and Figures 6, 7, 8). The integration of touch-based teaching behavior and ChatGPT significantly enhances the efficiency and quality of education by avoiding repetitive tasks, achieving a lighter and more personalized teaching approach, and developing a new teaching model and assessment system. Critical, innovative, and reporting thinking are embedded throughout the teaching process to trigger effective teaching behaviors, boosting interaction, student engagement, and creativity. This approach helps expand students' thinking, improves their proficiency in using ChatGPT, and effectively mitigates its negative impacts (see Tables 9, 10, and Figure 9).

Conclusion

ChatGPT, as a new technological tool, presents an important challenge in understanding its role in education and teaching. We adopt a positive outlook toward

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ChatGPT, encouraging both teachers and students to actively use this technology in the educational process. Given the potential of both quantitative and qualitative research methods to explore its use, this topic requires extensive exploration over time. The findings contribute to reflecting on and optimizing teaching models and strategies. This study examined the integration of serial-parallel teaching paths and triggered teaching behavior with ChatGPT at Mianyang Teachers' College, where it showed promising results in improving teaching efficiency and addressing the negative impacts of ChatGPT. As artificial intelligence continues to evolve, it is essential for education to embrace these technological trends and undergo continuous innovation and reform.

Limitations and Recommendation

Integrating ChatGPT into education presents significant challenges, requiring careful observation, calmness, and expertise. Concerns about ethical issues and academic misconduct are raised by some groups. However, the application of artificial intelligence technologies like ChatGPT in education has proven reasonable and increasingly effective. Differences in technological access and application exist across individuals, groups, and countries, with technology acting as a catalyst for change. Achieving a fair and just educational environment remains a major philosophical question. Moving forward, it is crucial to carefully consider ChatGPT's role in education and how to foster human-machine collaboration. Researchers should focus on developing integration models between education, teaching, and artificial intelligence to prepare for the emerging ecosystem of intelligent and multidimensional education.

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