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Effect of Small Private Online Course + Presentation, Assimilation, Discussion (SPOC+PAD) on Student Achievement in a Computer Course

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Abstract
This paper aims to document the implementation of the Small Private Online Course (SPOC) + Presentation, Assimilation, Discussion (PAD) teaching strategy to a computer course in a Chinese higher vocational college and assess its effect on student achievement. Through a quasi-experimental design, pre- and posttests will be used to assess student achievement in two lessons in a computer course. The study aims to enlist 160 first-year college students from four Stomatology classes in Gansu Health Vocational College. N-gain scores and tests of significant difference will be used to analyze the data.

Keywords: Presentation, Assimilation, Discussion teaching strategy, Small Private Online Course (SPOC)

CHAPTER 1:
Introduction
The Chinese Ministry of Education is promoting "Golden Lessons" to improve educational quality under the Education Informatization 2.0 initiative. This plan focuses on maximizing educational resource accessibility and enhancing students' IT literacy, moving beyond basic application to a deeper integration of technology in learning. Online courses are increasing, but they often lack personalized teaching, ignoring student differences in knowledge, abilities, and learning styles. To address this, educational strategies need to be more tailored to individual student needs.

The SPOC + PAD teaching strategy is highlighted as a way to meet personalized student needs and alleviate teacher shortages. It involves students watching instructional videos and practicing independently, with the ability to discuss and solve problems collaboratively on teaching platforms. However, teachers often underutilize digital resources, leading to lower online learning engagement and effectiveness. This paper explores integrating SPOC with practical teaching to assess its impact on student performance in computer courses.

CHAPTER 2:Study Objectives

2.1. General Objective

This study aims to investigate the effects of SPOC + PAD teaching strategy on the academic achievement of students in a computer course.

2.2. Specific Objectives

Describe the pretest and posttest scores of the students in the SPOC + PAD and traditional classes.
Determine the statistical difference between the pretest & post-test scores for both classes with the SPOC + PAD and traditional class.
Determine the statistical difference between the post-test scores of the SPOC + PAD and traditional class.
Propose a faculty development activity to develop the competencies of teachers in implementing SPOC + PAD in class.

2.3. Hypotheses

There is no significant difference between the pretest and post-test scores in both classes with the SPOC + PAD and traditional class.
There is no significant difference between the post-test scores in both classes with the SPOC + PAD and traditional class.

CHAPTER 3:Review of Related Literature

3.1. Small Private Online Course (SPOC)

Small Private Online Course (SPOC) was first proposed and used by Professor Amand Fox of the University of California, Berkeley (Goral, 2013). Small and Private are relative to Massive and Open in MOOC. Small refers to students generally ranging in size from tens to hundreds, while Private refers to the restrictive admission conditions for students (Kang, 2014). Research, such as that by Chen and Chen (2019) and Yang (2018), has shown SPOCs to enhance teaching effectiveness and student outcomes by integrating online and classroom learning, emphasizing personalized strategies and effective implementation in higher education.

3.2. Presentation, Assimilation, Discussion (PAD)

The PAD teaching strategy, introduced by Professor Zhang Xuexin from Fudan University (Sun & Asmawi, 2023), is a three-stage approach comprising lecture, independent learning, and discussion. In the lecture phase, teachers present key concepts concisely. Students then assimilate the material independently, deepening their understanding. Discussions facilitate in-depth interaction, allowing clarification and peer engagement. PAD's main feature is empowering students with control and accountability over their learning process.

Studies, including those by Ding, Sitthiworacart, and Morris (2022) and Sun and Asmawi (2023), have demonstrated PAD's effectiveness in enhancing English proficiency and writing performance among undergraduate students. These findings suggest PAD's potential in improving learning outcomes and fostering active participation, warranting further exploration of its application across various educational settings and disciplines.

3.3. SPOC + PAD

The SPOC + PAD strategy combines the Small Private Online Course (SPOC) with the PAD teaching model to create a blended learning approach that leverages technology and structured pedagogy. In the presentation phase, students gain preliminary knowledge online and receive in-class guidance focusing on key concepts. The assimilation phase involves online tutorials, textbook review, and targeted practice

exams, complemented by offline practical exercises. The discussion phase encourages online and offline interaction for collaborative learning, with group discussions and problem-solving activities.

This integrated approach addresses the shortage of teachers and optimizes the use of online resources, employing diverse teaching methods to enhance computer education effectiveness. It fosters student engagement, deeper learning, and critical thinking, which are essential for success in competitive fields (Zhuo, Liu, Zhang, & Wang, 2023; Chen & Chen, 2019).

3.4. Theoretical Basis

The SPOC + PAD teaching strategy, a form of blended learning combining online and offline elements, has been extensively studied for its educational benefits. Research has shown positive impacts on student achievement and engagement, with studies like Setyawan (2019) and He (2020) highlighting improvements in reading scores and innovative instructional modes, respectively. Wang & Zhang (2022) and Ahmad (2021) emphasize blended learning's role in fostering autonomous learning and language skill acquisition.

During the COVID-19 pandemic, Liu et al. (2022) and Ma et al. (2021) demonstrated blended learning's adaptability for educational continuity and alignment with national strategies. Zhang et al. (2023) and Islam et al. (2021) explored student-centered approaches, promoting collaborative learning and engagement. Ahmed et al. (2022) and Evans et al. (2019) provided insights into student preferences and the potential of professional development in blended learning contexts.

Constructivism, which aligns with SPOC + PAD's active and student-centered methods, is supported by the strategy's collaborative and reflective learning opportunities. It encourages profound understanding and long-term retention by connecting new information with existing knowledge. The autonomy and self-directed learning facilitated by SPOC + PAD, as discussed by Wang (2011) and Huang et al. (2020), enhance motivation and self-efficacy. Vygotsky's (1978) emphasis on the social dimension of learning is also supported by SPOC + PAD, fostering a sense of community and interpersonal skill development, as noted by Ouyang (2019).

In summary, the literature indicates that blended learning, including the SPOC + PAD model, positively influences various educational aspects, from academic performance to teaching effectiveness, with strong adaptability and potential for enhancing student learning outcomes and experiences.

3.5. Gaps in Literature

This study seeks to address the research gap by examining the SPOC+PAD blended learning model, specifically its application in a vocational college setting. It will implement the SPOC+PAD strategy in four stomatology classes at Gansu Health Vocational College for a computer basics course. Utilizing a quantitative experimental design with repeated measures, the study will assess the effectiveness of the SPOC+PAD model by comparing pretest and post-test scores and contrasting academic performance with traditional classes, aiming to determine the impact of this teaching strategy on student achievement.

3.6. Future Perspectives

Previous studies have examined SPOC and PAD separately, with limited research on their integrated application and its acceptability to learners. While blended learning has shown positive outcomes, there is a need to understand user perceptions of educational technologies, including their initial impressions of content, usability, and aesthetics, which significantly influence platform acceptability (Gafni et al., 2018). The dynamic educational landscape, with the emergence of various platforms and tools like Mentimeter, Quizlet, Schoology, and Poll Everywhere, calls for further research into their impact on learning experiences and student engagement (Siemens & Baker, 2012). The flexibility of the SPOC + PAD

strategy allows for the incorporation of new technologies, including generative AI, highlighting the importance of context in research to capture the unique features of these tools (Jiang et al., 2023).

Future studies should focus on developing professional development programs to enhance teachers' implementation of the SPOC + PAD strategy, including training, resource sharing, guidance, and feedback mechanisms, which can improve teaching effectiveness and student outcomes (Wuhue, 2023; Zhang, Shao, & Chen, 2023). Additionally, exploring the strategy's effectiveness across different subjects and teaching environments will provide a more holistic understanding and practical insights into its application.

CHAPTER 4:Methods

4.1. Study Design

Quasi-experimental, pretest post-test repeated measures design will be employed. Harris et al. (2006) described the quasi-experimental design as one that utilizes elements of real experimental methods to address practical problems. This design is suitable for evaluating the SPOC + PAD teaching strategy within existing educational constraints, allowing for the assessment of the intervention's impact on student performance over time without randomization.

In this study, subjects are divided into experimental and control groups without random allocation, a common method in quasi-experiments when initial groups are unequal. The pretest ensures the groups are comparable in proficiency on the research topic, crucial for valid quasi-experimental research. Post-test results are statistically analyzed to measure the intervention's effectiveness and the degree of difference between the groups. This process is repeated with groups interchanged to further validate the findings.

4.2. Study Participants

This study targets 160 first-year stomatology students from four classes at Gansu Health Vocational College for data collection and analysis, aiming to assess the impact of the teaching methods under investigation.

4.2.1. Sample size

The study will encompass a total enumeration of 160 first-year stomatology students, divided into four classes of 40 students each at Gansu Health Vocational College, from May to June 2024. This method ensures a comprehensive and unbiased understanding of the target demographic, enhancing the study's validity and reliability with consistent teaching conditions.

4.2.2. Inclusion and Exclusion Criteria

Inclusion Criteria:

(1) First-year college students from the class of 2023 (aged 18 to 23 years old).

(2) Enrolled in the stomatology major at Gansu Health Vocational College in China.

(3) Currently taking basic computer courses.

(4) Scheduled to attend computer courses from 8:50-12:10.

Exclusion Criteria:

(1) Missed at least 90 minutes or 1 session of the lesson.

(2) Missed any of the pretest and post-test tests.

4.3. Research Instruments

4.3.1. Pretest and post-test

This study involves comprehensive assessments with two pretests and two posttests, each consisting of 20 multiple-choice questions, validated by three experienced content experts. The pretest results will be used to form two comparable groups, experimental and control, to evaluate the teaching intervention's effectiveness through post-test performance and subsequent statistical analysis.

4.3.2. Lesson Plans

Three experts with PhDs or higher in relevant fields validated the lesson plans, ensuring impartiality and comprehensiveness. One expert specializes in the PAD strategy, confirming adherence to its key steps; another ensures the content's accuracy; and the third, an SPOC expert, assesses platform suitability for participants. Their feedback was critical in validating the study's lesson plan.

4.3.3. Data analysis tools

Data was organized and analyzed using MS Excel 2019 and SPSS 21.0, with statistical significance determined at $\alpha=0.05$, where $P<0.05$ indicates a significant result.

4.3.4. Data Retrieval and Disposal Plan:

A data management plan was implemented for the study, including secure electronic collection and storage of pre and post-test data, with encryption and access controls to protect participant confidentiality. The research team analyzed the data using statistical software to assess the SPOC + PAD teaching strategy's effectiveness. Post-analysis, data was retained as per protocol and regulations before secure disposal, ensuring permanent deletion and verification of data deletion. Personal identifiers were removed, and data access was limited to the research team for study purposes only.

4.4. Specific Procedures Based on Study Objectives

4.4.1. Communication Letters

The researcher sought school approval for student participation in the study by submitting a formal letter to the academic affairs office. Informed consent was obtained from participants, including individual consents, before proceeding with the electronic survey. A coordinator was hired if necessary to follow up on participant responses.

4.4.2. Informed Consent

The researcher developed an informed consent form, distributed it to participants with instructions, and obtained their consent, which was estimated to take 10 minutes to complete.

4.4.3. Ethical Considerations

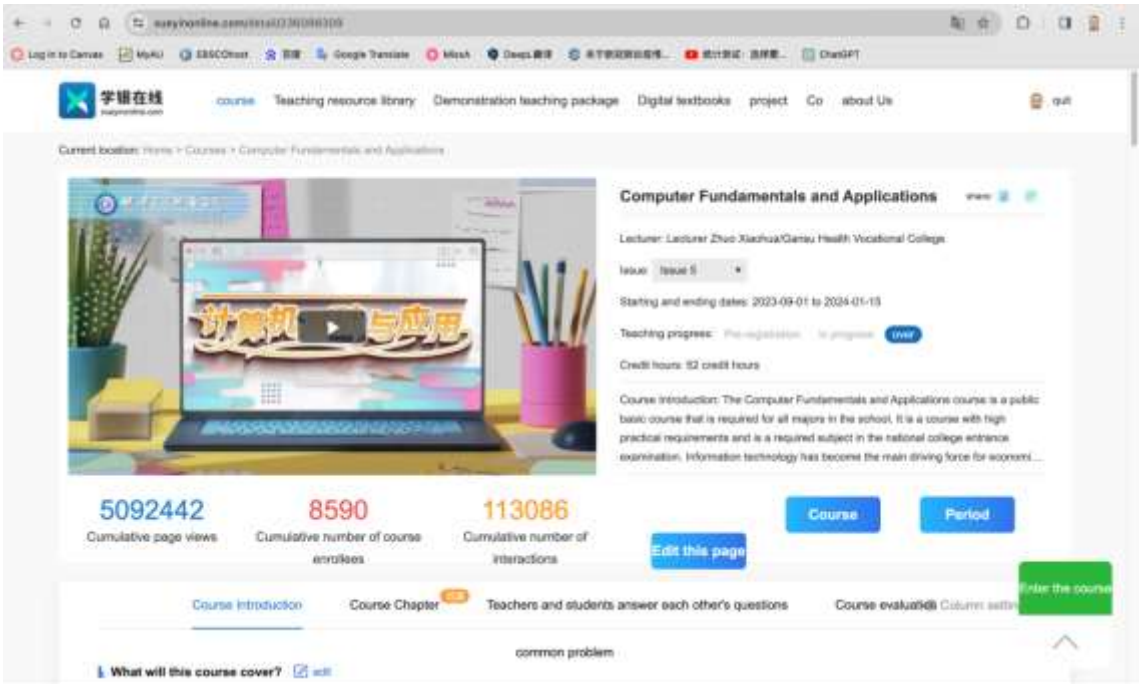
TThe researcher obtained Ethics Review Board (ERB) approval and ensured the study's protection of participants' rights and welfare. Participants were informed they could contact the Angeles University Foundation Research Ethics Committee with concerns. Approval from AUF-OVPRI Ethics Review Committee was secured before study commencement, with informed consent required for student participation. Confidentiality was assured, and the study aimed for conflict-free, honest results. An informed consent form was used, and students could opt out at any time without repercussions. Those with limited mobile data were offered prepaid loads, and participant information would remain confidential in any publications or presentations.

4.4.4. Online course platform

The Xueyin online platform was utilized by the research group I joined to offer an online open course on "Computer Fundamentals and Applications," complete with digital teaching resources. Students engaged

in online learning and activities through Chaoxing software on various devices, while teachers conducted teaching and research. The platform primarily served our school's computer courses but was also freely accessible to the public, with the external access link being https://www.xueyinonline.com/detail/236098309.

Figure 1. "Computer Fundamentals and Applications" Online course platform



4.4.5. Lesson plans

According to the requirements of the teaching syllabus for the course "Computer Fundamentals and Applications", teaching objectives were formulated, and two modules were selected for the teaching process to conduct experiments for a total of 6 weeks.

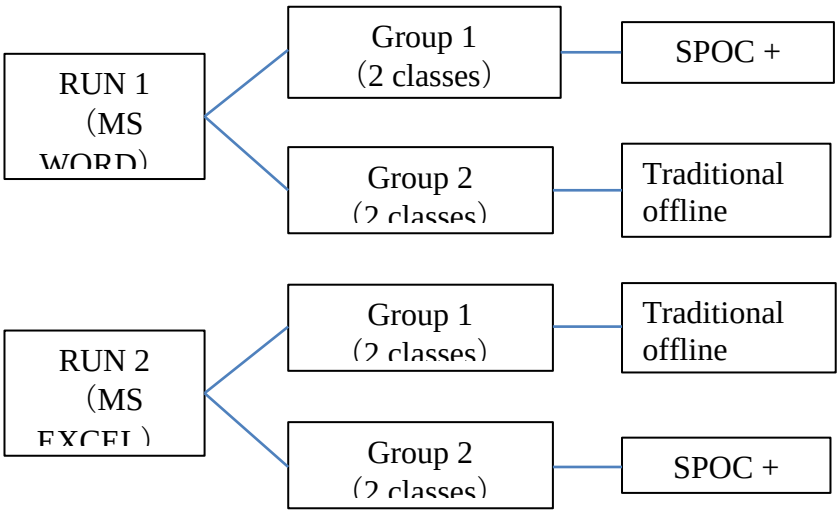
4.4.6. Specific procedures

The study meticulously designed the setup of two groups to compare the effectiveness of different teaching strategies, focusing on MS WORD and MS EXCEL modules to assess the impact of SPOC + PAD on computer course grades. The study was conducted in two runs, RUN 1 and RUN 2, to enhance the quasi-experiment's validity.

Pretests were administered before each module to the four classes, with content on Word and Excel basics. Classes were grouped based on average pretest scores to ensure comparable initial learning levels. One randomly selected group received the innovative SPOC + PAD teaching, integrating online learning and personalized PAD technology, while the other followed traditional teaching methods.

The experimental group's SPOC + PAD approach offered flexible online learning and personalized guidance, stimulating interest and improving efficiency. In contrast, the control group's traditional model, involving classroom lectures and practice, provided practicality but less personalization compared to SPOC + PAD.

Figure 2. Quasi experimental design with repeated measures



The study conducted a three-week MS WORD module experiment with the control group taught traditionally and the experimental group using the new SPOC + PAD strategy. A post-test was administered to gather data on student grades, followed by an independent sample t-test to assess the significance of differences between the groups. The MS EXCEL module experiment mirrored this setup, with the roles of the experimental and control groups reversed, and also concluded with a post-test and t-test analysis.

This design allowed for a comparison of student performance under different teaching strategies, with pretest and post-test measures tracking student progress. The study aimed to provide a comprehensive understanding of the impact of the new teaching strategy on academic performance, with rigorous data collection and analysis revealing the effects of SPOC + PAD on student achievement in computer courses.

4.4.7. Conducting Pre and Post Tests:

Before the study commenced, participants took a pretest in a controlled environment to establish a baseline of their computer course achievement. The pre and post-tests, validated by experts, featured multiple-choice questions and were administered electronically to ensure standardized conditions and ease of scoring. Post-tests, similar to the pretests, were conducted at the end of the one-and-a-half-month study period. Data were securely collected, anonymized to protect confidentiality, and analyzed statistically to assess the impact of the SPOC+PAD group versus the traditional teaching group on academic achievement.

CHAPTER 5:Statistical Analysis of Data

The study collected student grade data and proceeded with statistical analysis to assess the new teaching strategy's impact on computer course performance. Data were cleaned and organized, addressing inaccuracies, missing values, and outliers. Descriptive statistics, including mean and standard deviation, were calculated to understand data characteristics, and visual analysis through charts compared grade distributions between groups.

Hypothesis testing with paired sample t-tests was conducted to determine if significant performance differences existed between the SPOC+PAD and traditional teaching methods. The t-statistic and p-values were used to evaluate the significance of mean score differences, with a 0.05 significance level. N-gains, as explained by Suryandari, Kartika Chrysti, et al. (2021), were also calculated to measure learning

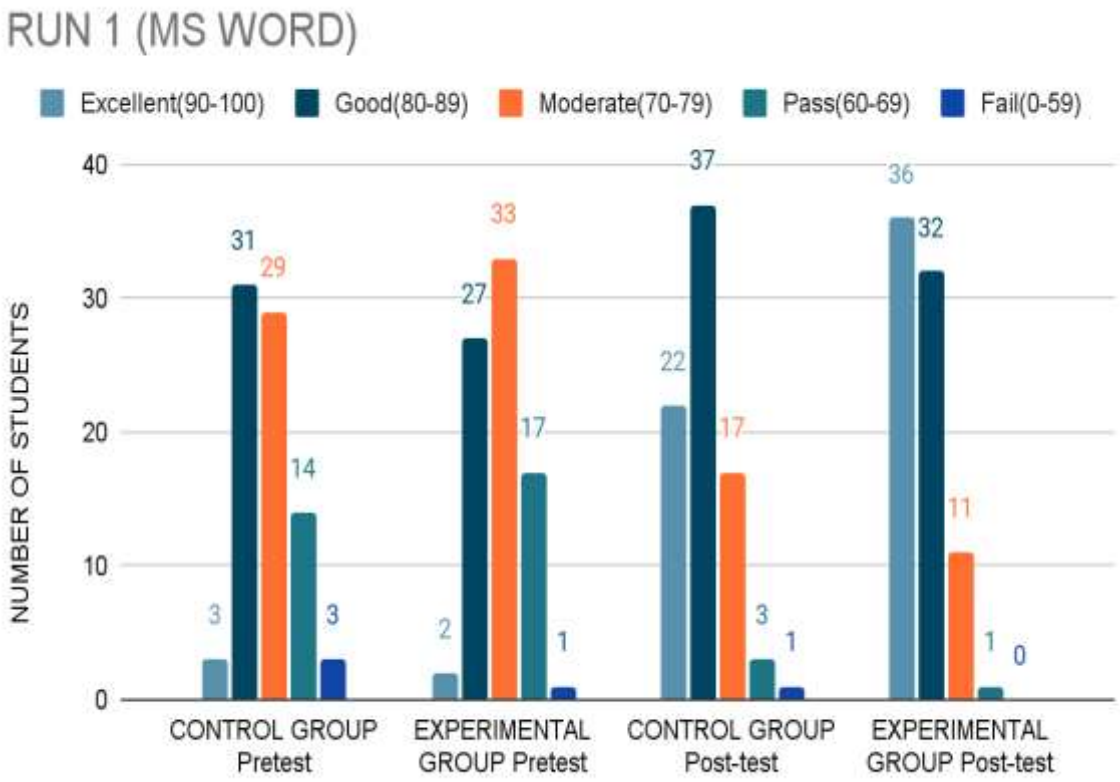
effectiveness, with values greater than 0.3 considered good and above 0.7 significant, reflecting the change from pretest to post-test scores.

CHAPTER 6: Results and Discussion

6.1 Brief introduction

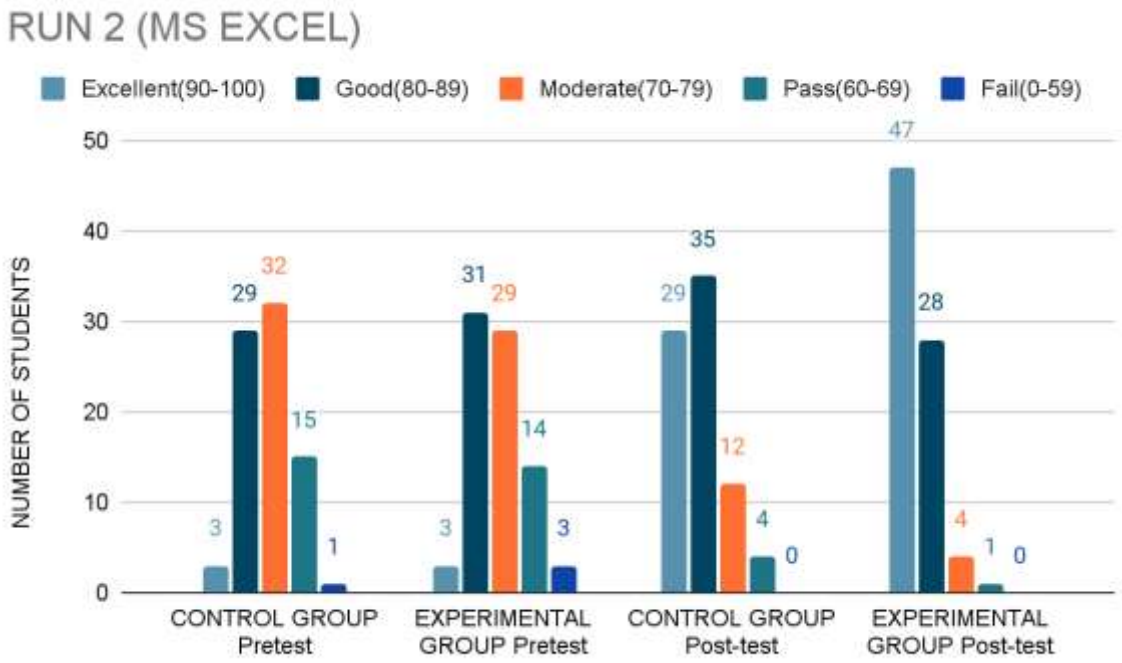
This section analyzed the SPOC+PAD teaching strategy's impact on computer course achievements, with data cleaned for accuracy and statistically evaluated using descriptive statistics. Charts visually depicted performance trends, and hypothesis testing, including t-tests and N-gains, quantitatively assessed learning effectiveness. The study categorized performance into five levels, from excellent to fail, to provide a detailed picture of student achievement.

Figure 3. Distribution level statistical graph of MS WORD



The SPOC+PAD teaching model significantly boosted the experimental group's excellent scores from 2 to 36, suggesting a substantial enhancement in advanced skills and knowledge. The control group also saw an increase in excellent scores from 3 to 22, though less pronounced. Both groups experienced a decrease in medium scores, with the experimental group showing a more notable drop, possibly indicating promotion of medium-level students to higher levels. The experimental group's dramatic improvement in the failing range, from 1 to 0, underscores the model's effectiveness in aiding underperforming students.

Figure 4. Distribution level statistical graph of MS EXCEL



The SPOC+PAD model significantly enhanced the experimental group's excellent scores, outperforming the control group, suggesting its effectiveness in advancing higher-level skills. The control group also saw some improvement, but to a lesser extent, indicating the traditional model's limited impact. Both groups saw a reduction in medium scores, with the experimental group showing a more substantial decrease, likely due to promotion to higher ranges. The experimental group's failure rate dropped to zero, highlighting the SPOC+PAD model's success in supporting struggling students.

6.2 Analysis of the Teaching Results of MS Word Module

6.2.1 Improvement in grades

In the MS Word module, the experimental group's N-gains value of 46.3% significantly exceeded the control group's 29.7%, indicating the SPOC + PAD model's superiority in enhancing MS Word proficiency. The experimental group also had a higher number of students who improved (48 vs 65 in the control group), suggesting greater effectiveness of their teaching approach. Additionally, fewer students in the experimental group remained stable or declined (7 stable, 8 declined), further supporting the positive influence of the experimental method on student performance.

Table 1. Word Mode N-gains Table

MODE	CLASS	PRETEST CLASS AVERAGE	POST-TEST CLASS AVERAGE	GROUP	N-gains
WORD	CLASS 1 (n=40)	74.625	82	CONTROL GROUP (n=80)	29.7%

	CLASS 2 (n=40)	74.875	82.5		
	CLASS 3 (n=40)	73.25	85.375	EXPERIMENTAL GROUP (n=80)	46.3%
	CLASS 4 (n=40)	74.875	86.75		

Table 2. Word Mode Changes Between Pretest And Post-test

GROUP	Changes between pretest and post-test		
	Improve	Stable	Decline
CONTROL GROUP (n=80)	48	17	15
EXPERIMENTAL GROUP (n=80)	65	7	8

6.2.2 Differences between the control group and the experimental group for MS Word pretest

TThe experimental group had an average score of 74.06 with a standard deviation of 8.42, while the control group's average was slightly higher at 74.75 with a standard deviation of 9.31. An independent sample t-test showed a t value of -0.490 and a p value of 0.625, which is not significant at the 0.05 level, indicating no significant initial performance difference between the groups. The small difference in average scores (0.69 points) and the similar standard deviations suggest that both groups started with comparable proficiency levels. This baseline equivalence is crucial for ensuring that subsequent experimental results are not influenced by pretest differences in student abilities.

Table 3. T-test Of Word Pretest Table

t-test				
	Group (mean ± SD)		t	p
	Experimental group (n=80)	Control group (n=80)		
Total score	74.06±8.42	74.75±9.31	-0.490	0.625
* p<0.05 ** p<0.01				

6.2.3 Differences between the control group and the experimental group for MS Word post-test

The post-test results revealed a significant difference in performance between the experimental and control groups. The experimental group's average score was 86.06 with a standard deviation of 7.78, whereas the control group had an average of 82.25 with a standard deviation of 8.53. The t-test showed a t value of 2.954 and a p value of 0.004, indicating a highly significant difference ($p<0.01$). The experimental group outperformed the control group by 3.81 points, and the reduced standard deviations compared to the pre-test suggest a more concentrated score distribution around the mean for both groups.

Table 4. T-test Of Word Post-test Table

t-test				
	Group (mean ± SD)		t	p
	Experimental group (n=80)	Control group (n=80)		
Total score	86.06±7.78	82.25±8.53	2.954	0.004**
* p<0.05 ** p<0.01				

6.2.4 Analysis results of MS WORD

The experimental intervention significantly improved the students' abilities, as indicated by the increase in post-test scores from 80.06 to 86.06 for the experimental group, a 6-point rise, surpassing the control group's 3.75-point increase from 78.50 to 82.25. Both groups showed overall improvement, but the experimental group's larger gain suggests the effectiveness of the applied teaching methods.

The post-test score distribution for both groups showed a reduced standard deviation, with the experimental group experiencing a more significant decrease from 10.08 to 7.78. This reduction indicates a more uniform teaching outcome and suggests that the SPOC + PAD model effectively supports students across different proficiency levels in enhancing their MS Word skills.

6.3 Analysis of the Teaching Results of MS Excel Module

6.3.1 Improvement in grades

In the MS Excel module experiment, the experimental group's N-gains value of 57.7% significantly exceeded the control group's 37.4%, reaffirming the SPOC + PAD model's effectiveness in enhancing computer skills. The grade distribution revealed 65 improvements, 9 stable, and 6 declines in the experimental group, compared to 57 improvements, 13 stable, and 10 declines in the control group. This indicates a higher rate of improvement and a lower rate of decline for the experimental group, suggesting their teaching method is more effective in advancing student learning. Overall, the Excel module test results indicate the experimental teaching approach is more successful in improving student grades.

Table 5. Excel Mode N-gains Table

MODE	CLASS	PRETEST CLASS AVERAGE	POST-TEST CLASS AVERAGE	GROUP	N-gains
EXCEL	CLASS 1 (n=40)	74.625	89.125	EXPERIMENTAL GROUP (n=80)	57.7%
	CLASS 2 (n=40)	74.875	89.5		
	CLASS 3 (n=40)	74.625	83.75	CONTROL GROUP (n=80)	37.4%
	CLASS 4 (n=40)	74.875	84.625		

Table 6. Excel Mode Changes Between Pretest And Post-test

GROUP	Changes between pretest and post-test		
	Improve	Stable	Decline
CONTROL GROUP (n=80)	57	13	10
EXPERIMENTAL GROUP (n=80)	65	9	6

6.3.2 Differences between the control group and the experimental group for MS Excel pretest

Both the experimental and control groups, each with 80 students, started with an average score of 74.75 points. The experimental group had a standard deviation of 9.31, while the control group's was slightly lower at 8.42. The independent sample t-test showed a t value of 0.000 and a p value of 1.000, indicating no significant difference between the groups at the outset, thus confirming baseline equivalence. The slightly higher standard deviation in the experimental group did not significantly affect the randomization's validity, ensuring that initial ability differences were not a factor in the experiment's results.

Table 7. T-test Of Excel Pretest

t-test				
	Group (mean ± SD)		t	p
	Experimental group (n=80)	Control group (n=80)		
Total score	74.75±9.31	74.75±8.42	0.000	1.000
* p<0.05 ** p<0.01				

6.3.3 Differences between the control group and the experimental group for MS Excel post-test

After at least three weeks of learning MS Excel, the control group showed a 9.44 point increase to an average score of 84.19, while the experimental group had a more substantial 14.56 point increase to an average of 89.31. An Independent sample t-test revealed a t value of 4.052 and a p value of less than 0.001, indicating the experimental group's mean score was significantly higher than the control group's.

The post-test results, starting from identical pretest scores, strongly suggest the effectiveness of the experimental intervention. The experimental group's improvement was notably greater than the control group's. Additionally, the post-test score distribution showed a smaller standard deviation for the experimental group (7.70) compared to the control group (8.28), suggesting a more focused score distribution and reduced variability among students, highlighting the intervention's impact on both average performance and score dispersion.

Table 8. T-test Of Excel Post-test

t-test				
	Group (mean ± SD)		t	p
	Experimental group (n=80)	Control group (n=80)		
Total score	89.31±7.70	84.19±8.28	4.052	0.000**
* p<0.05 ** p<0.01				

6.3.4 Analysis results of MS EXCEL

The post-test scores of both groups indicated effective teaching methods, with the experimental group showing a larger improvement of 14.56 points compared to the control group's 9.44 points, resulting in a significant difference of 5.12 points. This suggests that the experimental intervention provided substantial learning benefits, potentially influencing students' academic success and development.

The experimental teaching method also appeared to be more inclusive of diverse student abilities, as evidenced by the reduction in the experimental group's standard deviation from 9.31 to 7.70, while the control group's increased slightly from 8.42 to 8.28. This indicates a more uniform improvement among students in the experimental group.

A t-test confirmed the statistical significance of the score difference between the groups in the MS Excel module, supporting the SPOC + PAD model's effectiveness and versatility in teaching computer skills, as demonstrated in both MS Word and MS Excel.

6.4 General Discussion

The consistent results from both experiments demonstrate the SPOC + PAD teaching model's significant enhancement of student grades across different modules, highlighting its broad applicability in computer course instruction. The model has proven effective for both MS Word and MS Excel, indicating its high universality.

Student engagement in the experimental group is pivotal to the SPOC + PAD model's success. The online platform's discussion and feedback mechanisms facilitate idea sharing and problem-solving, enhancing the learning experience. The flexibility allows for anytime, anywhere learning, fostering interaction and boosting students' enthusiasm.

Despite its success, the SPOC + PAD model faces implementation challenges, such as student adaptability to technology and teacher proficiency with the model. These can be addressed through additional training and support. The model also presents opportunities for personalized learning, interactive discussions, and flexible scheduling, which educators should leverage to enhance teaching and learning outcomes.

CHAPTER 7:
Conclusion and Recommendations

7.1 Conclusion

The experimental results of this study consistently show that the SPOC + PAD teaching model can effectively improve students' computer course grades, especially in MS Word and MS Excel modules. The model promotes students' active participation and in-depth understanding by providing personalized learning paths and interactive learning environments. This finding provides an empirical basis for the field of education and supports educational innovation and improvement of teaching methods.

7.2 Recommendations

The study's findings underscore the positive impact of the SPOC + PAD teaching model on student performance in computer courses, particularly in MS Word and Excel. It suggests broader adoption of the model across institutions to boost teaching quality and student learning. Continuous evaluation and adaptation of the model to new educational and technological trends are advised.

Professional development for teachers is crucial for successful SPOC + PAD implementation, and integrating emerging technologies could further enhance its effectiveness. Research into student experiences with the model is recommended to tailor learning experiences.

Further application research across subjects and long-term studies on the model's impact on critical thinking and problem-solving are needed, along with cost-effectiveness analyses for different educational contexts.

Policymakers are urged to support the model in educational policies. The study provides empirical support for educational innovation, teaching method improvements, and sets a direction for future research and practice towards broader educational goals.

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References

1. Ahmad, J. (2021). Effectiveness of Blended Approach in Teaching and Learning of Language Skills in Saudi Context: A Case Study. English Language Teaching, 14(11), 118. https://doi.org/10.5539/elt.v14n11p118
2. Ahmed, A., Amin, S., McCarthy, G., Khan, A., & Nepal, R. (2022). Is blended learning the future of education? Students perspective using discrete choice experiment analysis. Journal of University Teaching & Learning Practice, 19(3). https://ro.uow.edu.au/jutlp/vol19/iss3/06
3. Chen, S., & Chen, L. (2019). Construction and Practice of SPOC Teaching Mode. Advances in Social Science, Education and Humanities Research, 350. https://doi.org/10.2991/aermt-19.2019.28
4. Ding, L., Jirarat Sitthiworachart, & Morris, J. C. (2022). PAD Class Teaching in Undergraduate English Courses in the Era of Information Technology. World Journal of English Language, 13(1), 286–286. https://doi.org/10.5430/wjel.v13n1p286
5. Evans, J. C., Yip, H., Chan, K., Armatas, C., & Tse, A. (2019). Blended learning in higher education: professional development in a Hong Kong university. Higher Education Research & Development, 39(4), 1–14. https://doi.org/10.1080/07294360.2019.1685943
6. Gaba, A. K., Bhushan, B., & Rao, K. (2021). Factors influencing the preference of distance learners to study through online during COVID-19 pandemic. Zenodo (CERN European Organization for Nuclear Research), 16(1). https://doi.org/10.5281/zenodo.4965925
7. Goral, T. (2013, July 6). SPOCs may provide what MOOCs can't. IAMSTEM HUB . UC DAVIS. https://iamstem.wordpress.com/2013/07/06/spocs-may-provide-what-moocs-cant/
8. Harris, A. D., McGregor, J. C., Perencevich, E. N., Furuno, J. P., Zhu, J., Peterson, D. E., & Finkelstein, J. (2006). The Use and Interpretation of Quasi-Experimental Studies in Medical Informatics. Journal of the American Medical Informatics Association, 13(1), 16–23. https://doi.org/10.1197/jamia.m1749
9. He, J. (2020). Construction of "three-stage asynchronous" instructional mode of blended flipped classroom based on Mobile learning platform. Education and Information Technologies, 25(6), 4915–4936. https://doi.org/10.1007/s10639-020-10200-9
10. Huang, R., Deng, L., Qi, X., Li, G., Gao, C., Wang, X., & Wang, N. (2020). Application Research of Mixed Teaching Mode of Higher Mathematics Based on "SPOC+ Flipped Classroom." Proceedings of the 2020 3rd International Conference on Humanities Education and Social Sciences (ICHESS 2020). https://doi.org/10.2991/assehr.k.201214.654
11. Islam, Md. K., Sarker, Md. F. H., & Islam, M. S. (2021). Promoting student-centred blended learning in higher education: A model. E-Learning and Digital Media, 19(1), 204275302110277. https://doi.org/10.1177/20427530211027721
12. Jiang, W., Zhan, Y., Sun, D., Sun, J., & Tian, P. (2023). Exploring the effects of SPOC-based blended learning on students' learning performance at higher vocational education. Interactive Learning Environments, 1–18. https://doi.org/10.1080/10494820.2023.2294774

13. Jiang, X., & Ning, Q. (2022). Evaluation and perception of online teaching of molecular biology using DingTalk for international medical students during the COVID -19 pandemic. Biochemistry and Molecular Biology Education, 50(5). https://doi.org/10.1002/bmb.21653
14. Kang, Y. (2014). The "Post-MOOC Era" of Online Education—SPOC Analysis. Tsinghua University Educational Research, 01(1), 085–093.
15. Kaplan, A. M., & Haenlein, M. (2016). Higher education and the digital revolution: About MOOCs, SPOCs, social media, and the Cookie Monster. Business Horizons, 59(4), 441–450. https://doi.org/10.1016/j.bushor.2016.03.008
16. Lalima, & Lata Dangwal, K. (2017). Blended Learning: An Innovative Approach. Universal Journal of Educational Research, 5(1), 129–136. https://doi.org/10.13189/ujer.2017.050116
17. Li, B., Yu, Q., & Yang, F. (2022). The Effect of Blended Instruction on Student Performance: A Meta-Analysis of 106 Empirical Studies from China and Abroad. Best Evidence in Chinese Education, 10(2), 1395–1403. https://doi.org/10.15354/bece.22.ar018
18. Liu, H., Zhu, J., Duan, Y., Nie, Y., Deng, Z., Hong, X., Haugen, M., Baker, J. S., & Liang, W. (2022). Development and students' evaluation of a blended online and offline pedagogy for physical education theory curriculum in China during the COVID-19 pandemic. Educational Technology Research and Development, 70(6), 2235–2254. https://doi.org/10.1007/s11423-022-10131-x
19. Ma, J., Xi, J., Wang, J., Liang, Z., Sun, Z., Qian, H., & Gong, A. (2021). The construction and application of a blended teaching strategy under the strategic background of healthy China. Biochemistry and Molecular Biology Education, 50(1), 114–119. https://doi.org/10.1002/bmb.21591
20. Maya, M., Anjana, V. M., & Mini, G. K. (2022). University students' perceptions of shifting between online and offline learning: lessons from Kerala, India. Asian Association of Open Universities Journal, 17(3). https://doi.org/10.1108/aaouj-03-2022-0031
21. Nola, R., & Gürol Irzik. (2006). Philosophy, Science, Education and Culture. Springer Science & Business Media. https://doi.org/10.1007/1-4020-3770-8
22. Ouyang, Q. (2019). An exploration into the collaborative training of applied talents in the "SPOC+PAD" classroom under the background of transformation—taking "Econometrics" as an example. Teaching and Educating People (Higher Education Forum), 11(102-103). https://doi.org/10.3969/j.issn.1008-2549.2019.11.041
23. Ranjan, P. (2020). Is Blended Learning Better than Online Learning for B.Ed Students? Journal of Learning for Development, 7(3), 349–366. https://doi.org/10.56059/jl4d.v7i3.412
24. Saleh, K., Rukiyah, I., & Arbain, M. (2021). Blended Learning as a Developmental Model Strategy of Teaching and Learning in Islamic Universities in Indonesia. Dinamika Ilmu, 21(2), 463–475. https://doi.org/10.21093/di.v21i2.3809
25. Setyawan, H. (2019). Blended Method: Online-Offline Teaching And Learning, On Students' Reading Achievement. English Education: Jurnal Tadris Bahasa Inggris, 12(1), 22–33. https://doi.org/10.24042/ee-jtbi.v12i1.4432
26. Siemens, G., & Baker, R. S. J. d. (2012). Learning analytics and educational data mining. Proceedings of the 2nd International Conference on Learning Analytics and Knowledge - LAK '12. https://doi.org/10.1145/2330601.2330661
27. Sun, L., & Asmawi, A. (2023). The Effect of Presentation-Assimilation-Discussion (PAD) Class Model on Chinese Undergraduates' Business English Writing Performance. Journal of Language Teaching and Research, 14(1), 57–69. https://doi.org/10.17507/jltr.1401.07

28. Suryandari, Kartika Chrysti, et al. (2021). "PROJECT-BASED SCIENCE LEARNING and PRE-SERVICE TEACHERS' SCIENCE LITERACY SKILL and CREATIVE THINKING." Jurnal Cakrawala Pendidikan, vol. 37, no. 3, 1 Nov. 2018, https://doi.org/10.21831/cp.v38i3.17229.
29. Taley, I. B. (2022). College students' perceived teaching presence in emergency remote online mathematics teaching. JRAMathEdu (Journal of Research and Advances in Mathematics Education), 7(3), 116–129. https://doi.org/10.23917/jramathedu.v7i3.17589
30. Vygotsky, L. S. (1978). Mind in Society: The Development of Higher Psychological Processes. The American Journal of Psychology, 1(1). https://doi.org/10.2307/1421493
31. Wang, C. (2020). Employing blended learning to enhance learners' English conversation: A preliminary study of teaching with Hitutor. Education and Information Technologies, 26(2), 2407–2425. https://doi.org/10.1007/s10639-020-10363-5
32. Wang, P. (2011). Constructivism and Learner Autonomy in Foreign Language Teaching and Learning: To what Extent does Theory Inform Practice? Theory and Practice in Language Studies, 1(3). https://doi.org/10.4304/tpls.1.3.273-277
33. Wang, X., & Zhang, W. (2022). Improvement of Students' Autonomous Learning Behavior by Optimizing Foreign Language Blended Learning Mode. SAGE Open, 12(1), 215824402110711. https://doi.org/10.1177/21582440211071108
34. Wuhue, J. (2023). Do SPOC really improve student learning in vocational schools? A meta-analysis of studies in Chinese contexts. Turkish Online Journal of Educational Technology - TOJET, 22(1), 49-59.
35. Xu, Z., Yuan, H., & Liu, Q. (2021). Student Performance Prediction Based on Blended Learning. IEEE Transactions on Education, 64(1), 66–73. https://doi.org/10.1109/te.2020.3008751
36. Yang, L. (2018). Research on Blended Learning Based on SPOC. Proceedings of the 2018 2nd International Conference on Education Science and Economic Management (ICESEM 2018). https://doi.org/10.2991/icesem-18.2018.52
37. Zhang, X., Zhang, B., & Zhang, F. (2023). Student-centered case-based teaching and online–offline case discussion in postgraduate courses of computer science. International Journal of Educational Technology in Higher Education, 20(1). https://doi.org/10.1186/s41239-022-00374-2
38. Zhang, Z., Shao, Z., & Chen, L. (2023). Application and research of SPOC+PAD teaching mode in "Introduction to Communication" under the background of epidemic. Journal of Journalism & Communication, (1), 79-81.
39. Zhuo, X., Liu, F., Zhang, Y., & Wang, L. (2023). Practical research on "PAD + blended learning" in basic computer courses in medical vocational colleges. Computer Knowledge and Technology, 19(8). https://doi.org/10.14004/j.cnki.ckt.2023.0346