

ความคิดเห็นต่อองค์ประกอบการเรียนรู้ 8 ด้านและผลสัมฤทธิ์ทางการเรียน ของนิสิตเภสัชศาสตร์ ชั้นปีที่ 3 เปรียบเทียบระหว่างการเรียนในรูปแบบออนไลน์และผสมผสาน Perceptions of the 8 Dimensions of Learning Components and Academic Performance of Third-Year Pharmacy Students: A Comparison Between Online and Blended Learning

นิพนธ์ต้นฉบับ

Original Article

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วารสารไทยเภสัชศาสตร์และวิทยาการสุขภาพ 2567;19(4):361-371.

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บทคัดย่อ

วัตถุประสงค์: เพื่อเปรียบเทียบคะแนนความคิดเห็นต่อองค์ประกอบการเรียนรู้ 8 ด้าน ระหว่างการเรียนรูปแบบออนไลน์และผสมผสาน และหาความสัมพันธ์ระหว่างคะแนนความคิดเห็นและผลสัมฤทธิ์ทางการเรียน (GPA) วิธีการศึกษา: เป็นการศึกษาแบบไม่ทดลองใช้เครื่องมือคือแบบสอบถามความคิดเห็น มาตรฐานวัดลิเคิร์ต 5 ระดับ (1-5 คือ เห็นด้วยน้อยที่สุดถึงมากที่สุด) กลุ่มตัวอย่างคือผู้เรียนเภสัชศาสตร์ชั้นปีที่ 3 ปีการศึกษา 2564 จำนวน 81 คน เก็บข้อมูลกับผู้เรียนภายหลังจบภาคเรียนที่ 2 (ผ่านการเรียนทั้งสองรูปแบบมาแล้ว คือรูปแบบออนไลน์ในภาคเรียนที่ 1 และรูปแบบผสมผสานและภาคเรียนที่ 2) วิเคราะห์ข้อมูลด้วยสถิติพรรณนา Mann Whitney U test และค่าสัมประสิทธิ์สหสัมพันธ์ของเพียร์สัน ผลการศึกษา: ผู้เรียนมีอายุเฉลี่ย 21.4 ปี ส่วนใหญ่เป็นเพศหญิง (67%) มี GPA อยู่ในช่วง 3.00-4.00 (67-75%) และครอบครัวให้การสนับสนุนด้านการเรียนอย่างเต็มที่ คะแนนความคิดเห็นของผู้เรียนโดยภาพรวมในการเรียนรูปแบบผสมผสานมีค่าสูงกว่ารูปแบบออนไลน์ด้วยค่าเฉลี่ย 4.05 ± 0.26 , 3.82 ± 0.29 ตามลำดับ ($p < 0.001$) โดยรายองค์ประกอบพบ 6 ด้าน คือ ผู้เรียน เนื้อหา สื่อการสอนและแหล่งเรียนรู้ การจัดการเรียนรู้ การติดต่อสื่อสาร และการวัดประเมินผล ที่สองรูปแบบการเรียนมีคะแนนแตกต่างกัน ($p < 0.01$) โดยเฉพาะด้านการสื่อสาร (ระหว่างผู้เรียน-ผู้เรียน และผู้เรียน-ผู้สอน) และด้านการจัดการเรียนรู้ (ภาคปฏิบัติการและฝึกทักษะทางคลินิก) ในขณะที่ด้านผู้สอนและเครือข่ายเทคโนโลยีสารสนเทศ มีคะแนนไม่แตกต่างกัน ($p = 0.849$, 0.547 ตามลำดับ) ผลสัมฤทธิ์ทางการเรียนไม่พบความสัมพันธ์กับคะแนนความคิดเห็น (ทั้งคะแนนภาพรวมและคะแนนรายองค์ประกอบ) สรุป: ความคิดเห็นทางบวกของผู้เรียนเภสัชศาสตร์ต่อองค์ประกอบการเรียนรู้ในการเรียนรูปแบบผสมผสานสูงกว่าในการเรียนรูปแบบออนไลน์ โดยความคิดเห็นนี้ไม่เกี่ยวกับระดับ GPA ของผู้เรียน ดังนั้นการเรียนรูปแบบนี้จึงเป็นรูปแบบที่น่าสนใจในการพัฒนาและปรับปรุงให้เป็นรูปแบบที่เหมาะสมกับผู้เรียนต่อไป

คำสำคัญ: การเรียนแบบผสมผสาน, การเรียนแบบออนไลน์, องค์ประกอบการเรียนรู้, ผลสัมฤทธิ์ทางการเรียน, ผู้เรียนเภสัชศาสตร์

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Abstract

Objectives: This study aims to compare students' opinion scores on 8 learning components between online and blended learning formats and to find the relationship between these scores and academic achievement (GPA). **Method:** The non-experimental study used a Likert scale questionnaire (1-5, from strongly disagree to agree strongly) as the research instrument. The sample consisted of 81 third-year pharmacy students from the academic year 2021. Data were collected from students after completing the second semester (having experienced online learning in the first semester and blended learning in the second semester). Data were analyzed using descriptive statistics, the Mann-Whitney U test, and Pearson's correlation coefficients. **Results:** The average age of the students was 21.4 years, with a majority being female (67%). Most students had a GPA between 3.00-4.00 (67-75%) and received full support from their families for their studies. Overall scores, students' opinions on blended learning were higher than on online learning, with average levels of 4.05 ± 0.26 and 3.82 ± 0.29 , respectively ($p < 0.001$). Significant differences were found in six components: student, content, instructional media and resources, learning process, communication, and assessment ($p < 0.01$). The communication (between student-student and student-instructor) and the learning process (practical sessions and clinical skill practice) showed notable differences. There were no significant differences in the components of the instructor and IT network ($p = 0.849$, 0.547 , respectively). The GPA showed no correlation with their opinions (both scores of overall and individual components). **Conclusion:** The positive perceptions of pharmacy students regarding the learning components were higher for the blended learning model than for the online learning model. These opinions were not related to the student's GPA. Therefore, this learning model is of interest for further development and improvement to be suitable for learners in the future.

Keywords: Blended learning, Online learning, Learning components, Academic performance, Pharmacy students

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Introduction

Traditional classroom learning (Onsite or Face-to-Face learning) has been the predominant method of education for a long time. This learning model emphasizes four key

components: (1) student, (2) instructor, (3) content, and (4) assessment.^{1,2} During the initial phase of the COVID-19 pandemic, online learning was introduced to replace traditional

learning. Online learning originated from distance education, utilizing online platforms for teaching and learning. The components of online learning have been proposed to include eight dimensions, encompassing the four dimensions above and adding four more: (1) instructional media and resources, (2) learning process, (3) communication, and (4) information technology network. In the early stages of the COVID-19 pandemic (early 2020), the primary issues with online learning arose from learners and instructors not being able to adapt and from various unpreparedness, such as equipment, information network systems, online platforms, learning resources, and online teaching materials, as well as the technology proficiency of the personnel. After some time, as the situation improved and adaptation occurred (2021), these problems gradually diminished. As the situation further relaxed (2022), the teaching and learning methods were adjusted once again to a blended learning model, which combines online and traditional learning as appropriate.^{3,4} Currently, the learning models have entirely transformed post-COVID-19 pandemic, and in addition with the new generation of learners who demand more autonomy in their learning. An appropriate educational model should provide learners with the freedom to choose their learning methods.⁵ Pharmacy students, similar to other health science students, need to develop communication skills and real patient care experience. Therefore, finding a suitable learning model for these students is of great interest. However, comparative studies on the eight learning components in online and blended learning models from the learners' perspectives are limited. This study aims to compare learners' opinions on the eight components of learning in both learning models and to explore the relationship between these opinions and academic performance (GPA). The main hypotheses are: (1) Learners' opinions on both learning models do not differ significantly, and (2) Learners' opinions are not related to academic performance. The study was conducted with third-year pharmacy students who have exclusively studied subjects offered by the faculty and have experienced both learning models in the 2021 academic year. A five-point Likert scale questionnaire was used to assess opinions on both models' eight learning components. The results will provide insights into learners' opinions on the factors influencing learning in both models and reveal the relationship between these opinions and academic performance. The findings can be used to develop appropriate learning components or models

for the new generation of learners in the Faculty of Pharmacy and other health science faculties.

Methods

This study employed a quantitative non-experimental research design, utilizing a retrospective survey to gather opinions on eight dimensions of learning components and academic performances from students engaged in online and blended learning models. The Human Research Ethics Committee of Mahasarakham University approved the study protocol, approval number 131-134/2565. The methodology included the following details:

1. Definition of Learning Components²: Eight dimensions of learning components were defined as

Student: Recipient of the content/knowledge from the instructor, covering three minor dimensions, namely, the students themselves, their family, and their learning environment.

Instructor: Content/knowledge transmitter to the students by providing instruction, guidance, and support to help students learn and understand the materials and skills.

Content: Knowledge that facilitates achieving the learning objectives.

Instructional Media and Resources: Tools aiding students in understanding the content, such as videos, simulations, academic articles, books, etc.

Learning Process: Designing learning experiences according to objectives, content, instructional media, learning activities, and assessment methods.

Communication: The interaction between instructor-student, student-student, and student-others.

Information Technology (IT) Network: Institution's internal and external network system.

Assessment: The process of measuring and evaluating learning during the course (formative assessment) and after the course (summative assessment) to reflect learning effectiveness and student ability.

2. Learning Formats: Two learning formats in this study were defined as

Online Learning: Conducted during the first semester of the 2021 academic year (Semester 1/2021) due to the COVID-19 pandemic. Lectures were delivered through various online platforms such as MS Teams, Zoom, and Google Meet, transforming virtual meeting rooms into classrooms. Teaching

materials included PowerPoint presentations, videos, images, and websites. For practical sessions, instructional videos and other resources were provided, along with equipment sent to students' homes. Small group discussions for case studies were held via breakout rooms. Exams were conducted online under faculty supervision, and grading was criterion-referenced, with grades ranging from A to F. Courses for the 1st semester included Pharmacology and Pharmacotherapy 1-2 (3P1 and 3P2), Clinical Pharmacy Laboratory 2 (CP2), Medicinal Chemistry 1, Pharmaceutical Technology 2, Pharmaceutical Quality Control 2, Pharmacy Administration, Information Technologies in Education, and Medicinal Herbs and Thai Traditional Pharmacy.

2.1. Blended Learning: Conducted during the second semester of the 2021 academic year (Semester 2/2021) as COVID-19 restrictions eased, combining online lectures (similar to the first semester) with traditional in-class practical sessions, maintaining social distancing. The assessments were conducted on paper in physical classrooms, and graded using the same criterion-referenced method as the online learning format. Courses for the 2nd semester included Pharmacology and Pharmacotherapy 3-4 (3P3 and 3P4), Clinical Pharmacy Practice 3 (CP3), Medicinal Chemistry 2, Pharmaceutical Technology 3, Applied Pharmacognosy, and Pharmaceutical Jurisprudence and Ethics.

3. Population and Sample

The study population comprised students from the Faculty of Pharmacy at Mahasarakham University enrolled in the current curriculum. These students had experienced both learning formats and had registered only for faculty subjects in the academic year 2021. The population specifically included 170 third and fourth-year students.

The sample group for this study consisted of 81 third-year pharmacy students from Mahasarakham University who were enrolled during the academic year 2021 (June 2021 - April 2022). This group included all third-year students who experienced both learning formats. Inclusion criteria were students who had registered for courses in that semester and consented to participate in the study throughout its duration. Exclusion criteria included students who withdrew from any course during the semester or requested to leave the study while data collection was ongoing.

The sample size was calculated using the statistical software STATA version 15, specifically utilizing the "Sample size for one mean" function. Parameters from a previous study

by Permwongk et al (2023), which surveyed nursing students' opinions on online learning, were used for substitution in the formula.⁶ The previous study reported an overall mean opinion score of 3.40 ± 0.52 (measured on a five-point Likert scale). The parameters used were $\alpha=0.05$, power of test= 0.80 , $m_0=3.406$ ⁶, $s.d.=0.526$ ⁶, and $\text{diff}=0.15$, resulting in a required sample size of 97 participants. However, due to the specific objective of this study, which aimed to test students enrolled in the same courses during the same semester to examine the relationship between opinion scores and GPA, it was decided to focus on a single-year group. Therefore, the sample consisted of all 81 third-year students. The fourth-year students, who had previously taken the same courses, were utilized for developing the questionnaire. Despite the smaller sample size compared to the initial calculation, a post-hoc power analysis using the mean opinion scores from this study indicated the power of the test as 1.0. This result confirms the adequacy of the sample size used in this study.

4. Research Instrument (Questionnaire Development)

The questionnaire used in this study comprised two sections: general information and opinions on eight dimensions of the learning components. A five-point Likert scale was employed, with scores ranging from 1 to 5 representing the following levels of agreement: 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (strongly agree). The questions were designed to apply to both learning formats to minimize bias due to differences in question phrasing, as advised by the expert panel who reviewed the questionnaire. The analysis of the opinion scores for each item used the following interpretation scale based on the average score: 1.00-1.49 (very low level), 1.50-2.49 (low level), 2.50-3.49 (moderate level), 3.50-4.49 (high level), and 4.50-5.00 (very high level).⁶

The content validity of the questionnaire was established by three experts, namely, an expert in educational research and development (Faculty of Education at Mahasarakham University), head of the curriculum of the Doctor of Pharmacy (PharmD) program (Faculty of Pharmacy at Mahasarakham University), director of teaching and learning innovation center, (Faculty of Pharmacy at Mahasarakham University). These experts evaluated the questionnaire, and their feedback was used to calculate the Index of Item-Objective Congruence (IOC) using the formula $\sum R/N$, where $\sum R$ is the sum of the scores given by each expert, and N is the total number of experts. The questionnaire items were then revised according

to their recommendations to ensure each item achieved an IOC score of 0.50 or higher.⁷ In this study, the IOC scores for individual items ranged from 0.67 to 1.00.

The reliability of the questionnaire was assessed by administering it to 40 fourth-year pharmacy students who had previously registered for third-year courses and had experienced both online and blended learning formats. The Cronbach's alpha coefficient reliability was calculated, yielding values of 0.80 for the online learning questionnaire and 0.84 for the blended learning questionnaire. These results indicate the good reliability of the questionnaire.⁸

The questionnaire will be administered using Google Forms, ensuring anonymous responses. It consists of two main sections: (1.) General Information (such as gender, age, family income, equipment readiness, living conditions, technological proficiency, GPA, etc.), this section is divided into two sets of questions to capture any changes that may have occurred between the two semesters due to the different periods and varying circumstances of the two learning formats (online and blended). This includes variations in family income, equipment readiness, etc. (2.) Opinions on Learning Components, this section evaluates students' opinions on eight aspects of the learning components, comprising 47 items. Each question is duplicated to address both online and blended learning models, ensuring a comprehensive comparison.

5. Data Collection

Data was collected using Google Forms in May 2022, at the end of the second semester. The students had already experienced both learning formats. They were briefed on the study purpose, terminology, and questionnaire procedures via MS Teams. Consent forms were signed, and students were randomly assigned numbers for anonymous responses. The questionnaire was administered in three rounds to manage the number of questions and response time. The first round was the questionnaire of section 1, the second round was the questionnaire of section 2 (dimensions 1 and 2) with 25 items, and the third round was section 2 (dimensions 3 to 8) with 22 items. Each dimension comprised the questionnaire of both learning formats. It took approximately 10-15 minutes per round to complete the questionnaire. The total period for completing the questionnaire was 30-45 minutes.

6. Data Analysis

General information and opinion scores were analyzed using frequency, percentage, mean±s.d., and mean

differences. Mean opinion scores between online and blended learning were compared using the Mann-Whitney U test. Pearson correlation coefficients were used to examine the relationship between opinion scores and GPA. With significance at $p < 0.05$, those data represented an association. The correlation coefficient (R) indicated the level of relationship as follows: 0.00-0.03 (very low level), 0.03-0.05 (low level), 0.05-0.07 (moderate level), 0.07-0.09 (high level), 0.09-1.00 (very high level). Data were analyzed using SPSS ver.27.0.1.

Results

1. General Information

The students had an average age of 21.4 years, with the majority being female (63%). Most families had a monthly income of over 40,000 THB and fully supported their child's education. Most of the students were ready for learning and exams. In both semesters, most students lived independently in dormitories and rented houses, which provided more privacy than living with family and helped them concentrate on their studies. During the second semester (blended learning), as the COVID-19 situation eased and practical classes resumed on campus, more students returned to dormitories. Other common study locations included coffee shops, with most students using their accommodation's Wi-Fi for studying. Regarding IT skills, most students were proficient, and some showed improvement in the second semester, with those who previously had moderate or low proficiency decreasing from 32% to 24.7%, and those who were proficient or expert increasing from 67.9% to 75.3%. The majority of students had a GPA between 3.00-4.00 (Table 1).

Table 1 Generation information and academic performance of students

Personal Information	N (%)	
	Online Learning (1/2021)	Blended Learning (2/2021)
1. Family Monthly Income (THB)		
< 20,000	17 (21)	16 (19.8)
20,001-40,000	28 (34.6)	30 (37.0)
> 40,000	36 (44.4)	35 (43.2)
2. Support for Learning Based on Family Status		
Supportive	71 (87.7)	76 (93.8)
Not Supportive	10 (12.3)	5 (6.2)
3. Support for Learning Equipment from Family		
Fully Supported	67 (82.7)	66 (81.5)
Partially Supported	14 (17.3)	15 (18.5)
Not Supported	-	-
4. Readiness of Equipment for Learning and Examination		

Ready	78 (96.3)	79 (97.5)
Not Ready	3 (3.7)	2 (2.5)
5. Living Conditions During Learning		
Living with Family	28 (34.6) Private Room 21, Living Room or Other 7	4 (4.9) Private Room 2, Living Room or Other 2
Not Living with Family	43 (53.1) Staying Alone 39, Staying with Others 4	73 (90.1) Staying Alone 62, Staying with Others 11
Combination	10 (12.3)	4 (4.9)
6. Other Learning Locations		
None	48 (59.3)	40 (49.4)
Have (Specify)	33 (40.7) Cafe 26, Library 2, Cafe and Library 3, Other 2	41 (50.6) Cafe 33, Library 2, Cafe and Library 4, Other 2
7. Internet System Used for Learning		
Mobile Internet	11 (13.6)	14 (17.3)
Wi-Fi	68 (84)	65 (80.2)
Both	2 (2.5)	2 (2.5)
8. Proficiency in IT skills for Learning (such as MS Team, Zoom, Google Meet, etc.)		
Somewhat Able	7 (8.6)	3 (3.7)
Able but Not Proficient	19 (23.5)	17 (21.0)
Proficient	46 (56.8)	50 (61.7)
Expert	9 (11.1)	11 (13.6)
9. Grade Point Averages (GPA)		
3.01 – 4.00	61 (75.3)	54 (66.7)
2.01 – 3.00	19 (23.5)	21 (25.9)
1.01 – 2.00	1 (1.2)	6 (7.4)

2. Comparison of Opinion scores on Eight Learning Components Between Online and Blended Learning Formats

When considering individual question scores (Table 2), the average scores were interpreted as follows: Component 1 (student), opinion scores ranged from moderate to highest level. Component 2 (instructor), the scores level were high to highest. Component 3, 4, 5, 6 (blended learning), and 7 (dimension of content, instructional media and resource, learning process, communication, and IT network, respectively), the scores of those components were at a high level, meanwhile, component 6 (communication in online learning) and 8 (assessment), the score levels were moderate to high. The average scores for blended learning were higher than for online learning in forty out of forty-seven items, with a difference of means greater than 0.5 points in items 1.1, 1.2, 1.7, 5.2, 5.3, 6.1, 6.3, and 8.1. On the other hand, the results found only five items had higher scores for online learning, with differences ranging from 0.04-0.28 points in item 1.4 (planning and achieving study plans), item 1.9 (regularly review of lessons after class), item 1.14 (family support for learning), item 1.20 (residential environment away from

entertainment or distracting areas), and item 2.4 (instructor adaptability for smooth teaching and learning), by item 1.9 had the largest difference of 0.28 points. Additionally, in item 1.10 (independent study and additional activities after class) and item 7.3 (interest and stimulate learning from different IT techniques), scores showed no difference between the two learning formats.

Overall scores (sum of all components), blended learning showed higher average scores (Table 3). Significantly differences were found in 6 components (except component 2 and 7) with $p < 0.001-0.01$. Especially, component 6 (communication) moved from the rank of sixth in the first semester to second in the second semester. This component represented the largest average score difference of 0.62 points, followed by Component 5 (learning process), Component 8 (assessment), and Component 4 (instructional media and resources), respectively. Component 1 and 3 (student and content) had the smallest average score differences of 0.16 points.

3. Relationship Between Academic Performance and Opinion Scores on Eight Learning Components

The average GPA for the first semester (online learning) was higher than for the second semester (blended learning), with scores of 3.32 ± 0.52 and 3.09 ± 0.64 , respectively. No significant relationship was found between GPA and opinion scores (overall and individual components), suggesting that the students' opinion scores did not correlate with their grades (Table 4). However, an exception was found for the correlation between individual questions and GPA. Item 1.9 (component 1, students: "ability to regularly review lessons after class"), showed a low but significant correlation with second-semester GPA ($p = 0.036$), with a correlation coefficient (R) of 0.23 (data not shown).

4. Additional Student Feedback

Students highlighted the advantages of online learning, such as increasing learning flexibility, self-managed study schedules, the ability to revisit lessons as needed, various media options for learning, improving IT skills, and saving time for travel and preparation to go to campus classes. The disadvantages of online learning included feelings of isolation, aligning with the significantly lower opinion scores for online learning compared to blended learning (component 6). Students preferred mixed-mode lectures but emphasized the need for traditional in-person formats for practical courses, particularly clinical practice involving patient interaction

Table 2 Students' Opinion scores of individual questions in online and blended learning

Questions	Online Learning		Blended Learning		Difference of means
	Mean±S.D. (n=81)	Interpretation	Mean±S.D. (n=81)	Interpretation	
Component 1 : Student					
1.1. You have a positive attitude (enjoyment and happiness) towards learning.	3.54±0.73	High	4.05±0.74	high	-0.51
1.2. You have the motivation and drive to learn.	3.19±0.95	Moderate	3.86±0.92	High	-0.67
1.3. You have good goals and expectations for your academic performance.	3.93±0.80	High	3.96±0.81	High	-0.03
1.4. You have planned your studies and successfully followed through with the plan.	3.32±1.01	Moderate	3.28±0.85	Moderate	0.04
1.5. You consistently pay attention and are diligent in your studies.	3.44±1.06	Moderate	3.53±0.95	High	-0.09
1.6. You thoroughly prepare for each class before it begins.	2.56±1.10	Moderate	2.51±1.01	Moderate	0.05
1.7. You maintain focus throughout each class.	2.73±0.91	Moderate	3.28±0.90	Moderate	-0.56
1.8. You express your opinions during class.	2.75±1.09	Moderate	2.95±1.08	Moderate	-0.20
1.9. You regularly manage your time for reviewing lessons after class.	3.22±1.14	Moderate	2.94±0.87	Moderate	0.28
1.10. You conduct additional research and engage in activities after class.	2.99±0.94	Moderate	2.99±0.92	Moderate	0.00
1.11. You seek academic advice from your instructors.	2.69±1.17	Moderate	2.89±1.21	Moderate	-0.20
1.12. You seek academic advice from friends, engage in group activities, and encourage taking practice tests.	3.49±1.05	Moderate	3.91±0.88	High	-0.42
1.13. Your stress levels have decreased.	2.88±1.03	Moderate	3.11±0.95	Moderate	-0.23
1.14. You receive encouragement from your family to support your studies.	4.09±1.07	High	3.99±1.12	High	0.10
1.15. You receive support from your family in providing a suitable study place.	4.52±0.65	Highest	4.59±0.70	Highest	-0.07
1.16. You receive full support from your family for the time needed for studying.	4.52±0.65	Highest	4.62±0.58	Highest	-0.10
1.17. You <u>do not</u> experience family burdens that might affect your studies, such as helping with household chores or family business.	4.16±1.04	High	4.49±0.76	High	-0.33
1.18. You have a good learning environment, including aspects such as noise, lighting, and temperature.	3.63±1.01	High	3.98±0.96	High	-0.35
1.19. You have convenient accommodation near facilities like restaurants, convenience stores, and laundry services.	4.12±1.07	High	4.27±0.92	High	-0.15
1.20. Your accommodation is far from entertainment or distracting places, such as gaming shops and shopping malls.	4.12±1.13	High	3.95±1.11	High	0.17
1.21. You have someone who listens and exchanges opinions with you.	3.98±0.97	High	4.09±0.94	High	-0.10
Component 2: Instructor					
2.1. Instructors plan learning activities and assessments with students, which promotes effective learning.	4.60±0.68	Highest	4.62±0.62	Highest	-0.02
2.2. Instructors use diverse teaching techniques, which enhances learning.	4.49±0.71	High	4.52±0.69	Highest	-0.03
2.3. Instructors manage learning activities and time appropriately, which enhances learning.	4.70±0.60	Highest	4.73±0.55	Highest	-0.03
2.4. Instructors can adapt well to situations, which ensures smooth learning and teaching.	4.73±0.52	Highest	4.69±0.58	Highest	0.04
Component 3: Content					
3.1. The content is comprehensive, aligned with course objectives, and appropriately sequenced.	3.94±0.78	High	4.05±0.71	High	-0.11
3.2. The lecture content is consistent with the learning format.	4.09±0.69	High	4.16±0.70	High	-0.07
3.3. The practical content is consistent with the learning format.	3.80±0.93	High	4.10±0.77	High	-0.30
Component 4: Instructional Media and Resource					
4.1. The instructional media is appropriate for the content, diverse, not repetitive or boring, and stimulates learning.	3.86±0.90	High	3.98±0.91	High	-0.12
4.2. The learning resources/documents/books for research are diverse, including DIC, library, databases (Lexicomp, Access Medicine).	3.52±1.03	High	3.85±0.88	High	-0.33
Component 5: Learning Process					
5.1. The learning process reduces learners' anxiety and burdens.	3.58±1.00	High	3.73±0.96	High	-0.15
5.2. In-class learning process allows the instructor to recognize learners' reactions directly and reflect immediately.	3.52±1.10	High	4.25±0.92	High	-0.73
5.3. The learning process enhances practical or professional skills.	3.69±1.02	High	4.28±0.79	High	-0.59
5.4. The learning process facilitates integrated activities that promote analytical thinking, synthesis, and creativity, following educational standards.	3.64±0.88	High	3.99±0.75	High	-0.35
5.5. The synchronized learning process increases convenience and saves preparation time before class.	3.79±0.98	High	3.83±1.05	High	-0.04
Component 6: Communication					
6.1. There are ample opportunities for communication with friends and instructors through various channels.	3.73±0.89	High	4.30±0.78	High	-0.57
6.2. Submitting assignments and asking questions to instructors is convenient with various channels available, reducing limitations.	3.64±0.83	High	4.10±0.85	High	-0.46
6.3. The learning format promotes interaction with classmates, such as following up on assignments and reviewing lessons together, which enhances knowledge learning.	3.20±1.03	Moderate	4.26±0.72	High	-1.06
6.4. You can develop and practice communication skills and express your opinions through various channels.	3.67±1.02	High	4.05±0.84	High	-0.38
Component 7: IT Network					
7.1. The internet network for learning is easily accessible, stable, and sufficient for use.	3.88±0.99	High	3.93±0.95	High	-0.05
7.2. Using diverse information technology (Google Meet, Microsoft Teams, Kahoot, Socrative, Quizizz) can help you improve these skills.	4.41±0.75	High	4.42±0.69	High	-0.01
7.3. Different IT techniques for learning increase interest and stimulate learning.	3.91±0.98	High	3.91±0.98	High	0.00
Component 8: Assessment					
8.1. The examination process (Midterm or Final) is uncomplicated, easy, and appropriate.	3.40±1.14	Moderate	4.26±0.82	High	-0.86
8.2. The examination process (Midterm and Final) encourages students to follow examination rules.	3.32±1.26	Moderate	3.68±1.05	High	-0.36
8.3. The assessment methods (Midterm and Final) are diverse (such as oral exams, OSCE, comprehensive exams, etc.)	4.01±0.84	High	4.07±0.85	High	-0.06
8.4. The assessment methods do not increase the workload for students.	2.89±1.12	Moderate	2.94±1.10	Moderate	-0.05
8.5. Continuous assessment helps students understand their knowledge level and content comprehension, allowing timely self-improvement.	3.80±0.93	High	3.96±0.86	High	-0.16

Table 3 The opinion scores (individual and overall component) in online and blended learning

	Mean±S.D. (n=81)		p-value ^a	Difference of Means
	Online Learning	Blended Learning		
Individual Component				
1. Student	3.52±0.51	3.68±0.48	p=0.001*	-0.16
2. Instructor	4.63±0.50	4.64±0.48	p=0.679	-0.01
3. Content	3.94±0.63	4.10±0.59	p=0.007*	-0.16
4. Instructional Media and resource	3.69±0.83	3.91±0.76	p<0.001*	-0.22
5. Learning Process	3.64±0.70	4.02±0.67	p<0.001*	-0.38
6. Communication	3.56±0.77	4.18±0.66	p<0.001*	-0.62
7. IT Network	4.07±0.66	4.09±0.70	p=0.576	-0.02
8. Assessment	3.48±0.74	3.78±0.67	p<0.001*	-0.30
Overall Components	3.82±0.29	4.05±0.26	p<0.001*	-0.23

a; Mann Whitney U test *; p<0.05 when compared between online and blended learning formats

Table 4 The correlation between opinion scores and academic performance (GPA) in online or blended learning

	Correlation ^a (R, p-value)	
	Online Learning (GPA of 1/2021 = 3.32±0.52)	Blended Learning (GPA of 2/2021 = 3.09±0.64)
Individual Component		
1. Student	0.01, p=0.931	0.01, p=0.935
2. Instructor	0.13, p=0.244	0.10, p=0.399
3. Content	-0.05, p=0.656	-0.15, p=0.176
4. Instructional Media and Resource	-0.01, p=0.950	-0.18, p=0.104
5. Learning Process	-0.19, p=0.094	-0.11, p=0.346
6. Communication	0.003, p=0.982	-0.12, p=0.305
7. IT Network	0.04, p=0.725	-0.003, p=0.978
8. Assessment	-0.03, p=0.828	-0.11, p=0.329
Overall components	-0.04, p=0.731	-0.19, p=0.085

a; Pearson correlation

Additionally, students suggested that assignments should be given at least 3-7 days in advance to enhance learning efficiency in both learning formats.

Discussions and Conclusion

1. Comparison of Opinion Scores on 8 Learning Components between Online and Blended Learning Formats

The results of this study show that, based on individual questions for each component, students had higher opinion scores in blended learning compared to online learning. Components with an average score difference greater than 0.5 points were components 1, 5, 6, and 8.

Component 1 (students) includes three dimensions: themselves, their family, and their environment. Higher scores were observed in items 1.1, 1.2, and 1.7 (about the learner's attitude, motivation, and concentration). These questions relate to the learners themselves. Component 5 (learning

management), the scores were higher in items 5.2 and 5.3 (immediate instructor feedback, enhancing practical and professional skills). Component 6 (communication) scored higher in items 6.1 and 6.3 (various communication channels and promoting interaction with classmates). Component 8 (evaluation) had a higher score in item 8.1 (simple and uncomplicated exams). Interestingly, item 1.9 (time management for review lessons after classes) showed higher positive online learning scores than blended learning. Overall scores, the blended learning format had a higher average, with significant differences in six out of eight components (excluding component 2 and 7).

Online learning, which utilizes online platforms and the internet to create virtual classrooms, allows students convenient access to learning resources.² In this study (semester 1), all lectures, practices, and exams were conducted online, enhancing students' freedom and reducing unnecessary activities.⁹ However, during the COVID-19

pandemic, online learners managed their review time better than those in blended learning (component 1, item 1.9). This contrasts with some studies indicating reduced use of online resources during the pandemic.¹⁰ According to item 1.13, students found online learning more stressful than blended learning, though score levels in both formats were moderate, with a minimal average score difference of 0.23 points. This indicates that students experience stress in both learning formats. Students reported increased workload, frequent assignments, and video materials in online learning format, causing fatigue, anxiety, and decreased motivation, potentially reducing self-motivation.^{10,11} Nevertheless, online learning saved travel time, allowing more time for reviewing lessons after class. The lower positive opinion scores in online learning might be due to a lack of happiness, motivation, and concentration (related to themselves dimension). However, family support was strong in both formats (related to their family dimension). In particular, item 1.14 (family encouragement) scored higher in online learning, balancing the decrease in self-motivation with family support, resulting in similar score levels in component 1 (3.52 and 3.68; the mean scores are at high levels).

Blended learning has combined online and traditional methods.^{3,4,12} In this study (semester 2), lectures were online, while practices were conducted in-person activity in campus, with traditional mid-term and final exams. The overall positive opinion scores for blended learning were higher, except for instructor and IT network aspects, likely because both formats used the same instructors and IT networks. Additionally, the primary reason for the higher scores in blended learning is likely due to students having the opportunity to return to in-person communication and interaction in the classroom at the faculty. When considering the ranking of scores, it is evident that component 6 (communication) shows a notable change in the average scores. Students explained that online learning involves less face-to-face communication compared to blended learning. Meeting and talking with instructors and friends in person prevents feelings of isolation and enhances peer learning (item 6.3). Moreover, blended learning retains the communication channels from online learning, such as chat features or online platforms, providing more communication options (item 6.1).

In this study, the students are Generation Z (born between 1995 and 2010). Generation Z students have a strong affinity for technology and social media.¹³ They spend

a significant amount of their time online to stay updated with various news and developments.¹³ The results of this study indicate that students have a more positive attitude towards blended learning than online learning. It is likely due to the COVID-19 pandemic situation, where online learning led to unhappiness as students were unable to meet friends and instructors as usual. Generation Z students require rapid communication on online platforms and face-to-face interactions.¹³ Interaction between instructors and students, as well as among students themselves, can significantly increase motivation for learning.¹⁴ Thus, blended learning can enhance students' motivation more effectively.^{14,15} Online learning during the COVID-19 pandemic has led to a lack of real interpersonal interaction. As a result, students may miss out on developing communication skills, such as observing the emotions and facial expressions of their conversation partners.^{4,15,16} These skills are crucial for health science students, who need to practice communication with real patients.¹⁶

Component 5 (learning management) showed a significant difference in average scores between the two learning modalities, ranking second. Active learning, where students participate and engage hands-on, enhances the academic achievement and satisfaction of learners.^{14,17,18,19} Blended learning revealed that practices conducted on campus contributed to higher positive opinion scores. Students felt that learning on campus allowed instructors to observe and respond to their reactions immediately, which improved practical skills (items 5.2 and 5.3).

Component 8 (assessment) also received less positive opinion scores on online learning than blended learning. The assessments in online learning were conducted via the Safe Exam Browser system and examination platform. These methods were perceived as more complex and difficult than traditional assessments in blended learning (item 8.1). Additionally, they increased student stress,¹⁵ Not only pressure from content assessment but also concerns about internet connectivity and the functionality of online examination systems.²⁰ However, there is also a study with a different view. That study asked for student opinions from various faculties and found that most students had positive opinions towards assessment when studying online learning format.²¹ This result may be due to the characteristics of the students' faculties, age, student nature, etc., which affect the expression of different opinions.²¹

2. Relationship Between Academic Performance and Opinion Scores on Eight Learning Components

The study found no correlation between average student's opinion scores (overall and individual components) and their GPA. Different learning formats do not correlate with academic performance.²² Various courses of each semester prevented GPA comparison between formats. In this study, the aim was not to compare the GPA of the two learning formats. Instead, the correlation between opinion scores and GPA was examined to ensure that students' opinions were not influenced by their grades. The findings confirmed that academic performance was unlikely to be a confounding factor in students' views. Further analysis revealed a low correlation between GPA and opinion scores for item 1.9 in blended learning during the second semester. This can be explained by the increased time spent on activities at the faculty and travel time, which reduced the time available for reviewing lessons after classes compared to online learning. As a study by Vaughan (2007) found that blended learning can cause time management issues for students.¹²

Opinions on learning formats are related to student characteristics such as age, marital status, and other personal attributes. A study involving students from various faculties within a university found that graduate students or married students prefer online or blended learning. This preference is due to the convenience it offers for managing regular work or taking care of a family. In contrast, most undergraduate students tend to prefer traditional in-person learning. Younger students often enjoy spending time on campus and participating in university activities.²¹ Graduate students might be another interesting group for studying opinions on various learning components. Additionally, Generation Alpha, the upcoming cohort of learners (born between 2011 and 2025), shares a love for technology similar to Generation Z. As digital natives, they prefer learning through watching, enjoy interactive and hands-on learning, have shorter attention spans, prefer collaborative work, and have more personalized learning plans.^{5,23} The needs of Generation Alpha may differ from those of Generation Z, thus requiring further research to identify suitable learning modalities for this generation.

Blended learning, which combines the advantages of both online and traditional learning, especially increases student freedom and flexibility.^{3,4,9,12} This can be seen from the current study, where nearly half of the students chose to study in additional locations like coffee shops, beyond their

homes and faculty. These locations likely provide a relaxing atmosphere and Wi-Fi, conducive to learning. An appropriate educational setup gives students the freedom to choose their learning methods according to their needs.⁵ Therefore, blended learning seems to be a suitable teaching method in higher education, particularly for health science students who need to practice patient care skills. The implementation of blended learning should consider student characteristics (age, education level, generation, etc.), an appropriate ratio of online to on-campus hours (at least 1:3)¹¹, and activities that increase student engagement. Some studies have identified disadvantages of blended learning, such as potential confusion due to various formats and a lack of motivation.²¹ These concerns highlight the need for well-structured components and factors tailored to different student characteristics, including engaging activities, appropriate assessments, etc.

3. Study Limitations

3.1. The formats in this study may not fully represent each learning style, as they were implemented during an emergency situation. Instructors might have had limited time to design appropriate teaching materials, and there was less use of modern, engaging tools (such as Quizizz, Kahoot, etc.) that enhance interaction between instructors and students. As a result, the focus was mainly on live lectures, making students passive learners. Exams for the online learning format were conducted through online platforms, eliminating real face-to-face communication, which could contribute to increased student stress and affect their opinion scores. In normal circumstances, these factors might have less impact. To enhance engagement and motivation in synchronous and asynchronous learning, instructors should design online lessons that foster learner-content interaction, adjust content volume appropriately, and encourage students to become active learners.^{14,15,17}

3.2. The COVID-19 pandemic might have caused inconsistencies in teaching standards across a semester (lectures and practices), especially in semester 1 of the online learning format. Courses varied in teaching and assessment methods, with some reducing pressure through diversified evaluations, potentially reducing main exam stress. GPA discrepancies between semesters might reflect varied subject arrangements.

3.3. This non-experimental research collected retrospective opinions on learning components using a questionnaire after both learning modalities had been completed. Both learning formats occurred in different semesters under real COVID-19 pandemic conditions, which might affect the study results since the courses and credit loads differed, leading to varying academic burdens. To control these factors, students were asked to provide feedback specifically on the Pharmacology and Pharmacotherapy subjects, including practices. These core clinical pharmacy courses had consistent content related to Pathophysiology, Pharmacology, and Pharmacotherapy, with practice following each topic. The courses were taught by the same group of instructors and had the highest total credit load per semester, with 7 credits in both semesters.

4. Recommendations

Based on the study findings, students showed a preference for blended learning over purely online formats, particularly in communication, a crucial skill for health science students. Importantly, these preferences were independent of students' GPA levels, despite the complete return to traditional classroom learning currently observed. Nevertheless, the study data remains beneficial for graduate-level teaching applications or curriculum development, especially in blended formats. Furthermore, should circumstances akin to the COVID-19 pandemic recur, insights from student feedback on learning components in both formats studied here can be invaluable for enhancing all 8 dimensions of learning. Studying diverse student categories, such as graduate students and Generation Alpha generation, remains an intriguing area for future research to explore further insights.

5. Conclusion

The results of this study indicate that blended learning received more positive feedback on learning components compared to a fully online format in six out of eight dimensions. Particularly, these areas include **communication** (students had real interactions with peers and instructors). **Learning process**, students returned to practice real skills at the faculty. **Assessment** were conducted traditionally. The opinion scores on these components were unrelated to their academic performance (GPA). Additionally, there was a low correlation between time management for reviewing lessons and GPA in the blended learning format.

Blended learning, which combines the advantages of both online and traditional learning, appears to be a highly suitable model for pharmacy students and other health science fields that require practical communication skills training in classrooms or practice settings. This approach provides a conducive learning environment and helps achieve the desired learning outcomes.

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