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Comparison of Online and Hybrid Education Models for First Aid and Emergency Care Students

İlk ve Acil Yardım Öğrencilerinde Online ve Hibrit Eğitim Modellerinin Karşılaştırılması

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ABSTRACT

Background: The Coronavirus Disease 2019 pandemic disrupted education and training processes, necessitating a transition to remote learning that significantly altered teaching methods for both students and instructors. To highlight the challenges arising from this rapid shift in applied health sciences, the present study aimed to compare the perceptions of professional competence among First and Emergency Aid students who received online versus hybrid education during the pandemic.

Materials and Methods: This descriptive cross-sectional study was conducted among second-year students at two universities: one providing fully online education (n = 59) and the other offering hybrid instruction (n = 61).

Results: No statistically significant difference was observed between the groups in understanding theoretical courses (p = 0.088); however, students who received face-to-face instruction within the hybrid model demonstrated significantly better comprehension of practical courses (p < 0.001).

Conclusion: In conclusion, while online education is adequate for acquiring theoretical knowledge, it is insufficient for developing clinical and technical skills. Accordingly, these findings suggest that practical courses in health education programs, such as First and Emergency Aid, should be conducted face-to-face whenever possible; when in-person attendance is required, appropriate safety measures should be implemented.

Keywords: Pandemic, professional competence, online education, hybrid education, first and emergency aid, paramedic

ÖZ

Amaç: Koronavirüs Hastalığı 2019 pandemi döneminde eğitim ve öğretimin kesintiye uğraması ve uzaktan yapılması öğrenci ve öğreticiler için eğitim yöntemlerinde değişime sebep oldu. Bu hızlı değişimin, uygulamalı eğitim bilimlerinde oluşturduğu zorluklara dikkat çekmek için pandemi döneminde online ve hibrit eğitim gören İlk ve Acil Yardım programı öğrencilerinin mesleki yeterlilik algılarının karşılaştırılması amaçlandı.

Gereç ve Yöntemler: Tanımlayıcı ve kesitsel olan çalışma online eğitim yapan bir üniversite (n = 59) ile, hibrit eğitim yapan bir üniversitenin (n = 61) İlk ve Acil Yardım programı 2. sınıf öğrencileri ile gerçekleştirildi.

Bulgular: Teorik derslerin anlaşılması açısından her iki grup arasında fark bulunmaz iken (p > 0,088), uygulamalı derslerin anlaşılmasında yüz yüze eğitim alan grup lehine fark tespit edildi (p < 0,001).

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ÖZ

Sonuç: Sonuç olarak; online eğitimin bilgi edinmede yeterli, ancak klinik ve teknik beceri edinmede yetersiz olduğu bulunmuştur. Zorunlu koşullarda İlk ve Acil yardım gibi sağlık eğitimi verilen programlarda uygulamalı derslerin gerekli önlemler alınarak yüz yüze verilmesi önerilmelidir.

Anahtar Kelimeler: Pandemi, mesleki yeterlilik, çevrim içi eğitim, hibrit eğitim, ilk ve acil yardım, paramedik

Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic has led to profound economic, social, and cultural changes worldwide, particularly in the field of health (1). Education became the second-most affected sector after healthcare. Face-to-face instruction was suspended globally, forcing millions of learners and educators to adopt alternative methods to maintain the continuity of education (2).

With the measures implemented to control the rapidly spreading pandemic, the online education model emerged as the most practical solution for ensuring educational continuity and achieving learning objectives (3). However, this process was also accompanied by various limitations and challenges (4). Previous studies have reported that online education offers advantages such as low cost, flexibility in time and location for both students and instructors, ease of communication, and opportunities to review recorded materials (5,6). Conversely, adverse effects such as sleep disturbances, decreased motivation, impaired social interaction, excessive phone and internet use, anxiety, and stress-related depression have been identified (7–9).

Face-to-face interaction remains crucial for effective communication (10). Clinical practice holds indisputable importance for professional development, especially in health-related disciplines. Such practices enable students to integrate theoretical knowledge with patient care, develop problem-solving abilities, and gain professional autonomy and teamwork skills (11,12).

The First and Emergency Aid (Paramedic) program, an associate degree in health sciences, combines theoretical and clinical training. The effectiveness of this program largely depends on adequate clinical experience. Although online education is an efficient method of knowledge acquisition, it poses challenges for applied health sciences (13). The transition away from face-to-face education during the pandemic created uncertainty in paramedic training, which relies heavily on interaction and hands-on experience, leading to professional concerns among students. Previous research has shown that online education is less effective for clinical training, where practical and technical skills must be developed (13,14). Moreover, studies conducted with paramedic graduates before the pandemic revealed higher perceived professional competence among graduates who participated in hands-on training (15,16).

Despite several studies investigating the effects of the pandemic on practice-based education among various health professional groups, limited research has focused on paramedic students who are the first healthcare providers to interact with patients in pre-hospital settings (4,17–19). Therefore, this study aimed to examine the effects of hybrid and online educational methods on paramedic students and to evaluate their perceptions of professional competence.

Materials and Methods

Based on an appraisal of the aforementioned findings, albeit with controversies, we hypothesized that:

$H0_1$: There is no significant difference between the views of students who received the hybrid and online education models.

$H1_1$: The views of paramedic students who received training during the pandemic regarding the hybrid education model are more positive than their views regarding the online education model.

$H0_2$: The hybrid education model does not contribute more to students academic success compared to online education.

$H1_2$: The hybrid education model contributes more to students' success than online education.

$H0_3$: The hybrid education model does not affect students' perceptions of professional competence in practical courses.

$H1_3$: The hybrid educational model positively affects students' perceptions of professional competence in practical courses.

Type of study: The study is a two-center, descriptive cross-sectional study.

Population and Sample of the Study

The study population consisted of paramedic students enrolled in the Vocational School of Health Services at two universities: one located in a metropolitan area offering hybrid education (School A), and the other located in a smaller city providing fully online education (School B). While students at School A completed their theoretical courses online and practical courses face-to-face, those at School B took all courses online. Before the Council of Higher Education (YÖK) decision mandating online education at the beginning of the pandemic (2020), both universities had completed one semester of face-to-face instruction. Subsequently, School A continued with two

semesters of hybrid education, whereas School B maintained two additional semesters of online education. Data were collected in March 2021 after the students had completed their second academic year.

The required sample size was calculated using G*Power software, assuming an effect size of 0.5, statistical power of 80%, and a margin of error of 5%, resulting in a minimum sample size of n = 98. A total of 61 of 65 students from School A and 59 of 62 students from School B voluntarily participated in the study. No sampling procedure was applied; all students who provided informed consent were included.

Data Collection and Analysis

Data Collection Tools: The questionnaire used for data collection was developed by the researchers based on a comprehensive literature review. It consisted of two sections. The first section included questions about the students' sociodemographic characteristics, grade points averages (GPAs), and opinions regarding the teaching method they received. The second section assessed students' perceptions of professional competence using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). These items measured the students' confidence in performing basic and advanced emergency procedures (e.g., intravenous injection, nasogastric tube insertion, and cardiopulmonary resuscitation [CPR]. The responses reflected students' self-reported competence rather than their actual performance; therefore, no multiple-choice or knowledge-based test questions were included, and objective performance measurement was not conducted.

Ethical approval was obtained from the Gümüşhane University Scientific Research and Publication Ethics Committee (approval number: 2021/3, dated: 14.04.2021), and administrative permission was obtained from the institutions where the study would be conducted. Students who voluntarily participated in the study were informed about the data collection forms. An online link was sent to the students who had provided written consent, and they were asked to complete the questionnaire. The study was conducted in accordance with the Declaration of Helsinki.

Statistical Analysis

Data were analyzed using the IBM SPSS Statistics 25.0 software package. Descriptive statistics (frequency, percentage, median, and interquartile range) were used to summarize the data. The Shapiro–Wilk test and histogram plots were applied to examine the normality of distribution. Since the data did not show a normal distribution (Shapiro–Wilk $p < 0.05$), non-parametric tests were used.

The Mann–Whitney U test was applied to compare the median scores between the online and hybrid education groups for continuous variables such as perceived competence levels in theoretical and practical courses. This test was preferred because it does not assume normal distribution and is appropriate for comparing two independent groups when ordinal data are used, such as Likert-type scales. The level of statistical significance was set at $p < 0.05$. All analyses were two-tailed. The results were presented with corresponding z and r values to indicate effect size and direction.

Results

Of the 120 students who participated in the study, 51.7% were female and 48.3% were male. The proportion of female students was higher in College B (66.1%) than in the other group. The proportions of students with a GPA of 3.01 or higher at the end of the training process were 32.2% in the online group and 62.3% in the hybrid group. While 42.5% of all participants wanted education to continue online, 44.1% of students who received only online education wanted it to continue in a hybrid format, and 63.9% of students who received hybrid education wanted it to continue only online. Among all participants, 68.3% attended online courses at home, and 71.7% used their smartphones for online education (Table 1).

The reasons students wanted to take their courses online were as follows: 38.3% preferred online education because it allowed them to study at their convenience, and 12.5% preferred it because they were employed. Problems encountered while attending online courses included technical connection issues (62.7%), inability to ask questions about unclear topics (54.2%), and lack of socialization (37.3%). Among hybrid students, 39.3% reported technical problems, 21.3% reported difficulty in asking questions about unclear topics, and 34.4% reported a lack of social interaction (Table 2).

In Tables 3 and 4, data on the comprehension of theoretical and practical courses are presented according to the educational method received by the students. There was no statistically significant difference between the online and hybrid education groups in terms of understanding theoretical courses ($p = 0.088$). The median score of online students was 3.00, and the median of hybrid students was 3.25.

A statistically significant difference in the comprehensibility of practical courses was found between the two groups ($p < 0.001$). The median for online students was 2.50, and for hybrid students, 3.50. Both groups stated that practical courses should be conducted face-to-face (Table 4).

Table 1. Demographics characteristics of students.

		Online education		Hybrid education		Mean of all participants	
		n	%	n	%	n	%
Gender	Female Male	39 20	66.1 33.9	23 38	37.7 62.3	62 58	51.7 48.3
Student GPA	2.00 and less 2.01–2.50 2.51–3.00 3.01–3.50 3.51 and more	3 10 27 19 0	5.1 16.9 45.8 32.2 0	1 8 14 24 14	1.6 13.1 23.0 39.3 23.0	4 18 41 43 14	3.3 15.0 34.2 35.8 11.7
How would you like the training to proceed?	Online Hybrid Face to face	12 26 21	20.3 44.1 35.6	39 10 12	63.9 16.4 19.7	51 36 33	42.5 30.0 27.5
Which tool is used to participate in distance learning?	Own computer Own smartphone Someone else's computer Someone else's device Other	15 42 1 1 0	25.4 71.2 1.7 1.7 0	9 44 5 0 3	14.8 72.1 8.2 0 4.9	24 86 6 1 3	20.0 71.7 5.0 0.8 2.5
Where do you participate in online training	My own home House of relatives Neighbor house	56 2 1	94.9 3.4 1.7	26 3 32	42.6 4.9 52.5	82 5 33	68.3 4.2 27.5
	Total	**59**	**100.0**	**61**	**100.0**	**120**	**100.0**

GPA, grade point average.

Table 2. Students' views on online and hybrid education.

		Online education		Hybrid education		Mean of all participants	
		n	%	n	%	n	%
Reasons for wanting online courses	I take lessons when I am available School lessons are boring I can't concentrate at school I am working	29 1 1 9	49.2 1.7 1.7 15.3	17 1 5 6	27.9 1.6 8.2 9.8	46 2 6 15	38.3 1.6 5 12.5
Drawbacks of following lectures online	Always have access to the internet Technical issues Individualization Staying away from social environments Not being able to ask questions	26 37 16 22 32	44.1 62.7 27.1 37.3 54.2	16 24 13 21 13	26.2 39.3 21.3 34.4 21.3	42 61 29 43 45	35 50.83 24.16 35.83 37.5

Multiple responses were allowed. Percentages are based on the number of students within each group.

The training method applied to the students and their skills related to health practices are presented in Table 5. A significant difference was found, favoring students who received hybrid education, in perceived competence for advanced health practices related to their profession ($p < 0.001$). Students in the hybrid education group reported greater confidence in performing practical procedures, such as intravenous and intramuscular injections; endotracheal intubation; nasogastric and urinary CPR resuscitation; and defibrillation. The median for students who received online education was 2.14, and the median for students who received hybrid education was 4.00 (Table 5).

Discussion

This study demonstrates the negative impact of fully online education on students' professional competence by comparing the perceptions of competence in practical courses among paramedic students who received hybrid and fully online education. In professions involving applied scientific disciplines, in-person instruction is essential. During the pandemic, the educational activities of paramedic students were adversely affected: clinical and laboratory practices could not be conducted, and students graduated and entered the profession through the online education system (20).

Table 3. Students' opinions on theoretical courses.

What is the method of education you received at school?	Online			Hybrid education			Total			
	Mean	n	SD	Mean	n	SD	Mean	n	SD	
I have no problems understanding the theoretical courses.	3	59	1.31306	2.9836	61	1.13272	2.9917	120	1.21956	
The time allocated for theoretical courses is sufficient for understanding the subject matter.	3.339	59	1.13882	3.0656	61	1.24992	3.2	120	1.19944	
The course materials used to teach the theoretical courses are adequate.	2.6441	59	1.30994	3.2623	61	1.09395	2.9583	120	1.23938	
I consider myself proficient in theoretical courses.	2.8814	59	1.31418	3.5574	61	0.90415	3.225	120	1.17009	
	Online education			Hybrid education						
	Mean rank	Sum of ranks	Median	Mean rank	Sum of ranks	Median	u	p	z	r
	55.03	3246.50	3.00	65.80	4013.50	3.25	1476.50	0.088	-1.705	-0.160

Mann–Whitney U test applied; z, standardized test value, p, probability value, r, effect size, $p < 0.05$ indicates significance. SD, standard deviation.

Table 4. Students' opinions on applied courses.

What is the method of education you received at school?	Online			Hybrid education			Total			
	n	SD	Mean	n	SD	Mean	n	SD	Mean	
I have no difficulty understanding the practical components of applied courses.	2.3559	59	1.551	3.4918	61	1.05866	2.9333	120	1.43623	
The course materials used to facilitate understanding of the practical training are adequate.	2.1017	59	1.15512	3.4754	61	0.9765	2.8	120	1.26757	
I can readily ask the lecturer about topics I do not understand during the lecture.	3.339	59	1.1687	3.7049	61	1.08542	3.525	120	1.13732	
I think that providing practice-based courses exclusively through distance education is insufficient.	4.0339	59	1.46177	2.918	61	1.6155	3.4667	120	1.63436	
	Online education			Hybrid education						
	Sum of ranks	Median	Sum of ranks	Median	Sum of ranks	Median	u	p	z	r
	41.31	2437.50	2.50	79.06	4822.50	3.50	667.50	0.001	-5.962	-0.540

Mann–Whitney U test applied; z, standardized test value, p, probability value, r, effect size, $p < 0.05$ indicates significance. SD, standard deviation.

A significant majority of students educated during the COVID-19 pandemic were digital natives born in the 2000s who actively use technology. The internet, computers, and mobile devices are integral to every aspect of their lives. The transition to remote education during the pandemic represented a novel experience for these young people, who were already accustomed to the digital world (21). In our study, the majority of students who received hybrid education expressed a preference for online learning, while half of those who received exclusively online education were satisfied with it. Different rates have been reported in the literature: 54.6% of medical students (2), 60% of health students (13), and 53.9% of nursing students (22) reported that they did not find online education effective. However, medical and nursing students stated that online education was comparable to traditional teaching because it met the course objectives, conveyed content accurately, and ensured appropriate use of time (23). In contrast, first aid and emergency care students exhibited negative attitudes toward online education (24). The reasons why hybrid-

Table 5. Students' self-perceived professional competence in clinical skills according to education method.

According to the method of education you received at school;	Online education			Hybrid education			Total		
	Mean	n	SD	Mean	n	SD	Mean	n	SD
I feel competent in intravenous route opening practice.	2.9661	59	1.33863	4.3607	61	0.7535	3.675	120	1.28444
I feel competent in administering intramuscular injections.	2.5593	59	1.29016	4.2131	61	1.03465	3.4	120	1.4284
I feel competent in tracheal intubation practice.	1.8814	59	1.05184	3.5738	61	1.20359	2.7417	120	1.41121
I feel competent in nasogastric catheter application.	1.7458	59	0.99296	3.5246	61	1.20563	2.65	120	1.41807
I feel competent in urinary catheterization.	2.0169	59	1.25247	3.3443	61	1.20948	2.6917	120	1.39504
I feel competent in cardiopulmonary resuscitation.	2.2881	59	1.20417	4.1311	61	1.00789	3.225	120	1.44049
I feel competent in using defibrillators.	2.0169	59	1.22463	3.7049	61	1.05427	2.875	120	1.41755

	Online education			Hybrid education						
	Mean rank	Sum of ranks	Median	Mean rank	Sum of ranks	Median	u	p	z	r
	36.42	2148.50	2.14	83.80	5111.50	4.00	378.50	0.000	-7.470	-0.680

Mann–Whitney U test applied; z, standardized test value, p, probability value, r, effect size, $p < 0.05$ indicates significance. SD, standard deviation.

education students preferred online learning included avoidance of in-person attendance for laboratory practices, transportation issues related to living in a metropolitan area, and risk of exposure to COVID-19 during hospital-based clinical practices.

Most students indicated that the main reason they preferred to continue their studies online was the ability to attend classes from any location at their convenience. Saving time, easy access to lessons, and the opportunity to rewatch lectures, aspects of flexibility provided by online education, were also cited as key preferences. Nursing students, in particular, value online education for its temporal and spatial flexibility, the ability to stay with family while attending classes, and reduced transportation costs (25,26). Medical students prefer online education because it enables them to review recorded lectures and removes temporal and spatial constraints (2,27,28). In line with the literature (29), our study found that a large proportion of students attended classes from their homes using their phones. Online education may continue to be preferred beyond the pandemic because of its flexibility in time management. However, students frequently reported issues such as lack of socialization, technical problems before or during classes, and inability to ask questions about topics they did not understand. These issues, including the inability to ask questions during lessons, not having a conducive home learning environment, spending excessive time in front of a computer, and difficulty focusing, have been highlighted in many studies (22,27,28,30). Medical students also mentioned the inability to examine cadavers during anatomy classes.

First aid and emergency care students reported that online education did not offer good learning opportunities, that acquired information was not retained, and that they experienced difficulties in learning (20). Although our students expressed positive views of online education, they also shared negative perceptions of their own motivation. Our results indicate that theoretical courses can be effectively delivered online or face-to-face and that the education provided was sufficient, even though distance education had not previously been implemented. No significant difference was observed between groups in their understanding of theoretical content delivered online; however, online education was preferred because of its advantages. Synchronous classes that offer an educational atmosphere closer to face-to-face education have been shown to increase the acceptability of online learning among students. Similarly, nursing students (31) and operating theatre students (32) stated that distance learning methods are sufficient for the theoretical components of courses but inadequate for practical training. Some studies report no difference between face-to-face and online instruction regarding learning outcomes, while other studies suggest that online education is more effective and efficient for

medical students (27). Therefore, theoretical courses can be effectively supported by online education.

Within the health professions, the First and Emergency Aid (Paramedic) program plays a critical role in enabling accurate diagnosis and timely intervention in prehospital care. In Türkiye, the Regulation on the Working Procedures and Principles of Ambulance and Emergency Care Technicians and Emergency Medical Technicians, published in 2009 under Decision No. 27181, emphasizes the critical importance of competencies in defibrillation and endotracheal intubation. A lack of proficiency in these skills may result in patient death. Error-free application of skills can only be acquired through high-quality, effective training in first aid and emergency care (20,33,34). In our study, students who received hybrid education reported significantly higher levels of perceived professional competence in practical courses (including IV/IM administration, intubation, nasogastric and urinary catheterization, CPR, and defibrillation) than students who received online education. Participation in face-to-face clinical practice appears to increase students' confidence and sense of readiness in performing professional skills. When students' academic achievement was evaluated based on GPA, 85.3% of those who received hybrid education had an average GPA of 2.5 or higher, which is consistent with our findings. Our study compared students enrolled in two associate-degree programs in different cities, both offering the same curriculum before and after the COVID-19 pandemic. Although the educational content remained consistent, the aim was to evaluate the impact of differing delivery models—one fully online and the other hybrid. Institutional characteristics, environmental factors, and potential variations in student demographics were not taken into account. This methodological limitation should be considered when interpreting the findings.

Paramedic students who received education during the pandemic reported feeling anxious about the risk of harming patients (20). Similarly, 75% of medical students who trained during the pandemic reported that they could not treat patients without in-service training and that they felt professionally inadequate (13). The education students receive at university is a crucial period during which they acquire the professional knowledge and skills necessary to obtain employment after graduation. Graduating with professional qualifications and competencies enhances self-confidence and reduces anxiety about finding employment. Face-to-face clinical practices, whether bedside or simulation-based, conducted under the supervision of instructors, provide effective training and confidence for quick and accurate interventions in real-life scenarios.

Study Limitations

The primary limitation of this study is that the vocational schools compared are situated in cities with differing socio-cultural and environmental characteristics**.** One of the universities, located in a metropolitan area, implemented a hybrid education model, while the other, situated in a smaller city, adopted a fully online approach. Although this study provided an opportunity to compare two educational delivery models, institutional structures, available resources, and student profiles may differ across universities. Our study compared students enrolled in two associate degree programs located in different cities, both offering the same curriculum before and after the COVID-19 pandemic. Although the educational content remained consistent, the aim was to evaluate the impact of differing delivery models—one fully online and the other hybrid. Institutional characteristics, environmental factors, and potential variations in student demographics were not taken into account. Therefore, the findings may have been influenced not only by the educational model but also by environmental and institutional factors.

Additionally, the data were based solely on students' self-reports. Only their perceptions of professional competence were assessed; objective measures such as knowledge levels or actual performance were not included. Since the study was conducted during the pandemic, psychological and environmental conditions specific to that period may have affected students' perceptions.

Conclusion

Face-to-face clinical training is essential for health sciences students to feel professionally competent and to reinforce their theoretical knowledge. Our study revealed that the negative aspects of online education during the pandemic stemmed mainly from systemic problems, and students perceived these aspects more positively when adequate planning and preparation were in place. Although distance education appears sufficient for delivering theoretical knowledge, it remains inadequate for fostering perceived professional competence in clinical and technical skills. Face-to-face clinical practice enhances students' perceived professional competence and self-efficacy in applied skills. Hybrid education, which combines online theoretical instruction with in-person clinical practice, improves students' perceptions of professional competence and supports their preparedness for professional roles. Therefore, in health education programs such as First Aid and Emergency Aid, a hybrid education model that includes face-to-face practical training should be prioritized over fully online education.

In light of these findings, future research should investigate how hybrid education models can be further optimized to balance theoretical knowledge acquisition with clinical skill development. It is also recommended that future studies include larger and more diverse samples from various universities and employ research designs that integrate subjective perceptions of competence with objective assessments of knowledge and performance.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the Gümüşhane University Scientific Research and Publication Ethics Committee (approval number: 2021/3, dated: 14.04.2021), and administrative permission was obtained from the institutions where the study would be conducted.

Informed Consent: No sampling procedure was applied; all students who provided informed consent were included.

Footnotes

Authorship Contributions

Concept: Ş.N.K., B.Y.K., B.N.B.D., Design: N.D.B., B.Y.K., B.N.B.D., Data Collection or Processing: B.Y.K., B.N.B.D., Analysis or Interpretation: N.D.B., Literature Search: B.Y.K., Writing: Ş.N.K., B.Y.K.

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