FOLIA MORPHOLOGICA

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ABSTRACT

Background: Distance education emerged as a potential solution to enhance access, standardize content, and facilitate updates. However, student perceptions varied widely. The COVID-19 pandemic prompted a rapid shift towards distance education in anatomy, presenting challenges and opportunities for medical students globally. A crucial area of study is how distant learning, utilized once more during the 2023 earthquakes, affects medical education and students. This study investigates medical students' perspectives on anatomy education in remote and in-person settings.

Materials and methods: This study involved surveying first and second-year medical students to gather their opinions and experiences regarding distance and face-to-face education. The advantages and disadvantages of anatomy distance education were then analyzed based on the students' responses.

Results: Individuals who preferred traditional in-person education were less inclined to utilize digital resources, whereas those who selected remote education shown a greater preference for the usage of digital resources ($p < 0.001$). Similarly, individuals who favored traditional in-person education exhibited low levels of confidence in online exams, whereas those who preferred remote education shown high levels of confidence ($p < 0.001$).

Conclusions: Considering the results of our study and our location in a potentially hazardous area affected by the North Anatolian Fault line in the Marmara Region of Türkiye, we believe that our experiences with distance education will help in effectively maintaining the Anatomy in Medicine education process.

Keywords: anatomy education, distance education, earthquake, COVID-19, medical students, challenges

INTRODUCTION

Disasters such as earthquakes profoundly affect medical education, necessitating curriculum adaptations and psychological support for students. Recent events, including the 2023 earthquakes in Türkiye and the ongoing conflict in Ukraine, have severely disrupted medical education institutions. Similarly, the COVID-19 pandemic has drastically transformed medical education and daily life [28]. With the closure of educational institutions, many schools rapidly transitioned to online education [11]. However, this shift posed significant challenges for educators, who had to balance maintaining educational quality with ensuring the safety of students and staff. This transition has highlighted both the opportunities and limitations of distance education, particularly in anatomy and medical studies.

Distance education in medical training presents both benefits and challenges. Studies suggest that online learning can enhance student engagement, motivation, and academic performance [20, 30]. It provides flexibility in time and location, supports theoretical knowledge acquisition, and proves effective for large-scale professional education [3, 30]. However, it is widely acknowledged that distance learning cannot fully replace traditional face-to-face medical education, especially for acquiring practical skills [26]. Challenges such as technological barriers, feelings of isolation, and increased workloads have been reported [30]. While some studies note high satisfaction among students and educators, others highlight a preference for in-person instruction [30]. The effectiveness of distance learning in medical education varies across contexts, underscoring the need for further research to develop optimal strategies [2].

Current distance education platforms have been enhanced to allow students to continue their studies in their existing environments [5]. While this approach ensures sustainability in various fields, achieving educational outcomes in health-related disciplines, particularly in medicine, remains a significant challenge. In medical training, including the critical domain of anatomy, alternative methods such as videos and digital atlases have been employed to mitigate the challenges of distance education [14, 17]. These adaptations aim to address

practical training gaps, though their impact on both students and faculty members warrants further exploration.

This study investigates the perceptions of preclinical medical students regarding distance and face-to-face anatomy education. By identifying the challenges and preferences associated with these modalities, we aim to propose solutions to current issues and enhance preparedness for future transitions to distance education, ensuring the continuity and quality of medical training.

MATERIALS AND METHODS

The study was carried out by applying an online questionnaire in which 1st and 2nd-year students of Tekirdağ Namık Kemal University, Faculty of Medicine voluntarily participated. Necessary permissions were obtained for the study.

A questionnaire was created that the students who participated in the survey could fill out anonymously, without being asked for any information that could reveal their identity, so that they could answer the questions without any concern. The collected responses were then exported in an Excel file and organized for analysis. Statistical analysis was performed by using the Mann–Whitney U-Test and Chi-Square test in IBM SPSS (version 26) software, and values lower than p ˂ 0.05 were considered significant.

RESULTS

First-year students' survey results

The study included 135 first-year students (53 males, 82 females) with an average age of 19.76 years ($\pm$ 1.52). No significant age difference was found between male (19.8 $\pm$ 1.3) and female (19.7 $\pm$ 1.7) students (p = 0.73) (Fig. 1).

Regarding school preferences, first-year students ranked the institution they attended as their seventh choice on average (6.67 $\pm$ 4.60). Female students prioritized this school significantly more than male students (p = 0.006).

Male students exhibited greater confidence in online exams compared to female students, with mean ranks of 79.29 and 60.70, respectively (p = 0.007). Male students also showed a stronger preference for remote delivery of theoretical courses compared to female students (p = 0.009), however, this difference was not observed for practical courses (p = 0.09).

Students who reported difficulties with distance education expressed negative opinions about preferring it over face-to-face education (Tab. 1).

No significant gender difference was found in the use of digital resources among first-year students (p = 0.101) (Fig. 2). Correlation analysis revealed a significant positive relationship between the use of digital resources and confidence in online exams with the preference for processing theoretical and practical courses through distance education (Tab. 2).

Second-year students' survey results

The study included 110 second-year students (45 males, 65 females) with an average age of 20.84 years (± 0.89). No significant age difference was found between male (20.98 ± 0.99) and female (20.74 ± 0.82) students (p = 0.18) (Fig. 3).

Second-year students, regardless of gender, ranked their school preference similarly (males: 9.84 ± 4.79, females: 9.18 ± 3.97, p = 0.45).

No significant gender differences were observed among second-year students in preferences for face-to-face theoretical (p = 0.68), remote theoretical (p = 0.11), face-to-face practical (p = 0.95), or remote practical courses (p = 0.24). Similarly, no differences were found in their attitudes toward remote versus face-to-face education in non-anatomy courses (p = 0.36), digital resource usage (p = 0.77), or confidence in online exams (p = 0.13).

As with first-year students, second-year students with difficulties in distance education expressed negative opinions about preferring it over face-to-face education (Tab. 3).

When asked to evaluate face-to-face and online courses based on past experiences, second-year students rated face-to-face courses higher for both theoretical and practical sessions (Fig. 4).

Correlation analysis indicated that second-year students' use of digital resources and trust in online exams correlated negatively with their experiences in face-to-face education. Additionally, negative correlations were observed between preferences for face-to-face and online methods for theoretical (r = –0.609) and practical (r = –0.447) courses (Tab. 4).

Qualitative feedback

In response to an open-ended question, students highlighted that while distance education was a necessity during the pandemic, theoretical courses were suitable for online delivery. However, they expressed that laboratory courses lacked sufficient teaching quality when delivered online and should, therefore, be conducted face-to-face.

DISCUSSION

Anatomy is a cornerstone of medical education, traditionally delivered through instructor-led theoretical and practical courses. In recent years, there has been a growing interest in integrating student-centered and asynchronous learning methods, such as video recordings and textbook readings, into the curriculum. However, a significant concern with asynchronous learning is the potential difficulty in comprehending the three-dimensional relationships of anatomical structures. Studies suggest that mixed reality technologies may help overcome this challenge by enabling the study of anatomy and functional relationships without increasing cognitive load [21].

Distance education offers several advantages, including improved access to information, standardized content delivery, easy updates, accountability through recorded sessions, and increased student motivation to engage actively [9, 29]. Research has shown that the diversity of materials used in online education can sometimes surpass those in face-to-face settings [16]. Furthermore, distance education has the potential to address faculty shortages, expand the reach of medical educators, and enhance productivity, particularly in low- and middle-income countries [15].

Despite these benefits, many studies highlight challenges and negative perceptions of online learning among medical students. In India and Pakistan, students reported dissatisfaction with online education [1]. Similar concerns were raised in Indonesia, where students cited a lack of interaction, difficulty concentrating, and challenges in understanding online lessons [12]. In India, additional issues included the lack of appropriate technological devices, internet connectivity, study materials, and time management skills, as well as reduced motivation [31]. In contrast, a study in China found that anatomy educators were willing to continue online teaching post-pandemic, following the increased adoption of distance learning during the pandemic [10].

In Spain, video-based teaching significantly improved students' understanding of theoretical anatomy content [27]. However, studies in Türkiye revealed concerns among nursing students about the efficiency of distance education (83.5%), unequal access due to limited resources, and the inadequacy of remote theoretical (56.4%) and practical (76.4%) courses [19]. Similarly, university students expressed dissatisfaction with distance education, considering it a temporary alternative to face-to-face learning, and raised concerns about technical problems and its limited societal benefits [18].

A similar study highlighted that distance education is perceived as less effective than traditional face-to-face learning, with students expressing dissatisfaction with video-based application courses and reporting that distance education does not save time [22]. The findings from our survey align with these observations, as students similarly indicated a preference for face-to-face education and expressed comparable concerns.

Additionally, a study conducted in our country revealed that while 33.8% of university students considered distance education sufficient, 74.1% believed it negatively impacted the quality of education. The same study reported that students commonly relied on YouTube (50.4%), electronic encyclopedias (27.3%), textbooks (57.6%), electronic books (54%), and electronic libraries (21.6%) as their primary learning resources during distance education [6]. These insights emphasize the mixed reception of distance learning, with students recognizing its potential for resource accessibility while critiquing its limitations in maintaining the quality of education and engagement levels compared to traditional methods.

In a recent study, it was stated that online anatomy practical education has no advantage or disadvantage against academic success compared to in-person education and can be an alternative learning platform [25]. Further studies emphasize that both practical (74%) and theoretical (61%) anatomy education are perceived as insufficient when conducted online. Students expressed a preference for theoretical content to be partially remote and practical training to be face-to-face [34, 35]. A study in Singapore, however, reported high satisfaction with online anatomy education facilitated *via* the "Zoom" application (85.5%) [32]. This contrasts with experiences at our institution, where the BigBlueButton platform's one-way communication model may have contributed to student dissatisfaction.

Both synchronous and asynchronous modes of distance education have unique advantages and limitations. Synchronous lessons allow for real-time interaction, immediate feedback, and reduced isolation through group work but may suffer from time constraints and technological challenges. Asynchronous lessons, while flexible and accessible, can create feelings of isolation, lack immediacy in feedback, and be unsuitable for practical training [13].

In anatomy education, autopsy, as well as dissection, provides a significant benefit in understanding normal and pathological conditions. Unfortunately, since the pandemic, autopsies have been performed less frequently throughout the European Union countries and their place in medical education has decreased. In a study conducted in Finland [24], autopsies were found to be of great educational importance for students, while the lack of the emotional aspect of virtual autopsies was mentioned. As in cadaver dissection, the situation in

autopsies shows the importance of the emotional aspect of the learning experience of the student's one-to-one participation.

Anatomy education requires specific adaptations to leverage the strengths of distance learning while addressing its limitations. Technologies such as virtual reality, 3D printing, and virtual anatomy tables show promise but are not yet widely implemented despite student interest [8, 33]. Moreover, exam security during online assessments remains a critical concern, as it is difficult to prevent unauthorized assistance.

The pandemic underscored the necessity of distance education but also highlighted gaps in preparation and material development. Students often relied on pre-recorded videos, which lacked the interactive classroom environment, leading to diminished engagement. Institutions must use student feedback to refine online anatomy education, ensuring that future adaptations meet both student needs and educational objectives [7, 23, 33].

Blended learning approaches, combining online theoretical instruction with face-to-face practical sessions, are increasingly recommended for post-pandemic education. Such strategies balance flexibility with the hands-on experience critical for anatomy training [4, 23, 33]. While distance education is unlikely to replace face-to-face learning entirely, it serves as a valuable complement, particularly in times of crisis.

CONCLUSIONS

Given our location in a seismically active region along the North Anatolian Fault line in the Marmara Region of Türkiye, our experiences with distance education provide valuable insights into the maintenance of the continuity of anatomy education under challenging circumstances.

The pandemic has highlighted the necessity of flexibility and innovation in medical education, particularly in anatomy, where both theoretical knowledge and hands-on practical experience are indispensable. While distance learning offers numerous advantages, including accessibility and flexibility, it also presents unique challenges that must be addressed to uphold the quality of education.

To navigate these complexities, a balanced approach that integrates the strengths of distance learning with the irreplaceable benefits of in-person training is essential. This requires collaborative efforts among educators, institutions, and stakeholders to develop robust, adaptive educational strategies. By addressing student concerns, leveraging emerging technologies, and ensuring equitable access to resources, we can enhance the effectiveness and resilience of anatomy education in the face of future disruptions.

ARTICLE INFORMATION AND DECLARATIONS

Data availability statement

The data that support the findings of this study are available from the corresponding author, Ali Zeybek, upon reasonable request.

Ethics statement

Authors' contribution

MO, data collection, writing, and finalizing, AZ, design, project development, writing, and review, MA, data collection, writing.

All authors reviewed the final version of the manuscript and approved it.

Funding

Acknowledgments

Conflict of interest

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

REFERENCES

1. Abbasi S, Ayoob T, Malik A, et al. Perceptions of students regarding E-learning during COVID-19 at a private medical college. Pak J Med Sci. 2020; 36(COVID19-S4): S57–S61, doi: 10.12669/pjms.36.COVID19-S4.2766, indexed in Pubmed: 32582315.

2. Abd-Elsayed A, Lawrence JP. Editorial — can distance learning improve the quality of medical education? Ochsner J. 2013; 13(3): 298, indexed in Pubmed: 24052756.

3. Aksu F, Akkoc R, Aras O, et al. Evaluation of distance and face-to-face anatomy education from the perspective of students during the COVID-19 pandemic period. Int J Morphol. 2023; 41(2): 522–526, doi: 10.4067/s0717-95022023000200522.

4. Aksu ZC. Distance education in COVID-19 pandemic: Insights from Turkish students. Research Methods in Social Sciences Final Report. 2020;11:1-15. 2020.

5. Al Lily AE, Ismail AF, Abunasser FM, et al. Distance education as a response to pandemics: Coronavirus and Arab culture. Technol Soc. 2020; 63: 101317, doi: 10.1016/j.techsoc.2020.101317, indexed in Pubmed: 32836570.

6. Babacan S, Dogru Yuvarlakbas S. Digitalization in education during the COVID-19 pandemic: emergency distance anatomy education. Surg Radiol Anat. 2022; 44(1): 55–60, doi: 10.1007/s00276-021-02827-1, indexed in Pubmed: 34476546.

7. Bagley JE, Randall K, Anderson MP. A comparison of sonography and radiography student scores in a cadaver anatomy class before and after the implementation of synchronous distance education. Ultrasound. 2015; 23(1): 59–66, doi: 10.1177/1742271X14567173, indexed in Pubmed: 27433237.

8. Byrnes KG, Kiely PA, Dunne CP, et al. Communication, collaboration and contagion: "virtualisation" of anatomy during COVID-19. Clin Anat. 2021; 34(1): 82–89, doi: 10.1002/ca.23649, indexed in Pubmed: 32648289.

9. Chen BY, Kern DE, Kearns RM, et al. From modules to MOOCs: application of the six-step approach to online curriculum development for medical education. Acad Med. 2019; 94(5): 678–685, doi: 10.1097/ACM.0000000000002580, indexed in Pubmed: 30681454.

10. Cheng X, Chan LKi, Pan SQ, et al. Gross anatomy education in China during the COVID-19 pandemic: a national survey. Anat Sci Educ. 2021; 14(1): 8–18, doi: 10.1002/ase.2036, indexed in Pubmed: 33217164.

11. Crawford J, Butler-Henderson K, Rudolph J, et al. COVID-19: 20 countries' higher education intra-period digital pedagogy responses. JALT. 2020; 3(1): 9–28, doi: 10.37074/jalt.2020.3.1.7.

12. Daroedono E, Siagian F, Alfarabi M, et al. The impact of COVID-19 on medical education: our students perception on the practice of long distance learning. Int J Community Med Public Health. 2020; 7(7): 2790–2796, doi: 10.18203/2394-6040.ijcmph20202545.

13. Demir E. Uzaktan eğitime genel bir bakiş. DUSBİD. 2014; 39: 203–211.

14. Flynn W, Kumar N, Donovan R, et al. Delivering online alternatives to the anatomy laboratory: early experience during the COVID-19 pandemic. Clin Anat. 2021; 34(5): 757–765, doi: 10.1002/ca.23722, indexed in Pubmed: 33470455.

15. Frehywot S, Vovides Y, Talib Z, et al. E-learning in medical education in resource constrained low- and middle-income countries. Hum Resour Health. 2013; 11: 4, doi: 10.1186/1478-4491-11-4, indexed in Pubmed: 23379467.

16. George PP, Papachristou N, Belisario JM, et al. Online eLearning for undergraduates in health professions: a systematic review of the impact on knowledge, skills, attitudes and satisfaction. J Glob Health. 2014; 4(1): 010406, doi: 10.7189/jogh.04.010406, indexed in Pubmed: 24976965.

17. Iwanaga J, Loukas M, Dumont AS, et al. A review of anatomy education during and after the COVID-19 pandemic: revisiting traditional and modern methods to achieve future innovation. Clin Anat. 2021; 34(1): 108–114, doi: 10.1002/ca.23655, indexed in Pubmed: 32681805.

18. Keskin M, Kaya DÖ. COVID-19 sürecinde öğrencilerin web tabanlı uzaktan eğitime yönelik geri bildirimlerinin değerlendirilmesi. İzmir Katip Çelebi Univ Sağlık Bilim Derg. 2020; 5(2): 59–67.

19. Kürtüncü M, Kurt A. COVID-19 pandemisi döneminde hemşirelik öğrencilerinin uzaktan eğitim konusunda yaşadiklari sorunlar. Avrasya Sos Ekon Araşt Derg. 2020; 7(5): 66–77.

20. Mercado-Asis L. Medical education through distance learning: how does it work? J Med Univ Santo Tomas. 2020; 4(2): 552–555, doi: 10.35460/2546-1621.2020-0021.

21. Michalski C, Cowan M, Bohinsky J, et al. Evaluation of cognitive load for a mixed reality anatomy application. Transl Res Anat. 2023; 31: 100247, doi: 10.1016/j.tria.2023.100247.

22. Ortadeveci A, Ermez MN, Oz S, et al. A survey study on distance anatomy education: challenges unique to anatomy. Surg Radiol Anat. 2022; 44(1): 41–47, doi: 10.1007/s00276-021-02772-z, indexed in Pubmed: 34031717.

23. Özen KE, Erdoğan K, Malas MA. Assessment of the opinions and experiences of anatomy educators regarding the distance anatomy education in medical facilities under the effect of COVID-19 in Turkey. Surg Radiol Anat. 2022; 44(5): 791–802, doi: 10.1007/s00276-022-02934-7, indexed in Pubmed: 35428908.

24. Pakanen L, Tikka J, Kuvaja P, et al. Autopsy-based learning is essential but underutilized in medical education: a questionnaire study. Anat Sci Educ. 2022; 15(2): 341–351, doi: 10.1002/ase.2073, indexed in Pubmed: 33730442.

25. Panchendrabose K, Iderstine MG, Hryniuk A. The use of an online anatomy laboratory for allied health education. Transl Res Anat. 2024; 35: 100292, doi: 10.1016/j.tria.2024.100292.

26. Panicio CFT, Santana A, Bermudes F, et al. Distance learning in medical education: an integrative review. Arq Med Hosp Fac Cienc Med. 2021, doi: 10.26432/1809-3019.2021.66.032.

27. Pereira J, Merí A, Masdeu C, et al. Using videoclips to improve theoretical anatomy teaching. Eur J Anat. 2004; 8(3): 143–146.

28. Reddy V, Soudien C, Winnaar L. Impact of school closures on education outcomes in South Africa. The Conversation. 2020; 18(3): 10–3, doi: 20.500.11910/15402.

29. Ruiz JG, Mintzer MJ, Leipzig RM. The impact of E-learning in medical education. Acad Med. 2006; 81(3): 207–212, doi: 10.1097/00001888-200603000-00002, indexed in Pubmed: 16501260.

30. Serediuk L. Features of distance learning in medical education — systematic review. Int Sci J Educ Linguist. 2023; 2(3): 51–66, doi: 10.46299/j.isjel.20230203.06.

31. Singal A, Bansal A, Chaudhary P, et al. Anatomy education of medical and dental students during COVID-19 pandemic: a reality check. Surg Radiol Anat. 2021; 43(4): 515–521, doi: 10.1007/s00276-020-02615-3, indexed in Pubmed: 33206209.

32. Srinivasan DK. Medical students' perceptions and an anatomy teacher's personal experience using an e-Learning platform for tutorials during the COVID-19 crisis. Anat Sci Educ. 2020; 13(3): 318–319, doi: 10.1002/ase.1970, indexed in Pubmed: 32374937.

33. Starszak K, Karaś R, Skalski A, et al. Anatomical theater or full digitization? Students' assessment and preferences in the field of anatomy teaching. Folia Morphol. 2024 [Epub ahead of print], doi: 10.5603/fm.101602, indexed in Pubmed: 39387399.

34. Şenol D, Toy Ş, Canbolat M, et al. Evaluation of online anatomy education given in medicine and dentistry faculties of universities during COVID-19 pandemic with student feedback. Konuralp Tıp Dergisi. 2021; 13(1): 30–35, doi: 10.18521/ktd.757819.

35. Turamanlar O, Güzel H. The view of medical students on the anatomy course given by distance education during Covid-19 pandemic. Anatomy. 2020; 14(3): 202–209, doi: 10.2399/ana.20.820414.

Table 1. P values of statistical comparison of first year survey results.

1st years	Remote_vs_F2F_ Non_anatomy	Problem_during_remote_teaching
Gender	0.506	0.054
Remote_vs_F2F_non_anatomy		0.019

Table 2. Correlation analyses of first-year students survey results.

	Remote theoretical	Remote practical	Trust online exams
Digital sources	**–0.664**[**]	**–0.737**[**]	**–0.545**[**]
Remote theoretical		0.840[**]	0.677[**]
Remote practical			0.625**

**Correlation is significant at the 0.01 level (2-tailed).

Table 3. P values of statistical comparison of the second year students survey results.

2nd years	Remote_vs_F2F_ non_anatomy	Problem_during_ remote_teaching
Gender	0.69	0.38
Remote_vs_F2F_non_anatomy		< 0.001

Table 4. Correlation analyses of second year students survey results.

	Remote theoretical	F2F practical	Remote practical	Digital sources	Trust online exams
F2F theoretical	–0.609[**]	0.530[**]	–0.529[**]	–0.455[**]	–0.499[**]
Remote theoretical		–0.271[**]	0.768[**]	0.576[**]	0.609[**]
F2F practical			–0.447**	–0.402**	–0.266**
Remote practical				0.693**	0.560**
Digital sources					0.459**

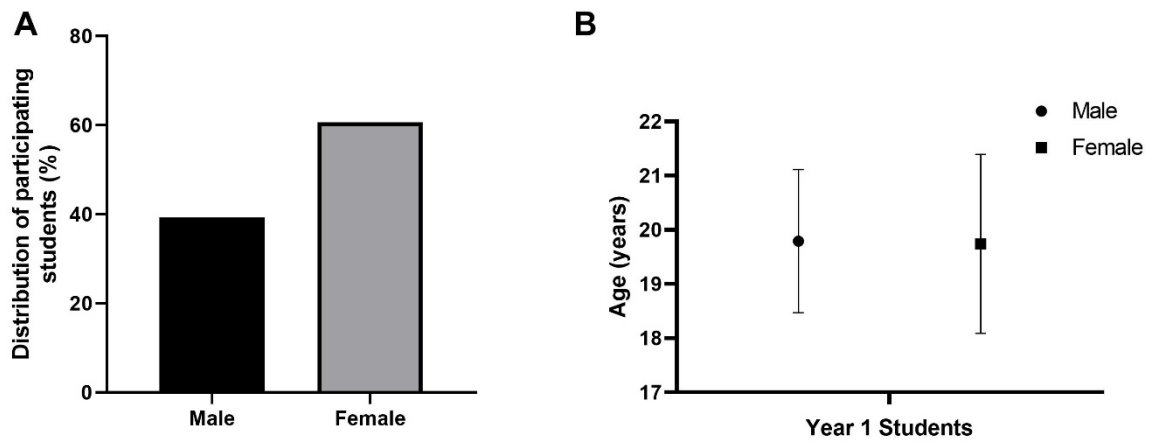[**]Correlation is significant at the 0.01 level (2-tailed).

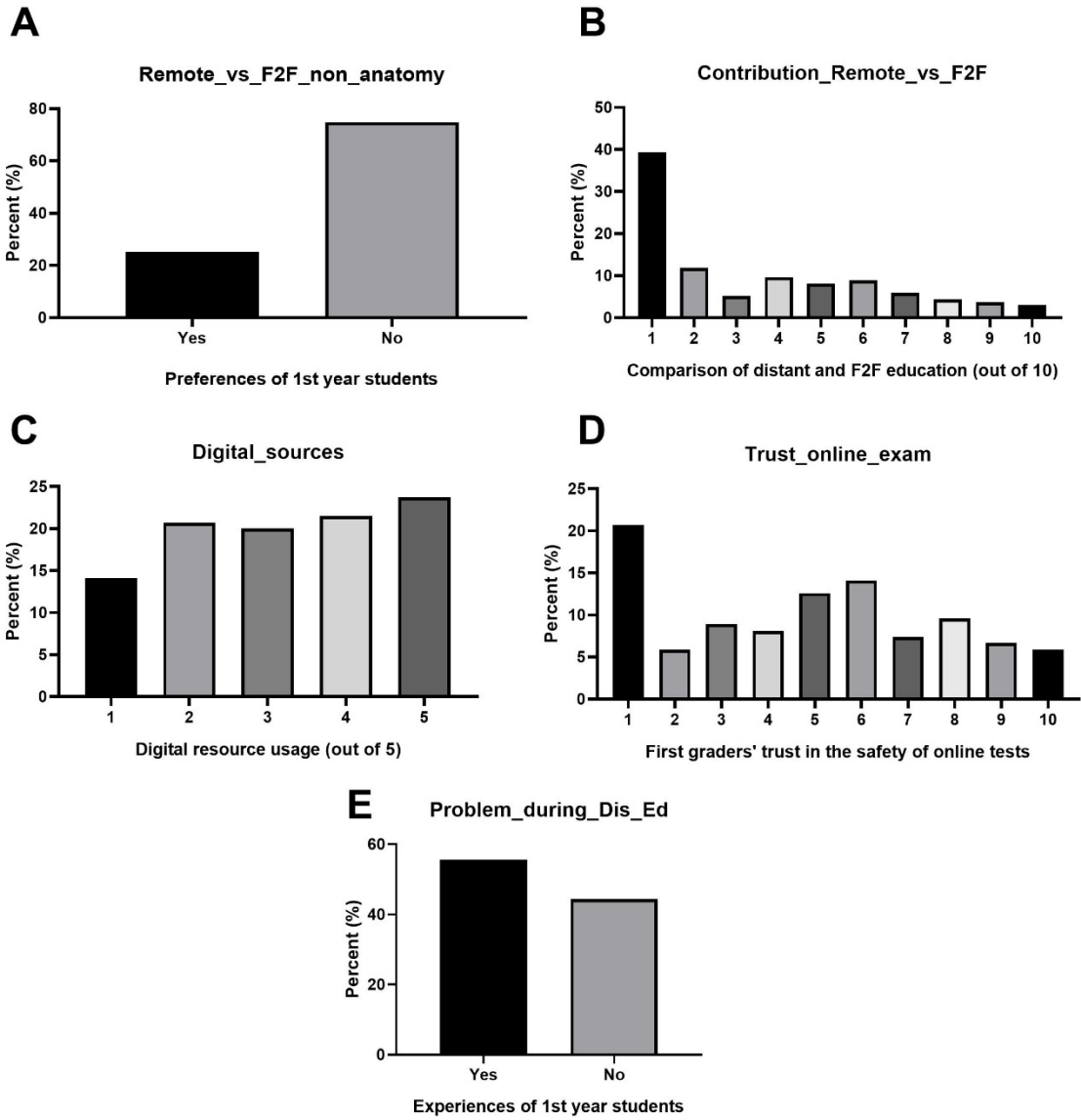**Figure 1.** First-year students' demographic information.
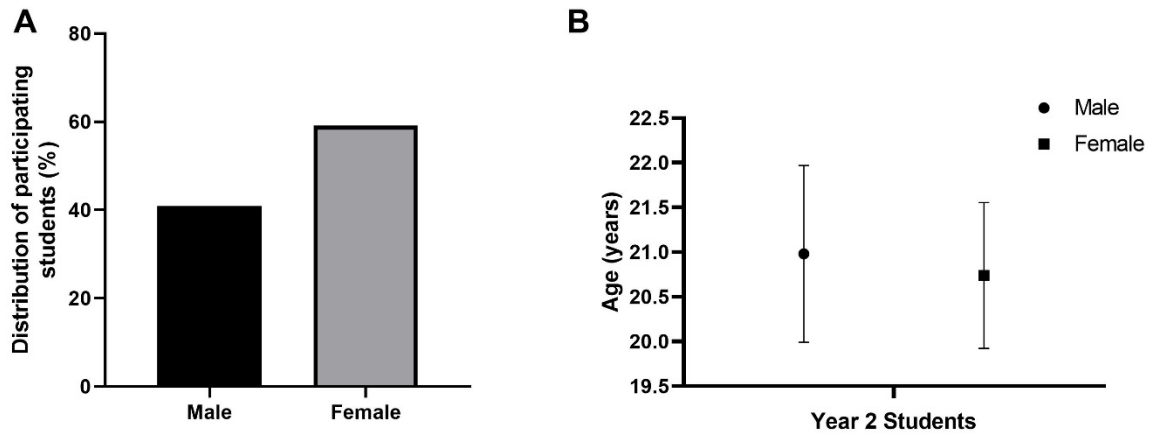
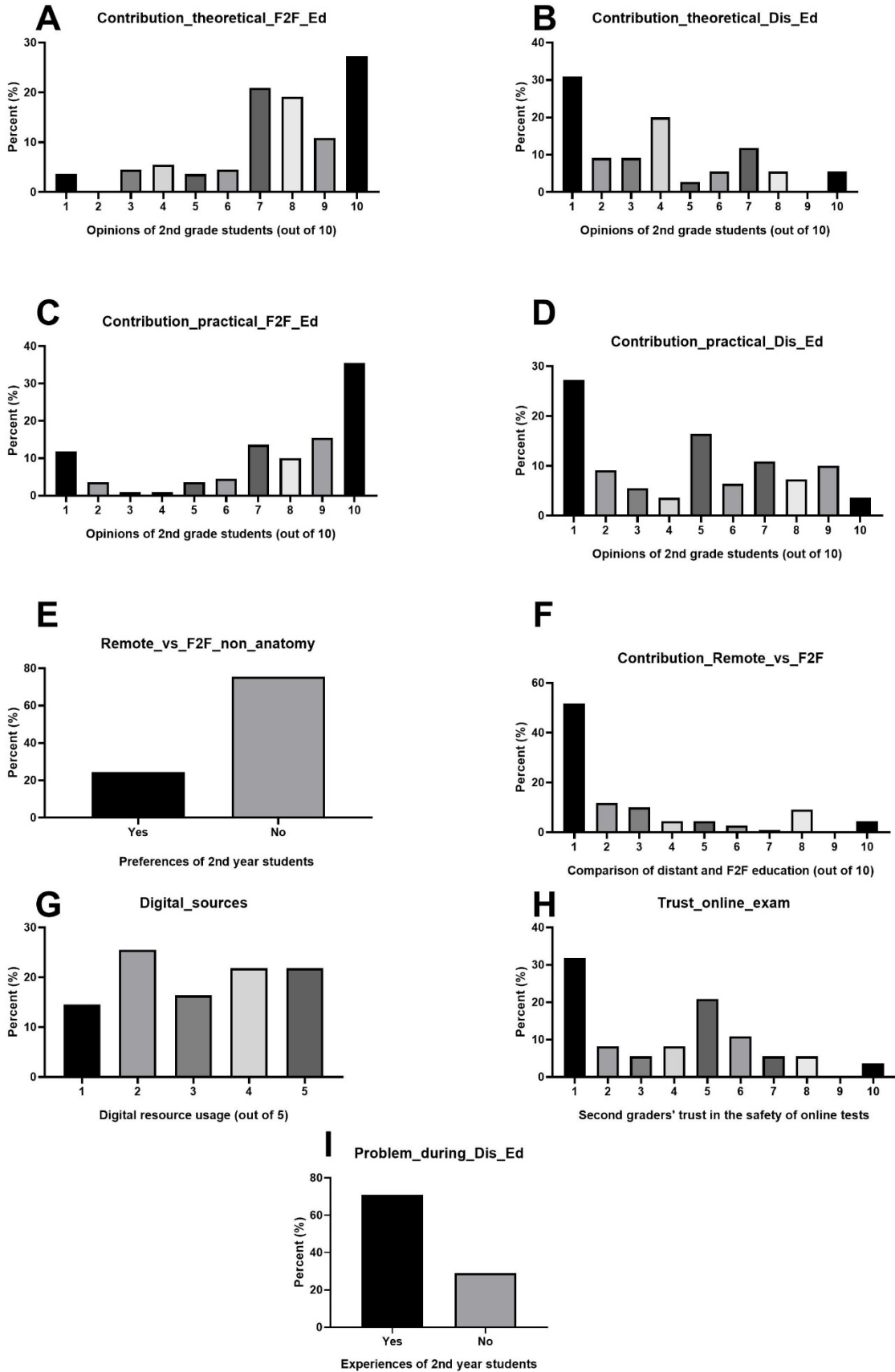**Figure 2.** First-year students' survey results.

Figure 3. Second-year students' demographic info.

Figure 4. Second-year students' survey results.