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E-learning in pathology courses in the times of COVID-19

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KEYWORDS
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Abstract
Introduction: Distance learning (DL) is a promising educational approach for teaching medical courses. Our Pathology College was faced with the difficulty of a complete online transition of the classes because of the public health measures implemented during the COVID-19 pandemic. The objective is to evaluate this teaching method of the Pathology College with reference to the learner's point of view.
Methods: After attending DL sessions in the Pathology College, pathology residents completed the questionnaire using Google Forms. Twenty-six out of 33 initially enrolled in the pathology course returned fully filled out, valid questionnaires.
Results: Twenty-four residents (92.3%) had already an E-learning experience. Almost 70% of participants were satisfied with their DL experience. Thirty percent of the participants thought that DL should replace face-to-face courses. Technical difficulties were encountered in 42% of cases with the most common one related to internet connection (66.7%). Interaction with teachers during DL courses was considered more difficult than face-to-face courses by 61.5% of participants. Participants found that learning via the virtual slide websites was better than learning in the histology workshop in 53.8% of cases. The main weaknesses of DL were the dependence on technical means (42.3%), the lack of interactivity with colleagues (26.9%) and teachers (26.9%).
Conclusion: Pathology lessons were successfully taught via DL, which was highly embraced by the students. Our findings shed light on a variety of areas of the students' DL experiences, and we strongly urge the faculty to take the students' opinions into account when formulating guidelines for higher-quality medical education.

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PALABRAS CLAVE
residentes de medicina;
evaluación de e-learning;
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El e-learning en los cursos de Patología en los tiempos de COVID-19

Resumen
Introducción: el aprendizaje a distancia (AD) es un enfoque educativo prometedor para la enseñanza de cursos de Medicina. Nuestra Facultad de Patología se enfrentó a la dificultad de una transición completa de las clases en línea debido a las medidas de salud pública aplicadas durante la pandemia de COVID-19. El objetivo es evaluar este método de enseñanza de la Facultad de Patología con referencia al punto de vista del alumno.
Métodos: después de asistir a las sesiones del AD en el Colegio de Patología, los residentes de patología completaron el cuestionario utilizando Google Forms. Veintiséis de los 33 matriculados inicialmente en el curso de patología devolvieron los cuestionarios válidos y totalmente cumplimentados.
Resultados: Veinticuatro residentes (92,3%) ya habían tenido una experiencia de E-learning. Casi el 70% de los participantes estaban satisfechos con su experiencia de AD. El 30% de los participantes pensaba que el AD debería sustituir a los cursos presenciales. Se encontraron dificultades técnicas en el 42% de los casos, siendo la más común la relacionada con la conexión a Internet (66,7%). La interacción con los profesores durante los cursos del AD fue considerada más difícil que los cursos presenciales por el 61,5% de los participantes. Los participantes consideraron que el aprendizaje a través de los sitios web de diapositivas virtuales era mejor que el aprendizaje en el taller de histología en el 53,8% de los casos. Los principales puntos débiles del AD fueron la dependencia de los medios técnicos (42,3%), la falta de interactividad con los colegas (26,9%) y los profesores (26,9%).
Conclusión: las clases de patología se impartieron con éxito a través del AD, que fue muy aceptado por los estudiantes. Nuestros hallazgos arrojan luz sobre una variedad de áreas de las experiencias del AD de los estudiantes, e instamos encarecidamente al profesorado a tener en cuenta las opiniones de los estudiantes a la hora de formular directrices para una educación médica de mayor calidad.

Introduction

All facets of human existence, including healthcare facilities, business prospects, travel and transportation, and social structure, have undergone significant changes as a result of the global spread of the coronavirus illness 2019 (COVID-19) brought on by SARS-CoV 2.[1] Because of COVID-19's effects on the education sector, schools and universities including health area have had to close in the majority of the affected countries as well as teaching hospitals which are solely handling "on-duty" shifts.[2]

Distance learning (DL) is a technique that is frequently utilized as a tool to spread information and culture. The use of DL in the field of health is a topic that is frequently discussed. Many nations have used this tool, and in Tunisia, some specialty colleges have adopted it to ensure the sustainability of medical resident training. It has demonstrated its effectiveness of sharing knowledge.[3]

Given the particularity of the Pathology speciality, the importance of analyzing slides through traditional histology workshop in acquiring diagnostic skills and the manipulation of light microscopes in the training of residents, the substitution of face-to-face training devices by digital means is an unprecedented experience as pathology residents had to quickly adapt to learning exclusively online. Due to the absence of double-scoping, educational innovation has been required to keep teaching microscopy. Whole slide imaging (WSI) is one alternative for digital pathology, however due to funding restrictions experienced by many departments this option is frequently unaffordable, especially in Tunisia. Alternatively, a trend toward teaching pathology through dynamic virtual microscopy provides an easily available, physically distant, and cost-effective option. A standard light microscope, a mounted digital camera, laptops, and videoconferencing software are necessary tools to share a slide image with the student (s).[4] Thus, the question of DL impact on the pathology residency curriculum was raised.

In this study, we propose to evaluate this teaching method of the Pathology College with reference to the learner's point of view.

Methods

Study design and sample

This is a descriptive cross-sectional study including pathology residents. It was based on a questionnaire created via "Google Forms" and sent to residents after attending synchronous online teaching sessions with, at the end of the course, accompanying images slide sets from surgical

specimens anonymized by removing all identifiable information, including the coded specimen number assigned for internal department tracking purposes from the Pathology College, during the period between March 2020 and December 2021. Following the presentation, students were given a quiz consisting of 5 questions based on digital pathology image slides. The questions in several modules were just multiple choice of "what is the most likely diagnosis?" This session was also recorded and is available for later playback.

The questionnaire consisted of multiple choice and short free response questions. The questionnaire focused on the following items:

- Organization of courses
- Organization of slide pathology images
- Overall assessment of online teaching
- Supervision and interaction with individual teachers
- Supervision and interaction with the course coordinator
- Learner motivation to attend online versus face-to-face instruction
- Strengths of video-conferencing compared to face-to-face teaching
- Difficulties and constraints encountered by students during this period of distance learning
- Learners' choice of teaching mode for future college courses
- Suggested ways to improve the distance learning system

The coordinator of each session is required to create the event via google calendar. He/she would send an invitation to attend a "google meet" to the learners involved in the session. At the beginning of each session, the coordinator accepted participants, introduced the speakers, and noted any questions asked via chat.

The coordinator also ensured the coordination between the different speakers, in particular the respect of time limit and the closing of the session with a summary of the content presented and the announcement of possible future sessions.

Study population

Inclusion criteria

We included all questionnaires completed by pathology residents assigned to pathology departments in Tunisian university hospitals, who attended the online teaching of the college courses.

Non-inclusion criteria

We did not send a questionnaire to residents of other specialties assigned to a pathology department for optional stage.

Exclusion criteria

We excluded pathology residents who are assigned to hospitals and did not attend online courses (1st year residents in 2022).

Statistical analysis

The statistical analysis was performed by Microsoft Office 2016 Excel software. It was descriptive focusing first on the study population and then on the learners' responses to the different questions in the online questionnaire.

Ethical considerations

Consent was obtained from all students included in this study to conduct this work. There were no conflicts of interest.

Results

A total of 26 pathology residents participated in the study among the 33 invited. The characteristics of the cohort are presented in Table 1.

Out of the 33 pathology residents, 22 (84.6%) were females. They were from Faculty of Medicine of Tunis in 10 (38.5%) cases and Monastir in 7 (26.9%) cases. Regarding the level of residency, 16 (61.5%) were in 4th year. Twenty-four residents (92.3%) had already an E-learning experience. The most used tool to follow DL was the laptop in 23 (88.5%) cases. All residents had access to internet connection, and it was through WIFI in 22 (88%) cases. Residents followed the courses at home in 25 (96%) cases and only one at a stage (4%). The time spent for DL was $\geq$ 4 hours in 14 (54%) cases. PowerPoint was the most used presentation program (81%).

Almost 70% of participants were satisfied with their DL experience. Thirty percent of the participants thought that DL should replace face-to-face theoretical courses.

Table 1 Characteristics of the study participants.

		Number (%)
Gender	Male	4 (15.4%)
	Female	22 (84.6%)
University	Tunis	10 (38.5%)
	Monastir	7 (26.9%)
	Sousse	6 (23.1%)
	Sfax	3 (11.5%)
Year of residency	4th year	16 (61.5%)
	3rd year	6 (23.1%)
	2nd year	4 (15.4%)
Previous E-learning experience	Yes	24 (92.3%)
	No	2 (7.7%)
Technological means used to follow the E-learning	Laptop	23 (88.5%)
	Tablet	2 (7.7%)
	Smartphone	1 (3.8%)
Access to a personal internet connection	Wifi	22 (88%)
	4G	4 (12%)
Location of e-learning course	Home	25 (96%)
	Stage	1 (4%)
Time spent for E-learning per month	$\geq$4 hours	14 (54%)
	<4 hours	12 (46%)

All participants reported that they were informed of the date of the online course in time. Nearly 54% of participants said they did not have the resources available in time.

Technical difficulties were encountered in 42% of cases. The most common difficulty was related to internet connection (66.7%). More than half of the residents (53.8%) felt that DL should be complementary to face-to-face teaching. Student involvement in DL was rated low to moderate in 69% of cases. Most of participants agreed, either totally (38.5%) or partially (34.6%), that the environment offered in the DL was as realistic as the one offered in the classroom/amphitheater. Over 73% of participants rated the level of technical support provided by course coordinators as at least satisfactory. More than 90% of participants were at least satisfied with the level of teacher involvement in the online training. Interaction with teachers during DL courses was considered more difficult than face-to-face by 61.5% of participants. Only 38.5% of the participants thought that the time management of DL course by the teachers was more difficult than in the classroom.

Participants felt that face-to-face courses were presented in a clearer manner compared to online courses in 73% of cases. Nearly 90% of participants found the course materials used by teachers interactive.

Concerning virtual pathology slides, participants found that acquiring diagnostic skills via the virtual slide websites was better than learning in the traditional double or multiheaded scope in 53.8% of cases. The main two reasons were: more time to analyze virtual slides than in the traditional histology workshop (42.9%) and the ability to view virtual slides at any time (35.7%). Only 11.5% felt that DL was not beneficial for life skills. More than 90% of the participants felt confident in making diagnoses after attending DL via the virtual slides. More than 60% of participants felt able to take exams on courses taught online in actual practice. The main strength identified by participants was the flexibility of learning locations and schedules (73.1%). The main weaknesses of DL were the dependence on technical means (42.3%), the lack of interactivity with colleagues (26.9%) and the lack of interactivity with teachers (26.9%). The main conditions for a successful DL experience identified by participants were willingness to adapt to a new technology (38.5%) and acceptability by students and teachers (34.6%). The suggestions and proposals of the participants were the creation of a media library gathering all the video presentations and virtual slides. Finally, learners' choices for how to teach future college courses was not in favor of online courses (70%).

Discussion

Since E-learning is the predominate method of academic activities among medical residents during the COVID19 pandemic, it is essential to evaluate their perception and satisfaction with the method to find weaknesses, enhance the program's quality, and make necessary revisions.[5] Thus, the current study sought to evaluate how pathology residents perceived and were satisfied with DL during the COVID-19 epidemic.

The main results of the study showed that DL is a satisfactory method from the learner's point of view. Students believe in 70% of cases that DL is a useful tool for carrying out academic activities. The main benefits identified by the residents were accessibility to the sessions from any location and schedules and the possibility of reviewing virtual slides at any time. However, only 30% of the participants think that DL should replace face-to-face theoretical courses.

The lack of face-to-face connection with the teachers and colleagues and the incidence of technological issues that occasionally hindered the smooth running of the sessions were the shortcomings highlighted by pathology residents.

The Pathology College chose to carry on its training programs for residents at various levels during the period of confinement imposed by our nation's government due to the worldwide health crisis. The only viable choice in these circumstances was DL.

Several authors have compared real audience teaching versus DL.[6–8] They have concluded that they were equivalent in terms of knowledge improvement. In our study, participants felt that face-to-face courses were presented in a clearer manner compared to online courses in 73% of cases. On contrary, according to several reports, the instructor's presentation style and visual presence play a key role in getting students interested in the content.[9] In traditional courses, pathologists typically focus their teaching efforts on tumor boards, conferences on medical autopsies, and directly under the microscope with visiting clinical teams. However, in a synchronous e-learning environment, the professor has additional responsibilities as a teacher, including helping students transition smoothly from traditional classroom settings to online classes, engaging the audience in conversation, and ensuring that everyone has a positive and active e-learning experience.

To overcome some of the drawbacks of e-pathology courses, one study proposed to combine the two teaching methods into a so-called hybrid "bent learning".[5] Recent studies proposed game-based learning, like "Kahoot!" which is a mobile game-based online digital formative assessment tool that has recently been examined by medical students.[10,11] Since gaming technologies are thought to be suitable for opportunistic learning and offer helpful learning techniques that promote continuing academic results,[12] pathology department should take this new tool into account to promote e-pathology courses. In our study, residents suggested the creation of a media library gathering all the video presentations and virtual slides which can be viewed at any time.

There are several obvious and evident benefits to using WSI instead of glass slides in acquiring diagnostic skills in DL pathology lessons. Scanning the original glass slide allows for the dissemination of a precisely replicated reproduction of the slide without having to resort to cutting more sections (which may or may not be representative of the original slide/pathology), depletion of a tissue block, which is important for ancillary studies that frequently affect patient treatment, obviating the necessity for packaging and posting slides, the possibility of glass slide breakage and delays/losses in transit, and the time WSI offers the students and teachers the chance to view the slide in real time while geographically apart, despite certain technical difficulties.[13] The latter capacity strengthens and even encourages distance education because glass slides do not

allow both participants to see the slide at the same time. Therefore, there are many and significant benefits of adopting WSI that much outweigh any drawbacks.[13] However, the deployment of WSI is within the means of several departments in Tunisia. The routine currency in all pathology departments are glass slides and, for teaching purpose, scanning slides via a mounted digital camera and a standard light microscope. In our study, participants found that acquiring diagnostic skills via the scanned images slides was better than learning in the traditional double or multi-headed scope in 53.8% of cases as they had more time to analyze virtual slides than in the traditional histology workshop and were able to view them at any time. More than 90% of the participants felt confident in making diagnoses after attending DL via the virtual slides.

In order to encourage and enable ongoing support and motivation of the learner, a continuous formative evaluation procedure is also to be carefully considered in this learning process.

The main limitation of our study is the small number of participants included. Indeed, this is a preliminary experiment, and the study should be extended to other groups of students with an inclusion of a control group for more objectivity.

Conclusion

Despite some limitations, the experience in e-pathology courses was efficient and welcomed by residents. In order to improve our understanding of the online teaching process and its quality, we also think that more research in the area of e-learning pathology should be done in the future.

Sources of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethics

The present study has been conducted according to the principles of the declaration of Helsinki. Ethical approval for the study was not required. Participants were made aware of the purpose of the study, the anonymous nature of the purpose, the anonymous nature of the dataset generated and the option to not respond if they so wished.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Credit authorship contribution statement

All the authors read and approved the final version of the manuscript.

Declaration of Competing Interest

The authors report no declarations of interest.

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