The Development of a Novel Virtual Tool to Enhance Clinical Skills in Medical Education

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Table of Contents

Original Manuscript **5**
Supplementary Files **17**
0 ..... **17**
0 ..... **17**
Figures **18**
Figure 1 ..... **19**
Figure 2 ..... **20**
Figure 3 ..... **21**
Figure 4 ..... **22**

The Development of a Novel Virtual Tool to Enhance Clinical Skills in Medical Education

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Abstract

Background: A significant component of Canadian medical education is learning how to approach the Objective Structured Clinical Examination (OSCE). The OSCE assesses skills imperative to good clinical practice, such as patient communication, clinical decision-making and medical knowledge. Despite the widespread implementation of this examination across all academic settings, very few preparatory resources currently exist that cater specifically to Canadian medical students. The MonkeyJacket is a novel, open-access online application built with the goal of providing medical students in Canada with an accessible and representative learning tool for the OSCE.

Objective: The goal of this research study was to analyze the utility of this novel platform, with the intention of releasing an open-access version for all medical students in the near future.

Methods: MonkeyJacket was developed to allow Canadian medical students the opportunity to practice their clinical examination skills with their peers using one centralized platform. The OSCE cases included in the application were developed using the Medical Council of Canada (MCC) guidelines to ensure their applicability to a Canadian setting. There are currently 75 cases covering five specialties, including cardiology, respirology, gastroenterology, neurology, and psychiatry.

Results: The MonkeyJacket application is an online platform that allows medical students to practice clinical decision-making skills in real time with their peers by simply sharing a link. Through this application, students can practice patient interviewing, clinical reasoning, developing different diagnoses, formulating a management plan, and can receive both qualitative and quantitative feedback. Each clinical case is associated with an ‘assessment checklist’ and incorporates audio and video recording that is accessible to students after practice sessions to promote personal improvement through self-reflection.

Conclusions: The development of the MonkeyJacket application will transform the ways in which Canadian medical students practice for OSCEs. Currently, limited resources exist that are accessible in cost, remote in nature, and specific to MCC. By providing students with relevant clinical cases, assessment checklists, and the ability to review their own performance, MonkeyJacket fills the aforementioned gaps in medical education by introducing a unique and innovative way for medical learners to develop their patient interviewing and clinical reasoning skills. The widespread implementation of this application will promote a more competent medical workforce which will benefit the most important stakeholder in medicine - the patient.

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Original Manuscript

Viewpoint

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Title: The Development of a Novel Virtual Tool to Enhance Clinical Skills in Medical Education

Abstract

Background: A significant component of Canadian medical education is the development of clinical skills. The medical educational curriculum assesses these skills through the Objective Structured Clinical Examination (OSCE). The OSCE assesses skills imperative to good clinical practice, such as patient communication, clinical decision-making and medical knowledge. Despite the widespread implementation of this examination across all academic settings, few preparatory resources currently exist that cater specifically to Canadian medical students. MonkeyJacket is a novel, open-access, online application built with the goal of providing medical students with an accessible and representative tool for clinical skill development for the OSCE and clinical settings.
Viewpoint: This paper represents the development of the MonkeyJacket application and its potential to assist medical students in preparation for clinical exams and practical settings.

Aim Statement: Limited resources exist that are virtual, accessible in cost, specific to the Medical Council of Canada (MCC), and most importantly, scalable in nature. The goal of this research study is to thoroughly describe the potential utility of the application, particularly in its capacity to provide practice and scalable formative feedback to medical students.

Development: MonkeyJacket was developed to allow Canadian medical students the opportunity to practice their clinical examination skills and receive peer feedback using a centralized platform. The OSCE cases included in the application were developed using the MCC guidelines to ensure their applicability to a Canadian setting. There are currently 75 cases covering five specialties, including cardiology, respirology, gastroenterology, neurology, and psychiatry.
Application Interface and Features: The MonkeyJacket application is an online platform that allows medical students to practice clinical decision-making skills in real-time with their peers through a synchronous platform. Through this application, students can practice patient interviewing, clinical reasoning, developing differential diagnoses, formulating a management plan, and they can receive both qualitative and quantitative feedback. Each clinical case is associated with an ‘assessment checklist’ that is accessible to students after practice sessions are complete in order to promote personal improvement through peer feedback. This tool provides students with relevant case stems, follow-up questions to probe for differential diagnoses and management plans, assessment

checklists, and the ability to review the trend in their performance.
Conclusions: The MonkeyJacket application provides medical students with a valuable tool that promotes clinical skill development for OSCEs and clinical settings. MonkeyJacket introduces a way for medical learners to receive feedback regarding patient interviewing and clinical reasoning skills that is both formative and scalable in nature, in addition to promoting inter-institutional learning. The widespread usage of this application can increase practice and feedback of clinical skills amongst medical learners. This will not only benefit the learner, but more importantly, can provide downstream benefits for the most valuable stakeholder in medicine - the patient.

Link: monkeyjacket.app

Keywords: Medical Education; OSCE; eOSCE; Virtual Health; OSCE Tool

Introduction

In 2020 and 2021, over five thousand final-year medical students graduated from a Canadian medical program and matched to a residency program [1]. For these cohorts, portions of in-person clinical learning were limited due to the Coronavirus Disease 2019 (COVID-19) pandemic. Alongside clinical learning, the COVID-19 pandemic also caused numerous academic and healthcare institutions to adopt more virtual learning platforms [2], thus emphasizing the importance of remote learning in the current day.

Prior to 2021, final-year Canadian medical students were required to pass an Objective Structured Clinical Examination (OSCE) held by the Medical Council of Canada (MCC) in order to progress to a residency training program [3]. Although this requirement has ceased for Canadian Medical Graduates (CMG), OSCEs remain integral within the medical education curriculum by serving as an assessment tool for clinical skills. The goal of the OSCE is to assess the candidate's clinical judgment, reasoning, knowledge, and skills. The examination is typically divided into twelve 11-minute-long stations, with a 2-minute break between each station. Stations can include clinical problems within the following fields: internal medicine, surgery, pediatrics, obstetrics/gynecology, psychiatry, and preventative medicine and public health [3].

Currently, the resources available to medical students for OSCE preparation and the real-world clinical setting are far and few between. While such resources exist, they are limited by one or more factors. One of the biggest limitations for existing OSCE resources is that they are not specific to the MCC objectives, thus restricting their use in a Canadian medical education setting. A major limitation is that they are often not directed at medical students, and rather at other healthcare professionals such as pharmacy students or nursing students. Although these resources are beneficial for practice purposes, other professions have different scopes of practice, and the OSCE feedback generated for students from such resources may not always be translatable. Additionally, many of the current OSCE preparation tools require user set-up with platforms such as Zoom or Microsoft Teams – there are few that exist as standalone applications in which students can access feedback, clinical prompts, and OSCE assessments within a single centralized platform.

Another important consideration of current resources is the inability to provide users with feedback regarding their clinical performance, specifically through formative learning experiences. Clinical educators often utilize quantitative scores and feedback in the form of checklists in order to provide students with assessments of their performance. However, this may not always be possible given the

time constraints of clinicians and staff. A possible solution to this is the utilization of peer feedback through formative learning experiences [4]. Unlike summative assessments and examinations, formative learning experiences provide students with opportunities in which they are able to focus on skill development, as opposed to percentages and grades. Several studies have demonstrated the benefits of formative experiences, such as encouraging reflective review, reducing test anxiety, and advancing the learners' self-regulation skills [5-6]. Moreover, the virtual nature of this application can contribute to inter-instructional learning in which peers who have additional knowledge or exposure within certain medical fields can enhance the clinical skills of those whose training lacks in these areas.

Given the emphasis on virtual learning coupled with the fact that few formative learning experiences currently exist for students, it is evident that there is a need for an electronic OSCE (e-OSCE) preparation tool that fills the aforementioned gaps in the medical education system. Thus, the beta version of the MonkeyJacket Application for OSCE practice was developed with these gaps in mind. The e-OSCE tool was piloted amongst a group of six medical students and resident physicians at Western University and McMaster University, with the goal to provide direct feedback to the software development team to refine the utility of the application. The primary research objectives of this study were to describe the approach to the development and dissemination of the MonkeyJacket e-OSCE application tool. This paper also aims to describe the potential utility of the application as a tool that provides scalable formative feedback for learners. The study will be used to describe the platform and enable the application to serve as a valuable tool in the Canadian undergraduate medical education.

Development

Purpose of Development

The MonkeyJacket platform was built with the purpose of developing a formative learning experience, rather than a summative one, in which the goal is to practice various clinical cases and receive feedback through peer evaluations.

Tool Development

The back-end of the MonkeyJacket platform was developed by a team of software engineers, project managers, and data scientists. The platform, including the video chat functionality, was custom coded using a combination of Jitsi, Javascript nodejs. Through numerous rounds of user testing and quality control, the application was consistently reviewed and improved by the development team, to ensure a smooth experience for users.

Development and Testing of the Application

The cases for the MonkeyJacket application were created by medical students and resident physicians. Trial and testing of the application were conducted by a group of six medical students and resident physicians over a span of three months. The group was encouraged to practice with everyone in the group to allow diversity in perspectives and to promote intra-group learning during the testing period. In addition to seeking group feedback regarding the practice cases and feedback checklists, the user study group was encouraged to provide feedback regarding functionality and ease of use. Comments were then relayed to the development team and appropriate changes to the

application were made.

Inclusion of Cases

The goal was to build practice cases that address CanMED roles (communicator, collaborator, leader, health advocate, scholar, professional, and medical expert) and provide formative feedback in the following disciplines: cardiology, respirology, gastroenterology, neurology, and psychiatry [7-9]. Within each discipline, cases were developed based on common and vital “red-flag” clinical presentations across patient demographics. Additionally, some uncommon and highly fatal conditions were also included within the dataset to represent the diversity of cases seen in clinical settings. There are a total of 75 cases in the dataset, with no repeated diagnoses. All aspects of OSCEs except the physical exam were assessed. The cases were based on a composite of patient cases, some of which were created based on real-life deidentified scenarios and others adapted from an existing repertoire of cases from resources geared towards medical students, such as “OSCE and Clinical Skills Handbook”, and other online resources [10-12]. The following table (Table 1) demonstrates the number of cases per discipline:

Table 1. Breakdown of cases within the data set, based on medical discipline.

Cardiology	14
Respirology	15
Gastroenterology	16
Neurology	15
Psychiatry	15

Building the Physician Candidate Prompts

The next step was developing the clinical prompt and task for each case, for both the student presenting as the “patient” and the student practicing as the “physician”. We followed the MCC guidelines in ensuring that it was written in a clear and unambiguous manner and could be completed in real time. For example, we avoided prompts such as “explore this further with the patient”, and instead replaced it with prompts such as “take a thorough history, with a focus on GI symptoms and summarize your findings”. We also avoided time-defining phrases such as “the symptoms started at 9am” and instead replaced it with more definite timelines such as “2 hours ago”. All clinical stems included the patient’s name, age, gender, presenting symptoms, and the task(s) which must be completed by the physician. The cases were framed such that it was the candidate’s first time assessing the patient rather than assuming that they have a pre-existing relationship with the patient.

Compiling Information for the Standardized Patient and Trainers

All patient case stems included the following demographic data: patient name, age, occupation, opening statement/ history of presenting illness including symptoms with qualification (onset,

duration, quality, severity, timeline, alleviating factors, etc), associated symptoms, past medical history, medication history, family history, and social history. For the latter items, only positive history (if the patient has a history of past illnesses or family history for example) were given. Non-verbal cues were also indicated on the patient's prompt so that they can communicate it to the physician, especially in psychiatry stations. For example, "I avoid eye contact, either looking at the ground or focusing on my hands. I give limited information making it obvious that I'm holding something back."

Developing the Feedback Checklists

In deciding the number of checklist items for each clinical prompt, we included items that were relevant to assessing the candidate's ability and ensured that the checklists were not exhaustive. The number of items on each checklist depended on the complexity of the case, but most consisted of 30-40 items. The checklist items all began with an action verb to guide the standardized patient, who is also the examiner, of what is expected of the physician.

Using the MCC guidelines, we ensured that the items were discrete, observable, and dichotomous. In ensuring that items were discrete, each checklist item assessed for one concept or grouped concepts together in which the candidate could get the full score even if they asked about one concept within the group. For example, in qualifying pain, a checklist item was "Elicits character of pain – sharp, dull". In this checklist item, the candidate would get full marks for asking about any character of pain. In ensuring that items were observable, we avoided terminology including "understands" and "appreciates", and instead used terms like "asks about" and "gives reasonable differential diagnoses". In ensuring that items were dichotomous, the candidate either received the full mark for the item or not, the checklist did not have any rating scales or instructions regarding part-marks.

Review, Revise, and Pilot

The MCC states that case development is an iterative process requiring thought, review, and revision and thus, one should be open to feedback. The first step of the review involved the medical development team, consisting of medical students and resident doctors, piloting the application in an iterative process to continue to refine the platform. In doing so, this allowed us to identify missing information from the patient script and to review the checklist to reduce ambiguity. Additionally, the cases were also reviewed by attending physicians in order to increase the validity of the clinical situations.

Ethical Considerations

This study does not contain or capture any human information or data. Therefore, as per Article 2.4 from the Tri-Council Policy Statement (TCPS) Research Ethics Board, this study is exempt from research and ethics review and does not require REB approval [13].

Application Interface and Features

Description of the Application

Upon entry into the platform, students land on a homepage in which they are able to enter their email and password credentials (Figure 1). Prior to the start of an OSCE station, the student completing the station as the acting physician receives a brief prompt which introduces the patient's name, age, and chief complaint (Figure 2).

-

Once both students have pressed “Begin station”, the practice OSCE station will start, and the session will begin. In this example, student A will be practicing their skills as the ‘physician’ and student B will be providing feedback as the ‘patient’. During this time, student A will only be able to see the brief clinical prompt entailing the chief complaint. However, student B will be able to view a more extensive patient history, along with behavioral cues, and the feedback checklist for items that student A should inquire about during the patient interview. While student A is performing the history, student B is responsible for completing the checklist along with answering clinical questions being asked by student A based on the history provided (Figure 3). At the end of the practice OSCE station, student B is responsible for completing the assessment checklist for student A in order to successfully save and submit the practice session.

Feedback Checklists

Checklist items can be divided into two categories: (1) generic and (2) relevant to the presenting concern. Examples of general checklist items can be found in (Table 2).

Table 2. Examples of general OSCE checklist items

Introducing self
Confirming patient name and age
Explaining reason for consult
Building initial rapport
Gaining consent
Asking open-ended questions
Asking about medications & allergies
Exploring social history (including cigarettes, alcohol, recreational drugs, diet, occupation, and physical activity)
Exploring and responding to ideas, concerns, expectations
Showing empathy
Avoiding jargon
Summarizing issues back to patient
Global score
Answering follow-up questions correctly

Relevant checklist items are those which are pertinent to the primary presenting concerns of the patient. For example, if the patient presents with shortness of breath, some relevant checklist items could include those listed in (Table 3).

Table 3. Examples of relevant OSCE checklist items, with the primary presenting concern of shortness of breath

Asking qualifying questions about presenting symptoms	Onset, duration, site, character, severity, duration, timeline of pain
Asking about relevant associated symptoms	Coughing, recent calf pain, palpitations, fever, chest pain
Asking about recent illnesses and past medical history	Heart disease, stroke, diabetes, hypertension, etc
Asking about relevant family history	Heart disease below the age of 55, diabetes, high cholesterol, auto-immune disease, history of atopy, etc.

At the end of all assessment checklists, the student is also asked to state the top two or three differential diagnoses based on the history presented. After stating the differential diagnoses, the student is asked for their top diagnosis. There are also other pertinent clinical questions that the student must answer. Examples of other clinical questions include deciding on the most appropriate imaging modality, other diagnostic tests, and initial management of the clinical presentation.

After assessment checklists are completed and submitted on the platform, a percentage score is calculated based on the total number of checkmarks received. The score is recorded and stored within the MonkeyJacket platform. Students are able to review all personal case attempts that they have previously completed within the platform. Additionally, audio files are also captured so that students can later review the session and reflect on not just their medical expert knowledge but also the soft skills of communication and rapport building that they must demonstrate (Figure 4).

Discussion

The MonkeyJacket application is a novel, innovative and unique tool for medical students seeking additional practice regarding development of clinical skills. The overarching goal of the MonkeyJacket application is to fill the gap that currently exists within medical education – a lack of scalable formative feedback for clinical skill development for learners. The MonkeyJacket application addresses this gap through the focus on peer-feedback and technological features built within the platform. Additionally, the application keeps track of participant scores so that individuals may review, trend and learn from their performance after practice sessions.

The biggest advantage of this platform is the potential for scalability it provides for medical leaners. According to Medical Education Statistics 2022, there were 14,967 faculty members and 11,865 medical learners across Canadian medical schools in 2019/2020 [14]. On top of clinical responsibilities of faculty members, they are also responsible for fulfilling teaching and academic requirements. As such, is it not feasible for faculty members to provide additional feedback to learners outside of the designated OSCE preparation time. The MonkeyJacket platform allows students to receive an abundance of feedback from peers, should they wish for additional practice. The scalability of the platform also decreases the administrative load on medical schools as students have simple access to additional clinical skills feedback that would not require constant faculty supervision.

Additionally, a significant advantage of the MonkeyJacket application is the remote nature of the web-based platform. Traditionally, practice OSCE examinations would be conducted in person, often with a student’s peer or friend. Utilization of the MonkeyJacket application is simple in that it allows a student to share the link with anyone that has access to a computer and internet connection, thus allowing students to practice regardless of their geographical location. Moreover, medical students would be able to practice with students from other schools, thus promoting inter-institutional learning. A medical student residing in British Columbia can easily practice history-taking skills with a fellow student in Ontario, thus learning from and teaching each other strategies that they have learnt within their individualized curricula. It is known that medical education institutions across Canada place emphasis on different areas of focus. For example, it was found that pre-clerkship pediatric clinical skills training greatly varied across the 17 Canadian medical schools, with 6 schools dedicating less than 7 hours and 8 schools dedicating over 10 hours, a total difference of 30% [15]. Development of a remote-based platform allows medical students to learn from their peers

who may have had additional exposure within certain areas compared to their own training, thus enhancing their knowledge.

In addition to the remote nature of the application, it also poses a great advantage in its accessibility through cost. A significant barrier for finding accessible practice resources for medical students is the cost associated with purchasing resources. It was found that, on average, osteopathic medical students spend $4,129 on resources exclusively for preparation of their board examinations [16]. Although this study was specific to medical students in the United States where there are different board examinations, Canadian medical students are not exempt from such costs. Canadian medical graduates, on average, finish medical school with $164,688 of debt, including education and non-education related expenses [17]. Although numerous companies offer preparation courses, this can vary from a few hundred dollars to several thousands. Thus, costs associated with expensive preparation courses and resources can be a significant barrier for students seeking resources. The MonkeyJacket platform is completely open access and free-of-charge. For medical students looking to gain extra practice, the MonkeyJacket platform provides a simple and accessible option, with multiple opportunities for peer-evaluation and tracking of progress.

Limitations

The functions and design of the MonkeyJacket web application were largely influenced by feedback received by medical students and residents. This was done in order to ensure the web application was serving its intended population with relevant feedback taken into consideration. Nonetheless, there were some limitations to the study.

One limitation of the study is the sample size of students included in the feedback process. In this study, there were five medical students and one medical resident involved throughout the testing process. As of today, the 6 participants have completed over 200 practice case scenarios while using the MonkeyJacket platform. Future studies should include a larger sample size of participants in order to obtain more diverse feedback regarding the functionality and usability of the application.

Another limitation of the study is that all participants were from either Western University or McMaster University. This application originated from researchers based out of Western University and thus, all students were recruited from the same institution for ease of organization and planning. Although this was advantageous as the knowledge and OSCE skills were standardized amongst study participants, this can also reflect a lack of diversity in perspective with respect to OSCE skills.

Lastly, traditional OSCE examinations are extensive in that they also evaluate a candidate’s ability to perform relevant physical exam and procedural skills in response to a primary patient concern. Given the virtual nature of the MonkeyJacket platform, it was not possible to integrate such assessments. However, one way to assess a candidate’s knowledge regarding relevant physical exam skills is to add it to the checklist and ensure the candidate knows the rationale for why certain physical exam components would be used.

Future Directions

In the future, the MonkeyJacket application will be preparing for extensive nation-wide deployment across Canadian medical institutions. Through partnership with major Canadian medical student

groups, the application will be disseminated for widespread use. This will allow us to collect a vast amount of quality improvement feedback. Ideally, we will be able to test to see if the use of the application leads to improved medical examination scores.

Currently, the cases included within the platform are tailored towards scenarios that can help develop clinical skills for medical learners who will become competent resident physicians. Expansion of the application in the future can include more specialized cases for specific residency sub-specialties. In addition, MonkeyJacket is not only useful for Canadian medical students, but also medical trainees globally, as clinical skills examinations are part of many international medical education programs. This can be explored in the future once the application is successfully deployed in Canada.

Conclusions

The MonkeyJacket OSCE tool is a comprehensive and accessible learning resource for medical learners. This innovative tool offers a solution for medical learners to address the current lack of practice tools and formative feedback within the realm of clinical skill development. As medical students proceed through their training, OSCEs are an integral component of assessments to ensure learners are demonstrating required competencies to safely practice medicine upon graduation. Development of comprehensive and accessible OSCE practice tools with built-in evaluations eases the stress associated with preparation for clinical exams, while promoting a more competent medical workforce, with the latter benefiting the most important stakeholders in medicine – the patients.

Acknowledgments

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Authors' Contributions

CS oversaw the direction of the publication and was the senior author and organizer of the project. AA and FF wrote the manuscript. AA created the figures. EA provided a summary of MCC objectives. AA, FF, EA, TB, AK, and EW conducted the practice OSCE sessions. All authors reviewed the final manuscript.

Conflicts of Interest

The MonkeyJacket application is owned by GoodLabs Studio. Christopher Smith and Thomas Lo are part of the GoodLabs Studio development team; however, there is no conflict of interest that effected this work.

Abbreviations

MCC: Medical Council of Canada
OSCE: objective structured clinical examination

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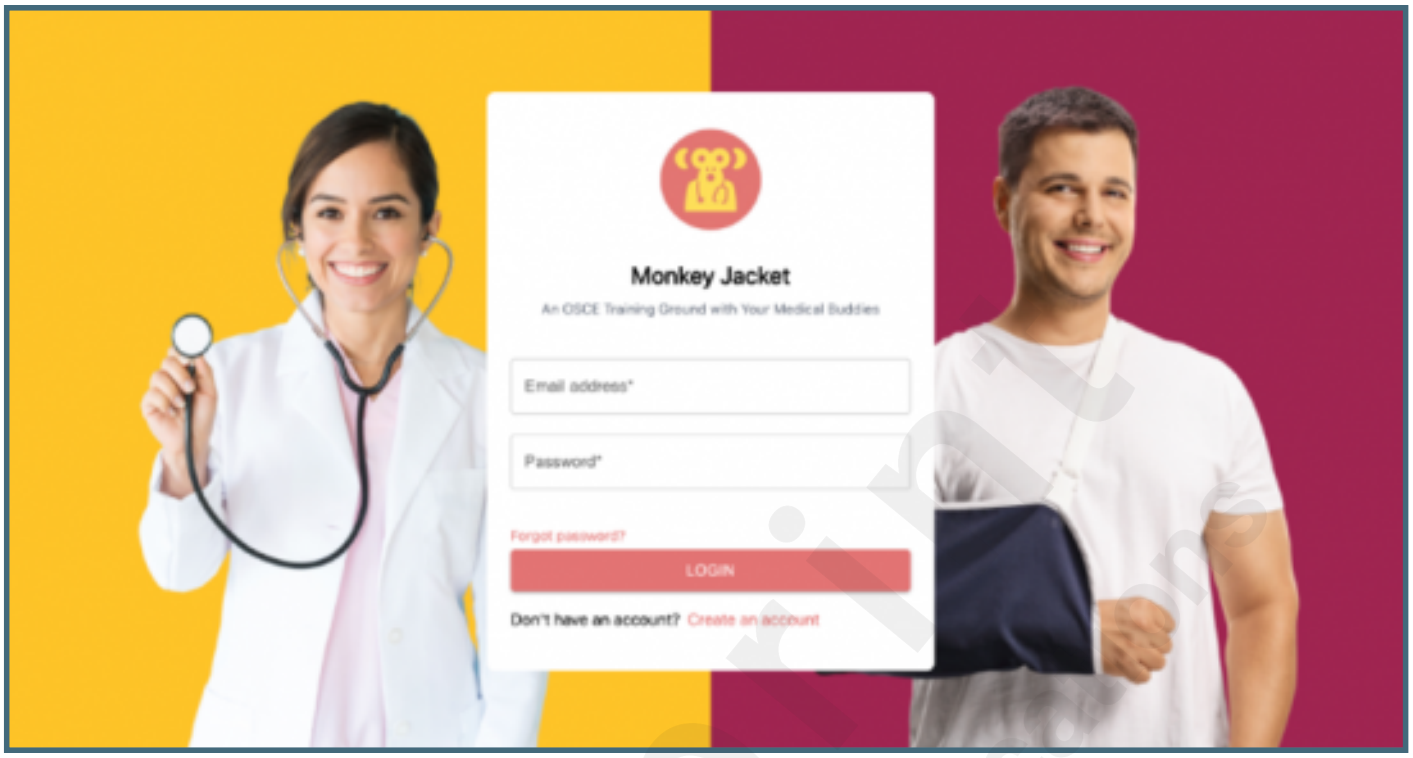
Supplementary Files

Untitled.
URL: http://asset.jmir.pub/assets/aa642ac6af645d2ca627b4218aded6b7.docx

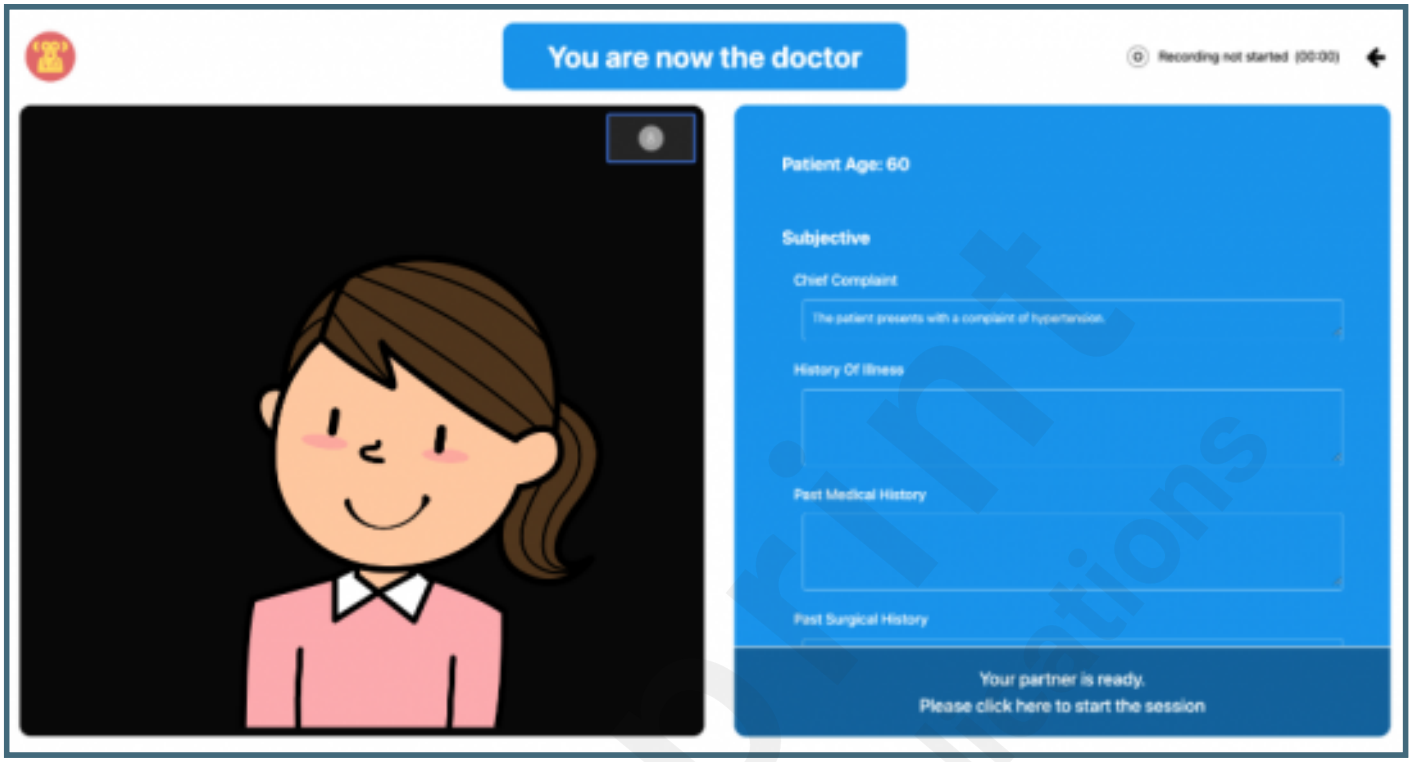
Untitled.
URL: http://asset.jmir.pub/assets/2216a9a15fc73e48c176a5fefd8948d2.docx

Figures

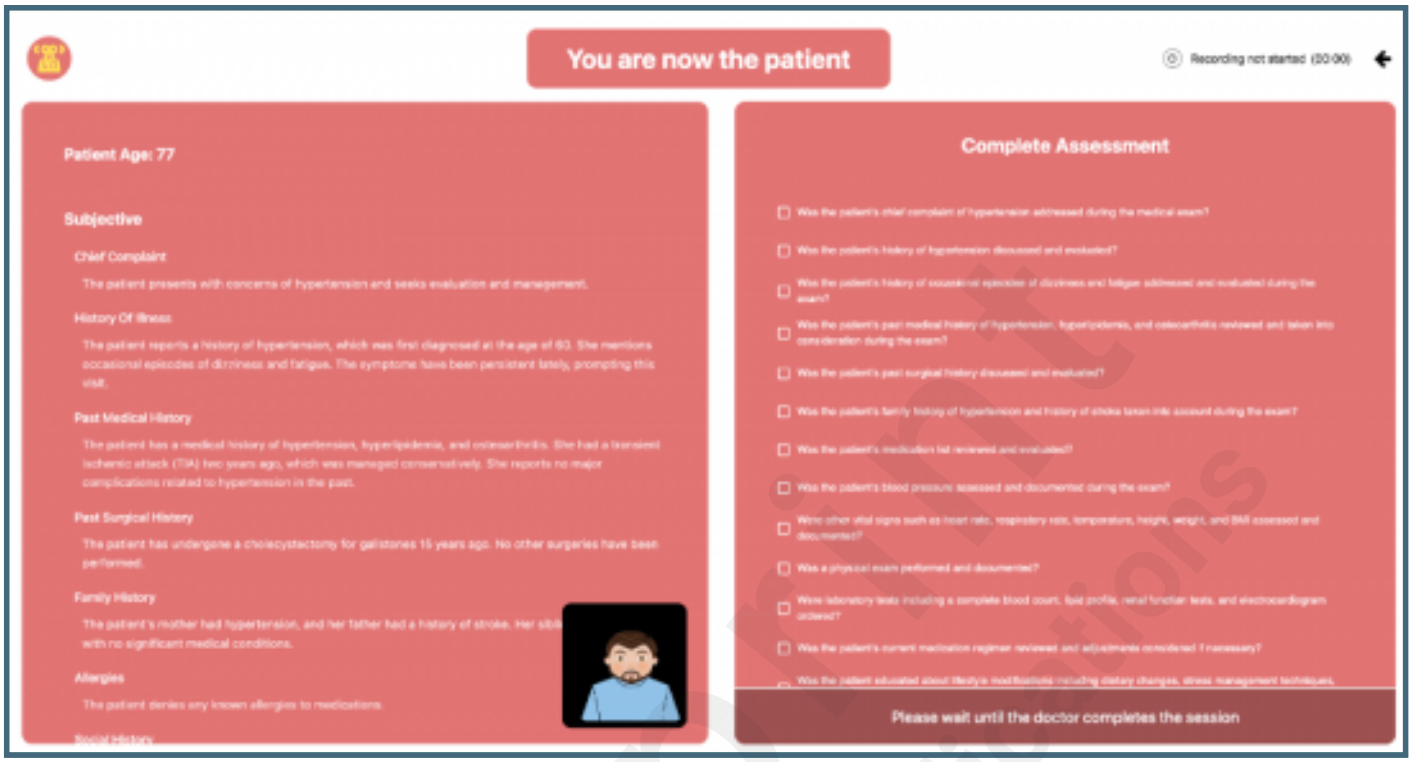
Main login screen of the MonkeyJacket platform.



Example screen of the student in the role of the physician. The student physician is able to see the student patient on the left side of the screen, and a blank clinical note that may be filled during the encounter.



Example of MonkeyJacket platform screen as the standardized patient. The case details are shown on the left and the checklist assessment is shown on the right.



Example of review screen, through which students may access their scores, their clinical notes, comments from their peers, and an audio file of the encounter.