How COVID-19 accelerated the digitization of teaching in the medical program at the University of Bern

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1. Introduction

When approached to share how the COVID-19 pandemic impacted digitization of the medical curriculum in Bern, we were at first a slight bit nonplussed. The experiences would surely be similar at different sites, over the different subjects and educational levels: there had been a cessation of lectures, introduction of videoconferencing software, and exams had been cancelled, etc. "Emergency remote teaching" had been higher education institutions' reaction worldwide and the digitization of learning and teaching was suddenly not an option but everyone's solution. So, what could the perspective of medicine and Bern add to what had not also been experienced by every other Swiss institution of higher education? In the end, we concluded that for all the similarities, every subject and every institution would also have had their own special challenges to face and to overcome in the face of the pandemic. In sharing these, even though the individual experiences might seem very specific, we all can find aspects that are relevant but that we did not consider before, or that should be in our minds when bracing for a second round of COVID-19 measures.

For this, we will share first a few lines on the development of medical education in Switzerland, how digitization formed the Bernese pre-pandemic medical program, and how three specific aspects of our medical program were impacted by COVID-19 and finally, what we think we learnt from that.

2. Medical education in Switzerland

Medical education in Switzerland is a federally regulated, structured university program lasting six years and subject to admission restrictions in German-speaking Switzerland. 2009 saw Swiss programs transformed into a bachelor's and a master's degree (3 years each). After successfully completing the master program, passing the Federal Licensing Examination is a prerequisite for entering residency training, which then concludes with a specialist examination after around 6 years. Following that, life-long, continuing professional education is compulsory for physicians.

While medical education for a long time relied on the transmission of knowledge from basic sciences to clinical subjects, recent decades have introduced profound changes like the transformation from discipline-orientation to organ- and system-orientation of learning outcomes, more emphasis on the prac-

tical clinical training and assessment, as well as the adoption of more learner-centred formats[1]. A common outcome-oriented framework for Swiss medical programs was recently adopted that also regards a physician's roles beyond the medical expert. This is why communication, teamwork, professionalism, and health advocacy but also managerial and academic competences are now also set goals of Swiss medical programs[2]. These developments take further pecu-

1 Bonvin, R., Nendaz, M., Frey, P., Schnabel, K. P., Huwendiek, S., & Schirlo, C. (2019). Looking back: twenty years of reforming undergraduate medical training and curriculum frameworks in Switzerland. GMS Journal for Medical Education, 36(5):Doc64.
2 Michaud, P. A., & Jucker-Kupper, P. (2016). The «Profiles» document: a modern revision of the objectives of undergraduate medical studies in Switzerland. Swiss medical weekly, 146:w14270.

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liarities of the medical profession into account such as close contact with patients during education, as much as they endorse a contemporary understanding of concepts like the patient-provider relationship and patient autonomy, also recognizing requirements set by multidisciplinary therapeutic teams and high-tech medicine. The exposure to real patients during the educational program and later in residency carries the ethical imperative to best prepare students for these encounters, not just to prevent harm being done to patients, but also to maximize learning from patient encounters[3],[4]. These features of medicine and medical studies explain the accumulation of some of the more unusual teaching content and formats in higher education such as simulation-based education including structured clinical skills training and assessment[5]. Problem-based learning put students back in charge of their learning at the cost of lecture time and introduced a format to enhance management and communication in teams while at the same time putting focus on the patient. Increasing exposition to ambulatory care emphasizes the role of family physicians and incorporates into teaching a range of medical problems encountered more often in primary than hospital care[6] and also fosters communicative and professional competencies.

Other courses address the need for more patient-oriented communication and touch on general and specific communication settings[7] including discipline-specific settings like emergency telephone consultations[8],[9],

pre-operative anaesthesia assessment[10], and geriatric assessment[11].

3. Pre-pandemic digitization of content and learning
The pre-pandemic digitization of content and learning needs to be outlined before the reactions can be described, as digital media have long been commonplace throughout the program. The whole curriculum is organized via the learning management system ILIAS (ILIAS open source e-Learning e.V., Cologne, Germany), in conjunction with the university's campus management system KSL (KSL Team GmbH, Aachen, Germany) that together only recently replaced the faculty's proprietary internal system "studmed" after 20 years of service. Digitization of learning content also started relatively early on: lectures had already been commonly co-delivered as podcasts on the day following the respective live lecture to allow for repetition in one's own time. Regarding content delivered as e-learning, the MedSurf Suite[12] has incorporated online learning material that focuses on visual content and has been constantly expanded and updated since its inception in 1997. As a collection of interactive learning modules, it gives credit to the fact that much in medicine is based on visual recognition of structures, why the suite supports learning in gross anatomy, histology, and pathology, making use also of a virtual microscope application. Beyond preclinical content, MedSurf also fosters clinical skills acquisition with modules on cardiology (including audio material, i.e. heart murmurs), dental medicine, haematology, ophthalmology, radiology, and urology. Clinical content is complemented by the DocCom.Deutsch platform[13] that facilitates the acquisition and honing of communication skills and makes use of video-based worked examples. Beyond these, students have access to the university library's digital content and the UpToDate evidence-based clinical resource base (Uptodate Inc., Waltham, MA, USA). In addition, the potential of digitization experienced new attention with the upscaling of the medical program from an annual 240 admissions into the program to currently 340 enrolments per year. To tackle this "+100" challenge, 36 new video tutorials to support the acquisition of clinical examination skills, were rolled out, following a blended learning approach.

3 Ziv, A., Wolpe, P. R., Small, S. D., & Glick, S. (2003). Simulation-based medical education: an ethical imperative. *Academic medicine*, 78(8):783–788.

4 Bauer, D., Lahner, F., Huwendiek, S., Schmitz, FM, Guttormsen, S. An overview and approach to selecting appropriate patient representations in teaching and summative assessment in medical education. (under review for publication).

5 Bonvin, R., Nendaz, M., Frey, P., Schnabel, K. P., Huwendiek, S., & Schirlo, C. (2019). Looking back: twenty years of reforming undergraduate medical training and curriculum frameworks in Switzerland. GMS Journal for Medical Education, 36(5):Doc64.

6 Hari, R., Harris, M., Frey, P., & Streit, S. (2018). Broadening the clinical spectrum for medical students towards primary care: a pre-post analysis of the effect of the implementation of a longitudinal clerkship in general practice. BMC medical education, 18(1):34.

7 Pless A, Hari, R, Brem B, Woermann U, Schnabel K. (2020). Using self and peer video annotations of simulated patient encounters in communication training to facilitate the reflection of communication skills: An implementation study. GMS Journal for Medical Education, in press.

8 Brem BG, Schnabel KP, Woermann U, Hari R, Pless A. Telephone consultation for medical emergencies – Development, implementation and evaluation of a course for 5th year medical students in identifying and handling medical emergencies via telephone. (under review for publication).

9 Schaufelberger, M., Harris, M., & Frey, P. (2012). Emergency telephone consultations: a new course for medical students. The Clinical Teacher, 9(6):373–375.

10 Berger-Estilita, J. M., Greif, R., Berendonk, C., Stricker, D., & Schnabel, K. P. (2020). Simulated patient-based teaching of medical students improves pre-anaesthetic assessment: A rater-blinded randomised controlled trial. European Journal of Anaesthesiology, 37(5):387–393.

11 Goeldlin, A. O., Siegenthaler, A., Moser, A., Stoeckli, Y. D., Stuck, A. E., & Schoenenberger, A. W. (2014). Effects of geriatric clinical skills training on the attitudes of medical students. BMC medical education, 14(1):233.

12 Woermann, U, Rolli, M., Tschanz, S., Eggli, P. (2005). Enriching the curriculum with media. Swiss Medical Informatics, 21(56):14–17.

13 https://doccom.iml.unibe.ch/

4. The impact of COVID-19

Then the COVID-19 pandemic happened. While in retrospect the digital solutions in place were a solid base to build upon, the sudden shift from onsite to online teaching and learning at first glance showed that the status quo was not enough. Still, Bern started off with a bit of a head start. Bearing in mind on the one hand how emergency remote teaching and e-learning or blended learning based on good evidence differ, time pressures and the ongoing uncertainty of the developing pandemic on the other hand made compromise to that knowledge a constant necessity.

Cessation of live classes was a common enough and obvious consequence to counter the spread of the virus and the alternatives lay somewhat close at hand. Following a short hiatus, instead of cancelling lectures, they were recorded in empty lecture halls, or lecturers made screencasts from home, both devoid of an audience or synchronous interaction with their students; but still the content was delivered. Though a recommendation prior to the pandemic, the possibility of podcasting lectures had been ultimately at the discretion of the individual lecturer. Now, the provision of recorded lectures was made mandatory for all. Seminar classes could still be delivered using one of the university's (or the university hospital's) licensed videoconferencing platforms[14] which facilitated the delivery of online seminars within the second half of March. Since the digitization of lectures and seminars (and the time before and after) would result in a lack of bonding time for the new cohort of students entering the bachelor's program, first year classes were given priority for face to face classes to support and establish the social cohesion within that student group – provided the pandemic would allow for this.

5. Three example cases

There were three aspects of the program that we regard as the most challenging in adapting to the pandemic's impact, i.e. the training of practical clinical skills, communication training with standardized patients, and the summative assessment, which is why in the following, these three shall be looked at more closely.

5.1. Clinical skills training

The purpose of clinical skills training (CST) in the 3rd year, is the acquisition and consolidation of general and special medical bedside skills. General history taking and examination techniques are taught and then

practiced, pre-pandemic, first with fellow students and only then with real patients in the participating hospitals. The objectives of the respective trainings are set out in specific scripts and guidelines and cover cognitive, psychomotor, and affective goals. Altogether content of 17 different disciplines is covered (e.g. family medicine, pulmonary and cardiovascular systems, and paediatrics) over the academic year, facilitated in small groups over four to five afternoon sessions at the skills lab (BiSS[15]) and/or at hospital wards. To demonstrate state of the art clinical assessment, a set of video examples for most of the subjects' skills was produced and available to define a common Bernese standard. Teaching sessions were accompanied by a mid-term, formative peer assisted "objective structured clinical examination" (OSCE) while passing a summative OSCE at the end of the term was necessary to acquire the bachelor's degree.

In the wake of the pandemic, direct patient contact was restricted during the spring term and some students were drafted into army service to help handle the pandemic in Ticino or volunteered to support hospital staff. Additionally, the clinical burden and the danger for physicians covering the wards, doctors who had usually facilitated the CST, could not be estimated at that time. So, while all bedside teaching and clerkships where students were integral parts of ward teams could continue through the spring term (obviously within the boundaries set by strict hygiene and physical distancing policies), clinical teaching where the students were visiting parties at the wards were cancelled. This led to the further delivery of the CST being stopped within the third week in March. While the mid-term formative assessment in January had been carried out as planned, the continuation of the course was not considered suitable due to prevention measures implemented by the relevant regulatory bodies, which is why third-year students in the end attended only half the intended sessions. In order to at least partially compensate for the loss of regular CST sessions, additional resources were put into the finalization of a set of clinical skills video tutorials that had already begun in the summer of 2019. They were originally not scheduled for imminent release but were now finished before the summative end-term OSCE in June. In contrast to the 5th year OSCE that was postponed to 2021, the 3rd year summative end-of-term OSCE was performed following a strict hygiene protocol. The number of stations was reduced by 50%, with face masks obligatory for all participants (candidates, proctors, examiners, technical staff) and stations reduced to history taking and examination skills assessed with simulators as to eliminate physical con-

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14 Jitsi (TM), Microsoft Skype for Business (Microsoft Corporation, Redmond, WA, USA), Microsoft Teams (Microsoft Corporation, Redmond, WA, USA), Webex Meetings (Cisco Systems Inc., San Jose, CA, USA), and Zoom (Zoom Video Communications, Inc., San Jose, CA, USA)

15 https://cms.biss.iml.unibe.ch/

tact between candidates and standardised patients. Fortunately, the whole exam could be observed via the skills lab's surveillance system so physical contact could further be minimized.

For the autumn semester, the university's instruction is to provide students unable to attend live classes with the means necessary for self-study. For this reason, alternative ways of practising practical skills are currently being devised, like a video guide for an alternative phlebotomy (venepuncture) exercise, for which students can build their own model at home using a courgette (the arm), a slice of cheese (the skin), and a modelling balloon (the vein), with the balloon and phlebotomy equipment to be provided by the skills lab.

5.2. Communication training

Students in the sixth year of the program have the opportunity to train four complex communication situations with simulated patients (SP). Engaging with the scenarios "end of life", "shared decision making", "strained patient physician relation", and "patient handover", students conduct difficult interviews in a safe simulated environment and receive feedback from the interview partner's (the patient's) perspective. The interviews are video recorded and made available on ILIAS where students have access to their own respective video that they are to review and reflect upon, documenting their observations or questions with the SWITCHcast annotation tool[16]. The videos and the annotations then serve as basis for small group seminars with physician tutors where selected video sequences and annotations are discussed together[17].

Unfortunately, the very day this communication training was scheduled to start was the day face-to-face classes were suspended. Immediately, all on-site events were cancelled and students as well as simulated patients notified. With videoconferencing software available, the opportunity to re-organize communication training for online delivery presented itself. Since at that time it was unclear if the 6th year students would be drafted into hospital service to overcome a potential staff shortage, participation in an online communication training could not be made compulsory, which is why students were asked if they were interested in voluntary online communication training. About a quarter of the students participated, so SPs were recruited, provided they had the

necessary hardware at their disposal. SPs were trained in using the software, the training itself delivered via Zoom. This turned out to be a surprisingly resource intensive task due to the extremely varied hard- and software configurations in use but also heterogeneous computer literacy among the SP users. Then, as the originally scheduled course dates had to be abandoned, students and SPs were paired for individual trainings at individual times. The trainings could still be voluntarily recorded locally and uploaded to the ILIAS platform. These recordings allowed for the secondary use of evaluating how well the online interviews had worked. Using this approach, it was possible to perform more than 140 interviews.

Adopting simulation-based training to an online format, as just described, required considerable work backstage to ensure a safe work environment for the SPs: immersing oneself in psychologically demanding roles and giving feedback afterwards can be the source of significant stress in SPs[18]. Strategies to promote and ensure their motivation as well as their well-being are feedback, debriefing and work-related relationships[19]. For this, implementing policies for any simulation involving SP, whether on-site or online, is important, as reflected in the standards of best practice for working with SPs[20]. While there was an established face-to-face process implemented for this, the COVID-19 workaround required three further practices to be introduced: SPs were provided with contact details of an SP-educator and were encouraged to get in touch any time if questions and/or problems occurred; SPs were actively contacted and (digitally) debriefed in groups of 3 (those covering a common communication scenario) and interviewed regarding their experiences regarding simulation and technique; and SPs were asked to complete a survey to evaluate their experiences.

The following lessons about simulation in working with SPs in a virtual environment were distilled from telephone support and the evaluation. Firstly, immersion into the role turned out to be different for SPs working in a virtual setting than being on-site, with immersion generally feeling less intense. A possible reason cited for this was an increased cognitive load, especially in the

16 https://help.switch.ch/cast/annotate/

17 Pless A, Hari, R, Brem B, Woermann U, Schnabel K. (2020). Using self and peer video annotations of simulated patient encounters in communication training to facilitate the reflection of communication skills: An implementation study. GMS Journal for Medical Education, in press.

18 Abe, K., Suzuki, T., Fujisaki, K., and Ban, N. (2007) Demographic characteristics of standardized patients and their satisfaction and sense of burden in Japan: The first report of a nationwide survey. Jap J Med Educ. 38: 301–307.

19 Schlegel C, Bonvin R, Rethans JJ, Van der Vleuten C. Standardized Patients' Perspectives on Workplace Satisfaction and Work-Related Relationships: A Multicenter Study. Simul Healthc. 2016;11(4):278–85.

20 Lewis, K. L., Bohnert, C. A., Gammon, W. L., Hölzer, H., Lyman, L., Smith, C., Thompson, T., Wallace, A., Gliva-McConvey, G. (2017). The Association of Standardized Patient Educators (ASPE) Standards of Best Practice (SOBP). Advances in Simulation, 2(1):10.

beginning, caused by having to handle the encounter's technical aspects. Secondly, the de-roling (shedding the adopted role after the encounter) had changed: while some SPs reported easier de-roling when working virtually, due to the less intense immersion, others had problems de-roling. Even experienced SP seemed to unconsciously neglect established de-roling practices (e.g. changing clothes) when working at home. Another factor that usually supports de-roling, the change of the location from the simulation facility to back home, could not take place in the virtual setting. After problems regarding de-roling became evident through feedback and debriefing of SPs, awareness of the importance of de-roling practices was integrated in the guidance of the SPs by the trainers. No further problems were reported thereafter. And thirdly, some SPs stated that the on-site contact to the students had felt more personal, while the virtual delivery was experienced as obstruction between the student and the SP. Again, others reported that due to the self-organization of the encounters, their schedules were less tight, leaving room for personal conversation with the students, which was highly appreciated, especially during physical distancing and seclusion policies during the pandemic.

5.3. Assessment

Assessment, both formative and summative, in written or practical formats, plays an important role in medical programs. One assessment cycle encompasses a series of steps, from preparing an exam (writing and managing exam questions, data-banking management of exam questions, assembling an exam), running it (organising exams on paper or on tablet computers, collecting exam data), and evaluating the exam data generated (e.g. calculating pass/fail scores, individual scores, and psychometric quality indicators). In Bern, before the COVID-19 outbreak, the whole assessment cycle had been fully digitized, with paperless tablet exams replacing paper-and-pencil written exams, and tablet-supported live-rating of practical exam performances during OSCE[21]. Tasks still carried out by human resources included task/question authoring, expert observation and performance rating during OSCE, as well as software maintenance and handling of the technology for the exams.

With what seemed to be a thoroughly digitized assessment cycle, it would seem the pandemic-related measures would not relevantly disrupt the management and delivery of exams. Quite the opposite was the case unfortunately and unexpected challenges had to be met. Hygiene restrictions prevented running the exams in lecture halls as previously intended. Then, with some research showing that the SARS-CoV-2 could survive on surfaces, and due to the fact that touchscreens might be damaged by disinfectants, many exams had to be delivered using paper and pencils. Since answer sheets were then quarantined off to further protect staff, electronic scanning was late, resulting in additional time until results could be calculated.

Finally, there was an urge towards exams that could be taken from home, which requires a flexible technical solution like the "bring your own device" principle. The challenge was to revise the software[22] used for the tablet exams within weeks and to adapt it to a web-format suitable for home-based exams. This was technically not trivial: instead of monitoring a set of known devices running a set of known software constellations now the activities of hundreds of different devices with their individual settings would have to be monitored. Also, a communication channel with the examinees was needed, to manage upcoming problems that could hinder successful login, running and finalisation of the exam. Reactions to possible problems reported needed to be reacted on instantly, even with up to 600 students simultaneously working online for the same exam. Still, after intensive adjustments, piloting and re-adjustments, following a strenuous period, it was possible to successfully hold exams with several hundred students at two Swiss medical faculties still within the spring semester.

6. Lessons learned

So, what did we find? First of all, looking at the three examples described, good preparation and a bit of fortune played a role: with half the classes for clinical skills training cancelled, the digital workaround was based on videos that were on the brink of completion and could be finalized in time to count as modest substitute for face to face classes. At the same time, we found how even communication trainings could be delivered digitally, which until then was not considered an option. On another level, this was as much true for administrative and academic meetings, where the pandemic impasse levelled the way for digital reform in education. However, practical exams in medicine that rule out physical contact and thus physical examination will remain an uneven compromise, like the assessment of communicative competencies with both sides wearing face masks.

It was also noticed how some workarounds that were easy to implement from a technical point of view, carried far-reaching implications on a social level.

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21 *https://www.iml.unibe.ch/angebote/assessment/examic-assessment-suite/eosce*

22 *https://www.iml.unibe.ch/angebote/assessment/examic-assessment-suite*

The online delivery of lectures and seminar classes was anticipated to diminish time and space to foster social cohesion among university entrants which is why for the autumn semester special focus was put on face-to-face classes for first year students, as much as the pandemic would allow. Similarly, while simulation classes employing simulated patients could be delivered digitally after some administrative effort, it was found that de-roling could be an unexpected challenge for simulated patients in the real, physical world at their home environment. Lastly, even assessment that already relies heavily on software solutions and that is delivered digitally is in some part anchored in the physical world and can be antagonized in the physical domain, not just through hard- and software challenges. As long as "open-book exams"[23] are not commonplace, proctoring a digital exam taken from home prompts optimist approaches like trusting test-takers not to cheat and pessimist demands for audio-visual surveillance of examinees. ∎

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23 Jervis, C. G., & Brown, L. R. (2020). The prospects of sitting 'end of year' open book exams in the light of COVID-19: A medical student's perspective. Medical Teacher. epub ahead of print.