

Faculté de médecine et médecine dentaire

Mind the Gap - Educational Videos to Move From Medical Theory to Clinical Practice

A Qualitative Analysis

Auteure : Felicitas Beger

Promotrice : Dr. Marie-Claire Van Nes

Co-Promoteur : Prof. William D'Hooore

Lecteur·rices : Prof Françoise Smets, Prof. Gaëtane Leloup,
Prof. Dominique Vanpee

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Felicitas Beger, Medical Student

Université catholique de Louvain

Brussels, Belgium

Author Note

Felicitas Beger, Medical Student, Université catholique de Louvain

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Contact: feli.beger@gmail.com

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Abstract (English)

Context

Transition periods, as the one from medical theory to clinical practice, constitute obstacles for many medical students. This study aims to evaluate the usefulness of a video-based e-learning tool, which was created to help students prepare for their final exam, and to familiarize them with the clinical application of entrustable professional activities (EPAs). It further aims to give learners more confidence and key knowledge to face the struggles of everyday clinical work. The tool is based on principles of competency-based medical education and the EPAs defined by our medical faculty.

Methods

Based on a constructivist approach, a survey with closed and open questions was administered to all final year medical students. A qualitative analysis, using an affinity diagram and applying open coding techniques to the data retrieved from the open questions allowed to identify the main results of this study.

Results

Medical students appreciated the e-learning tool for its usefulness, its accessibility, and its learner-centeredness. Impacting long-term memory, the self-assessment questions helped students to anchor important key messages. In a clinical context, the tool allowed students to reduce stress and increase autonomy, helping them to bridge the gap from theory to practice. Additionally to the initial goal of evaluating the usefulness of a learning tool, we found valuable insight on how students perceive this particular transition towards practice.

Conclusions

We found that this e-learning project is a useful learning tool for final year medical students, especially for the application of EPAs in a clinical environment. It is relevant to the students' feeling of preparedness for clinical work and for their capacity to bridge the gap from theory to practice. The challenging period that is the transition from medical theory to clinical practice is a pivotal moment in motivating and training medical students for their future practice, and probably has an impact on patient safety and quality of care. To make the transition a successful learning experience, more in-depth research and a multidisciplinary approach to this gap between theory and practice are needed. The impact of learning interventions around the transition on quality of care and patient safety remains to be researched.

Keywords: medical education, e-learning, competency-based medical education, entrustable professional activities, reflective practice, formative feedback

Résumé (Français)

Contexte

Les périodes de transition, comme celle de la théorie médicale à la pratique clinique, constituent des obstacles pour de nombreux étudiants en médecine. Cette étude vise à évaluer l'utilité d'un outil d'apprentissage en ligne basé sur des vidéos, qui a été créé pour aider les étudiants à se préparer à leur examen final et à les familiariser à l'application clinique des activités professionnelles déléguables (APDs). Il vise aussi à donner aux apprenants plus de confiance et des connaissances clés pour faire face aux difficultés du travail clinique quotidien. L'outil est basé sur les principes de la formation médicale basée sur les compétences et les APDs définis par notre faculté de médecine.

Méthodes

Basé sur une approche constructiviste, un sondage avec des questions fermées et ouvertes a été administré à tous les étudiants en médecine de dernière année. Une analyse qualitative, utilisant un diagramme d'affinité et appliquant des techniques de codage ouvertes aux données extraites des questions ouvertes, a permis d'identifier les principaux résultats de cette étude.

Résultats

Les étudiants en médecine ont apprécié l'outil d'apprentissage en ligne pour son utilité, son accessibilité et son approche centrée sur l'apprenant. Impactant la mémoire à long terme, les questions d'auto-évaluation ont aidé les élèves à ancrer des messages clés importants. Dans un contexte clinique, l'outil a permis aux étudiants de réduire le stress et d'augmenter l'autonomie, les aidant à combler l'écart entre la théorie et la pratique. En outre, nous avons trouvé des informations précieuses sur la façon dont les étudiants perçoivent cette transition particulière vers la pratique.

Conclusions

Nous avons constaté que ce projet d'apprentissage en ligne est un outil d'apprentissage utile pour les étudiants en médecine de dernière année, en particulier pour l'application d'APDs dans un environnement clinique. Les étudiants se sentent mieux préparés au travail clinique et le fossé entre la théorie et la pratique leur paraît moindre. La période difficile qui est la transition de la théorie médicale à la pratique clinique est un moment charnière pour motiver et former les étudiants en médecine pour leur future pratique, et a probablement un impact sur la sécurité des patients et la qualité des soins. Pour faire de la transition une expérience d'apprentissage réussie, une recherche plus approfondie et une approche multidisciplinaire de cet écart entre la théorie et la pratique sont nécessaires. L'impact des interventions d'apprentissage autour de la transition sur la qualité des soins et la sécurité des patients reste à étudier.

Mots-clés : éducation médicale, e-learning, éducation médicale basée sur les compétences, activités professionnelles fiables, pratique réflexive, rétroaction formative

Mind the Gap - Educational Videos to Move from Medical Theory to Clinical Practice.

A Qualitative Analysis

Training healthcare professionals for the 21st century is not an easy task. With an ever-changing world full of new scientific discoveries every day, with threatening epidemics and an increasing demand by patients to be involved in their own care, new healthcare professionals face the need to be extra flexible in order to deal with these challenges.

The educational process that is needed to move from a young, motivated student to a future-ready, accomplished graduate however, still looks a lot like a black box to many educators and faculty staff. While policy makers and faculties are very aware of the outcomes that are needed for graduates to face all of these new challenges, it is unclear what to actually do in order to prepare the students in the best way for their role of being young doctors.

A concept that can be helpful to define and reshape the learning process is competency-based education (CBE). CBE and more specifically competency-based medical education (CBME) are being used in order to make sure that higher education students achieve the competencies that they are supposed to achieve by the end of their studies. A curriculum based on CBME is one way to tackle the issue of the black box, by constantly evaluating the competency level of the learner and supporting them to progress to the next higher levels.

Especially in times of great learning challenge and transition, it is very important to not forget about the principle competencies a given learner is supposed to achieve. One of these learning challenges and intense transition processes is the period at the end of medical school, when a medical student has finished her or his theoretical education and passes on to purely clinical practice. Indeed, moving from theoretical knowledge to clinical practice is a challenge for many students. We believe it, however, to be the basis for the final transformation from student to clinician. It therefore seems of great importance to pay more attention to this critical period in the journey from unexperienced student to future-ready clinician.

At the UCLouvain, a novel approach to the achievement of key competencies during this particular transition period has been developed. Starting this process in 2017, it was meant to be an innovative educational approach for final year students to review important topics for their final exam. It was a teacher of emergency medicine who started creating videos illustrating a pragmatic approach to the main complaints a medical student can face during clerkships. These

videos were not only created as a guide during clinical practice, but were also meant to help students prepare for their final exam by encouraging clinical reasoning.

Throughout the course of this study, which aimed to evaluate this new learning tool, the authors realized the magnitude of its significance for the transition from medical theory to clinical practice. This is why this thesis, while outlining the results of our evaluation, is also based on the overall theme of the transition from theory to practice, from student to clinician.

The tool that is being evaluated through our study is an e-learning approach, using short learning videos coupled to self-assessment questions. With an e-learning tool, easily accessible for students who work in the hospital full time, the authors intended to give the learners more confidence and key knowledge to face the struggles of every day clinical work. An introduction to this novel approach and the scientific basis behind the transition and CBME, which the videos are based on, are presented on the next pages.

The transition from knowledge acquisition to clinical practice

Medical students' preparedness for practice seems to be one of the most crucial topics in medical education of the 20th century. In a discipline that is ever-changing, with daily groundbreaking discoveries in research and treatment options, it is important for medical graduates to have a good basic knowledge of clinical medicine and the different situations they may encounter. In their report "Health professionals for a new century" Frenk et al. explain novel health challenges that future generations will face:

"New infectious, environmental, and behavioral risks, at a time of rapid demographic and epidemiological transitions, threaten health security of all. Health systems worldwide are struggling to keep up, as they become more complex and costly, placing additional demands on health workers." (1)

A current example of these novel risks is the coronavirus COVID-19 which challenges health workers on a global scale and strains the worlds' economy in ways never seen before.

With medical graduates having to deal with problems like this, in a 21st century world of rapid changes and ever more demanding jobs, one critical step in their journey to becoming young doctors is the period of transition from medical theory to clinical practice.

Being launched into a hospital world full of difficult and uncertain situations can be a challenging time and the negative feelings and effects that surround it have been described in many studies. For example, studies from the US and the UK suggest that when young residents start their work all on the same day, there is an increase in patient morbidity and medical mistakes (2,3). Other studies found that many students and junior doctors feel anxious and unprepared when facing clinical practice (4,5) and this is also the general impression one gets when personally talking to final year medical students. This long term anxiety could be one of the factors explaining why there are such high levels of burnout and emotional exhaustion among medical students and residents (6).

Moreover, a study from the UK showed that students actually are not prepared enough for certain tasks. These tasks include prescribing, clinical reasoning and working in a multi-disciplinary team (7). But not everybody sees this transition as a threat. Other papers suggest that this transition period is certainly a challenging time, but as every challenge it should be harnessed for its developmental opportunities (8–11). After all, the students are at their peak of personal reflection and development at the time of transition, and giving them tools to successfully bridge this gap to become resilient young doctors can help them to make the most out of this challenge. Kilminster et al. explain that transitions are actually “critically intensive learning periods” (12) that are important to be recognized by the actors surrounding the student during this time in order to make them successful learning experiences.

The transition period from student to healthcare professional, with students having studied a lot of theory and at that moment being ‘thrown into’ clinical practice for the first time, is a time that hasn’t received much attention from medical educators and faculty staff at our university so far. It is, however, certainly one of the biggest challenges that students face in medical school. Making sure that future graduates are as prepared as they can be to face this challenge and harness its learning potential is the responsibility of every medical school.

The British General Medical Council (GMC) defines the competencies any medical graduate should display when finishing medical school:

“Medical students are tomorrow’s doctors. In accordance with good medical practice, newly qualified doctors must make the care of patients their first concern, applying

their knowledge and skills in a competent, ethical and professional manner and taking responsibility for their own actions in complex and uncertain situations.” (13)

It is obvious that the care of patients should have the highest priority for future doctors. It therefore is of the utmost importance that medical graduates be well prepared to start practicing clinical medicine in order to be able to provide high quality and safe patient care.

Having had to decrease the duration of medical studies from seven to six years to comply with European regulations, the time for clerkships for medical students at the UCLouvain has recently been reduced from one and a half years to only one year. Many medical students that study in the new six-year course are afraid, not without reason, that their preparedness for practice may be decreased compared to the students who studied for seven years before them. It is clear that this challenging period which is the transition from medical theory to clinical practice needs more attention from medical educators and faculty staff alike, in order to make sure that our students are well prepared to face the challenges of clinical work, and later on, residency.

Competency-Based Medical Education

At the end of the 20th century, a new concept of medical education was developed which has contributed to all the major curriculum reforms of the 21st century: competency-based medical education. The concept of CBME was first introduced by McGaghie et al. in a report to the World Health Organization in 1978 (14). Competency-based education is an educational concept that focuses on the competencies that a learner should have acquired at the end of any given curriculum.

Frank et al. propose the following definition for CBME in their paper ‘Competency-based medical education: theory to practice’

“An outcomes-based approach to the design, implementation, assessment and evaluation of medical education programs, using an organizing framework of competencies.” (15)

Especially the greater learner centeredness of the CBME approach is noteworthy, with direct knowledge application during the learning process and multiple assessment methods in an

authentic, clinical context. The overall educational goal is a formative one as opposed to the summative, knowledge-acquisition based “traditional education”. Taking a step back and looking at it from a larger point of view, CBME can be regarded as a form of Outcome Based Education (OBE), a concept which opposes traditional criteria that focus on the time-based curriculum process and instead emphasizes a competency-based approach. The curriculum development in OBE is all about the product, the outcomes the learners should display at the end of a course (16). In OBE, our vision of training future-ready healthcare professionals that excel at their work helps us define those outcomes and more specifically the skills that these professionals need. Zooming back into CBME, we can say that competency-based medical education, in line with OBE, puts the focus on expertise (→ competence) instead of time spent training (→ time-based) when it comes to measuring a doctor’s proficiency in doing their job.

So far, several countries have introduced medical education concepts that revolve around outcome-based education and CBME. Canada started by developing the CanMEDS framework in 1996, the USA followed by introducing its Milestones concept and finally the UK set up the Outcomes for Graduates. These frameworks all describe the specific knowledge, skills and attitudes future graduates should have acquired during their training, but they also talk about the roles of the healthcare professional in the 21st century. It is no longer sufficient to be an expert in your own field to be a good doctor. The CanMEDS framework for instance is organized around seven physician roles: medical expert, communicator, collaborator, manager, health advocate, scholar, and professional (17). This competency framework is outcome-oriented: it is “focused on the abilities needed by all physicians to meet the health care needs of the patients, communities, and societies they serve” (18). An overview of the CanMEDS framework can be found in appendix 1.

With this new emphasis on the learning process itself, and on the skills and abilities of future graduates, it is of utmost importance to introduce, next to the CBME framework, a way of monitoring the progress of the students towards the defined outcomes. Without monitoring and accompanying this progress, it is unlikely that the students will achieve the key competencies that they need. An important tool to evaluate whether those skills and abilities have been achieved are Entrustable Professional Activities (EPAs). EPAs were first introduced in the Netherlands in 2005 by ten Cate when he described the shift of medical curricula towards outcome-based education and introduced the EPAs as an assessment tool for this new outcome-

based concept of education (19). According to ten Cate “EPAs have a holistic nature: they include knowledge, attitude and skill” (19) and therefore help us bridge the gap between the former ‘medical professional only’-attitude towards a bouquet of seven roles that a physician has to play (as defined by the CanMEDS framework). EPAs can also be seen as the translation of the outcomes that a medical curriculum should have into actual hands-on clinical practice. For example, a typical EPA for undergraduate medical education is “gather a history and perform a physical examination” (20) followed by several sub-points specifying the exact competencies a student should display when it comes to history taking and physical examination.

A crucial point in EPAs is that it is a process in which both the supervisor and the student have to play equal, proactive parts in order for the EPAs framework to be successful. The student should understand the use of EPAs in his or her own learning process and take them as a basis to prepare an individualized learning plan in order to achieve the specific competencies. The supervisor should know the EPAs that a student is working on and give specific, constructive feedback in order to help the student achieve a satisfactory level of competence for the different professional activities.

The video-based learning tool

The faculty of medicine at the UCLouvain recently defined 15 EPAs for undergraduate medical education, in an effort to base clerkship evaluations on the actual competencies that interns acquire during their clerkships. These entrustable professional activities are now the basis of each of the eight evaluations throughout the year of rotations, and are based on the EPA framework “AAMC Core Entrustable Professional Activities for Entering Residency” proposed by the Association of American Medical Colleges (AAMC) in 2014 (20,21). A list of the 15 EPAs defined at the UCLouvain can be found in appendix 2.

In 2017, a professor of emergency medicine introduced learning videos as a complementary tool next to a course which is entitled “démarche clinique” which translates to ‘clinical approach’. It is a weekly course throughout the three final years of medical school which aims at integrating different medical specialties in a horizontal way, thereby teaching students how to solve different clinical problems, touching upon different specialties. The clinical problems which the course is based on are the 90 most important clinical situations a

student can encounter during clinical practice, which stem from the “Swiss Catalogue of Learning Objectives for Undergraduate Medical Training”(22). A link to both the catalogue and its updated version, the “Profiles”, can be found in appendix 3.

The learning videos that were created in 2017 aimed at using those 90 most important clinical situations and combining them with the EPAs recently introduced for the clerkships. The learning tool was supposed to complement tradition lectures, to help students prepare for their final exam in medical school and for them to have a better idea of how to actually apply EPAs in clinical practice. The professor wanted to make sure that the students are prepared to practice those competencies and face important clinical encounters during their clerkships. The goal was to look at common clinical situations from a purely clinical angle, instead of just learning the ‘theory’. Thus, the videos show how to practically communicate with the patient, how to concretely administer drugs, what to look out for in case of urgent situations, and other skills that are useful in a clinical context and that might not have been taught explicitly through lectures. Links to the seven first pilot videos can be found in appendix 4.

By giving students a tool to bridge the gap between theory and practice, the videos were also an answer to the general feeling of ‘unpreparedness’ of the students attending the new six-year course of medicine at our university. Associated to the videos, students had access to a self-assessment with specific questions and exercises, testing knowledge about the content of the learning videos.

The present study aims to evaluate the first seven pilot videos and their self-assessment as for their usefulness and the appreciation by final year medical students. It was important for the producers to get student feedback in order to improve the videos, and to make them the most useful possible. Showing the importance of new teaching techniques like this one within the medical curriculum seemed an additional benefit of conducting a large student survey.

Moreover, throughout the survey process it became increasingly clear what an important time for the students this transition period from theory to practice really is. We therefore base our qualitative evaluation and this study within the larger picture of the transition from medical theory to clinical practice.

Methods

Context of the study

At the UCLouvain, the medical studies curriculum comprises six years, with the first two and a half years dedicated to basic sciences and (patho-) physiology, and the last three and a half years focusing on clinical medicine. As for practical clerkships, the curriculum remains mainly theoretical until the end of the fifth year. There is a one-month clerkship each in the fourth and the fifth year. The sixth year consists of pure clinical practice, with the students rotating through different specialities every few weeks. At the end of the sixth year, students present their final exam which is based on all the different clinical subjects they passed.

Before the start of this project, there was no specific preparative action undertaken in order to help students with their transition from the mainly theoretical courses to actively working and learning in a clinical context. The clinical learning videos that this study is evaluating are the first tool developed to support students' individual transition process and provide them with the key messages for the most common clinical situations encountered during their clerkships.

The seven first pilot videos of this project were made available to the class of 2017-2018 during their year of clinical rotations and were mandatory to watch in order to prepare for the emergency medicine part of the final exam. They were initially supposed to help students review important topics for their final exam and to familiarize them with the clinical approach to entrustable professional activities. Throughout the course of this study, which aims to evaluate the learning videos for their usefulness, the significance of this e-learning approach in terms of accompanying the transition from medical theory to clinical practice became apparent.

Qualitative approach and research paradigm

The present study is based on a survey open to all medical students of the year 2017-18.

Surveys, apart from providing quantitative data, can help represent the diversity of respondents' opinions and characteristics when they provide open questions that give the respondents the possibility to express themselves freely. This study relies on questionnaires comprising Likert-type, yes/no and especially open questions.

For the qualitative analysis, an approach combining an affinity diagram and open coding techniques applied to 65 pages of qualitative data retrieved from the open questions allowed to

identify the main results of this research project. The quantitative results from the closed survey questions helped to give an overall idea of the general student appreciation of different characteristics of the learning videos.

Literature Review

To get an overview of the current state of the art regarding CBME and its clinical application through EPAs, the use of videos in education, and the best strategies for a qualitative evaluation of students' learning outcomes, a thorough literature search was performed. The electronic search of literature was conducted using Google Scholar, PubMed and Scopus. This search was augmented by a hand search of the reference lists of relevant articles and the internet.

Sampling strategy and Data Collection Methods

To get a representative sample of student opinions, the learning videos and coupled self-assessment assignments were used as preparatory material for the final exam of all sixth-year medical students of the year 2017/2018. Students who watched the videos filled in a short questionnaire after each video and a general questionnaire at the very end, after having watched all seven pilot videos. Questionnaires were chosen as data collection method for this project as they can be administered to a large number of participants and provide flexibility in answering for respondents, not taking up too much time out of the students' busy pre- and post-exam life. Additionally, even if the non-response rate may be higher for questionnaires compared to interview surveys, the resulting data is often of better quality and "especially with more sensitive questions, self-administered mail surveys performed better with, in general, less social desirability in responses, [and] more reporting of sensitive behaviour" (23).

In a future research project, it may however be judicious to take the qualitative methods further and to include focus groups to further specify the students' different points of view.

While the short questionnaires after each video were based on quantitative data, containing the same questions each time to increase the comparability of the specific video evaluations, the big general questionnaire gave the students the possibility to openly express their opinions with their own words.

The present study focuses mainly on the outcomes of the main questionnaire which provides the majority of qualitative data. This main questionnaire, used to evaluate the impact of the learning videos and the auto-evaluative questions on the students' learning satisfaction, contained 16 questions. Likert-type scales, yes-or-no questions as well as open spaces for comment were used as measuring tools to ensure a diversity of answers representing the different student opinions.

The Likert-type-scale is a psychometric measurement tool of attitudes, beliefs and opinions. For each question, the respondent can choose between several options that represent different degrees of agreement or disagreement, in a multiple-choice type format. Likert-type scales have proven to be easy and quick to answer and are a solid way of quantifying a certain population's attitudes on various statements. Often people tend to choose the most neutral answer in a Likert-type question. This was avoided in our study by giving only four instead of five response-options (for example instead of using "strongly agree – agree – neutral – disagree – strongly disagree" we used "strongly agree – agree – disagree – strongly disagree").

The closed questions with 'yes' or 'no' as answering options allowed to get quantifiable data on several important points. Dichotomous questions allow the researcher to get simple validation from the respondent for questions that do not require nuanced answers. For instance, in the short questionnaire for each video, solely yes/no questions were used, in order for the evaluators to be able to closely compare the different videos and deduct their individual strengths and weaknesses.

The open-ended questions, mainly coupled to closed-ended questions, served as a tool to expand the depth of the question and make space for the 'why' and the 'how' behind the students' answers. A large commenting space per question was intentionally placed to give students the opportunity to express their thoughts and opinions freely. These open-ended questions provided the qualitative data that was later analysed using coding techniques, leading to the main results of this paper.

Data Processing

While the Likert-type and closed questions were not processed further, but used as guiding data for the qualitative research, the focus of this study lies on the qualitative analysis of the comments provided by the students. The data from the questionnaires was provided in French

and translated to the English language by the author of this study, under the supervision of two senior researchers.

Overall, 65 pages of text were analysed.

Quantitative Data Processing

The quantitative data from the Likert-type and open questions was used to complement the qualitative data. It was particularly helpful to get a clear picture of the students' overall opinion.

Qualitative data processing

The overall approach to this study is a constructivist approach which encompasses the observation and interrogation of participants for data generation to understand a phenomenon from the perspective of those experiencing it. The strategy of qualitative analysis used was the “immersion/crystallisation (intuitive) analysis style” as proposed by Malterud in 2001 (24), keeping in mind the concepts of relevance, validity and reflexivity outlined in the same paper.

The first step to perform this type of qualitative analysis was to process the data, organising and comparing the material received. The comments of the students were first attentively read two times by the author alone before being re-arranged into subgroups per question. The subgroups were created according to specific student-opinions.

Most comments were separated into three main subgroups and smaller sub-categories: general comments, comments specific to the question asked and suggestions for changes in the videos and the overall concept.

As an example, the first question “In general, do you find the content of the videos useful regarding your learning outcome?” yielded 4 pages of comments which were re-arranged into ten categories (e.g. “enthusiastic comments”, “comments on the usefulness of using visual learning tools”, “concrete suggestions”, ...). The document containing the re-arranged comments can be made available by contacting the author of this paper.

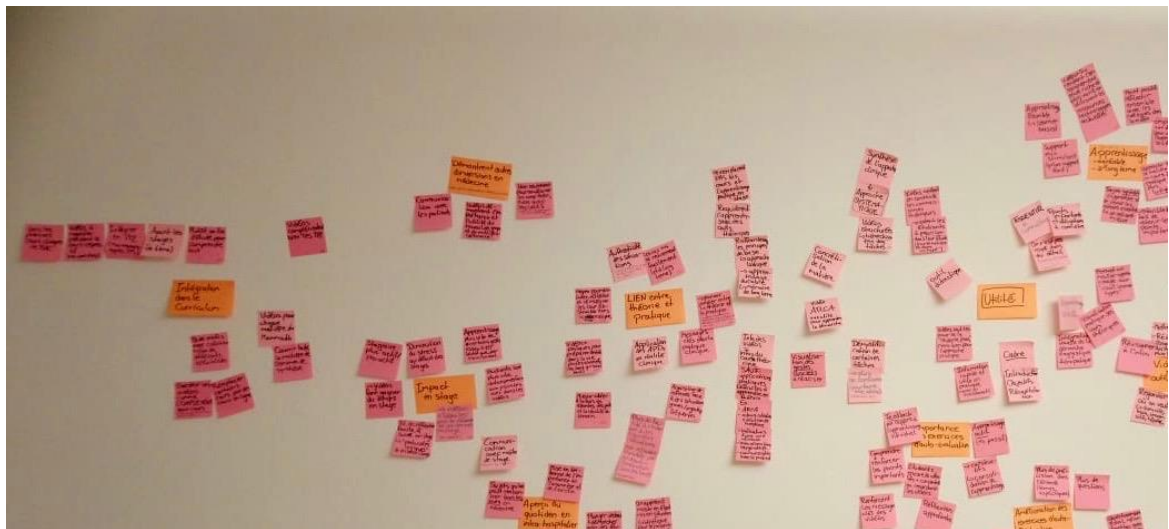
Data Analysis

After the thorough organisation and restructuring of the 65 pages of data, the step of data analysis, a process of intellectual abstraction, followed suit. Its goal was to compare the different categories and to crystallise common themes and patterns representing the different opinions of the sixth-year students.

In order to do so, a three-day session of affinity mapping (“sticky-note-analysis”) was performed. Affinity mapping, or affinity diagramming, is a technique first used in project management and contextual design research.

It “*is a brainstorming technique that organizes large amounts of disorganized data on a large number of ideas, process variables, concepts, opinions, and other information into groupings based on natural relationships*” as explained by D.R. Kiran in his book ‘The Seven Modern Tools of TQM’ (25).

Overview of the
affinity diagram
(wall of 3m)



Affinity mapping helps to break up traditional cognitive patterns and gives the brainstormer the opportunity of seeing the content as a whole, unveiling the relationships between different groups of data.

In the case of our qualitative analysis, the author read carefully through the re-arranged comments and, using the immersive technique of qualitative coding, extracted different topics and subgroups that were noted on sticky notes and arranged by patterns on a large wall. The practice of finding new themes that emerge through the process of affinity mapping can be

described as open coding, a widespread method of qualitative analysis, mainly used in social sciences.

Saldana describes qualitative coding as follows:

“A code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence- capturing, and/or evocative attribute for a portion of language-based or visual data” (26).

Based on Saldana’s ‘Coding Manual for Qualitative Researchers’, the open coding process this work is based on uses the techniques of descriptive coding and pattern coding. While descriptive coding summarizes the primary topic of a given piece of textual data, pattern coding or analytical coding leaves space for interpretation, letting the researcher (with their subjective opinion) give a meaning to certain patterns that were crystallised from the data.

The final affinity diagram, which provided an overview of all patterns crystallised from the data, was reduced and re-arranged to find 12 focus points with several sub-topics. These 12 points were finally subject to a last in-depth analysis, in collaboration with senior researchers, and were reduced to the three main themes that constitute the pillars of the outcome of this work. To close the cycle of coding, the main codes were reapplied to the data and tested for significance.

Overall, for the analysis and interpretation of around 65 pages of textual data no computer program was used. The qualitative data analysis was performed solely by researchers.

Researcher Characteristics and Reflexivity

It is important to acknowledge the effect of the researcher on the outcomes of the qualitative data analysis. The researcher is a final year medical student with an interest in medical education. She undertook this research because she is herself concerned by the difficulty of transition from theoretical teaching to medical practice and wanted to find out the possible impact of supplying students with learning videos to ease this transition. She hopes for her efforts to be considered by her medical faculty for future decisions concerning medical education and innovation.

The analysis of the present study data was mainly performed by the author, with her individual bias and subjective interpretations, based on previous experience in the field, and her growing knowledge of the topic throughout the working process. A specific bias stems from the author being a medical student herself, analysing the data from a medical students' point of view. There is therefore presumably an interaction between the characteristics of the author and the approach to the study, the methods and the results sections. This can be regarded as both a strength and a weakness, but definitely a bias, of the study. This bias may in part have been mitigated by a close collaboration between the researcher and two senior physicians.

To increase reflexivity despite the underlying bias, specific attention was paid during data analysis to include critical and diverse student opinions, and not only the most common opinions.

Lastly, there were no relationships between the author and the participants of the study.

Ethical Issues pertaining to Human Subjects

This study is currently being examined for approval by the ethics committee of the Cliniques Universitaires Saint Luc.

Results

The quantitative results of the main questionnaire can be found in table 1, at the end of this paper.

Response rate

From a quantitative point of view, 152 out of 447 final year medical students of the year 2017-2018 answered the main questionnaire. 146 questionnaires were filled in completely, while there were 6 questionnaires containing item nonresponses.

The overall response rate for the 152 of 447 potential respondents, based on the American Association of Public Opinion Research definition RR6, is 34% (27). This response rate accounts for the answers to Likert-type and closed questions. It includes the six incomplete questionnaires. For the open comments it is not deemed necessary to analyse the corresponding response rates, as they are of no importance to the outcome of the qualitative analysis.

The response rates to the short specific questionnaires for each video ranged from 80 to 151 answers. Given the heterogeneity of response rates, only the quantitative results of the main questionnaire, which has an overall more stable response rate, were taken into account for this study.

Overview of quantitative data

This section provides an overview of the results from the Likert-type and dichotomous questions. These results give us a general idea of the overall opinion of the students regarding the videos. No further quantitative analysis has been pursued, however, as this study focuses on the qualitative analysis of the comments given by students through the open questions of the questionnaire.

The overall appreciation of the videos by the students, through Likert-type and closed yes/no questions, was quite positive.

Concerning the learning benefits for students, 95% reported that the videos were often or always useful to their learning outcome. For 73%, the learning objectives of each video were always clearly understandable. Students appreciated that the objectives were mentioned in the beginning and summed up in the end for most videos. 44% believed that the videos always help

simplify complex learning tasks while 53% found this to be the case often but not always, as they believe that certain complex tasks can be difficult to learn through a video-based approach. Concerning the videos as a tool to complete notes from class, 27% thought this was rarely the case, while 49% found the videos often helped to complete their notes.

68% of the students were of the opinion that the videos never cover too much material or go into too much detail while 32% thought this was only rarely the case. 60% believed the videos rarely missed important information. 14% however, thought relevant information was left out often or always. It is interesting to see that some students demand for the videos to be more detailed while others realize that the videos should not exceed their maximum length of ten minutes, fearing that they would not be an effective learning tool anymore otherwise.

Overall, the videos often or always met the expectations of 97% of responders and only rarely met the expectations of 3% of responders. In regard to this extreme satisfaction of the students, we suspect a certain response bias. Of course there was a positive learning outcome reported by the students through their comments, which may account for some part of the positive appreciation. However, some students may also have applauded the overall efforts to innovate in medical education at our university. Others may simply have shown their appreciation of a new digital tool, those kinds of online learning opportunities being widely appreciated by this generation of millennials.

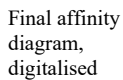
Regarding the auto-evaluation, 65% of the students found the self-assessment questions after the videos to be always useful, while these self-tests were useful often but not always to 32% of students. Open comments suggest that students thought the auto-evaluation questions were too easy, not challenging them enough to think broader and outside of the box. For their exam preparation they wish to be challenged more and to learn to adapt their reflective processes to new situations.

In regard to the emergency medicine part of the final exam that these videos were used to prepare for, the answers were mixed. 37% of students were convinced the videos would definitely prepare them well for their final exam, while 61% thought that probably or only maybe these videos would prepare them. However, as most students answered the survey before passing their final exam, it is difficult to know whether the learning tool made an actual difference in their preparation or not.

Concerning the usefulness of these learning videos during clinical training, the vast majority of students, 97%, believed these videos would have been even more useful had they been available early on during clinical training. It becomes clear through the students' comments that they feel the videos would be helpful to decrease stress during the first weeks and to be more confident in their own clinical approach. Again 97% found the videos useful as a complementary teaching tool to traditional lectures. It was important for students to note that the videos should remain a complementary tool and not replace lectures. More details on this can be found in the qualitative analysis of the students' comments.

Lastly, 61% of students thought that it would have been definitely helpful to their learning progress to have similar videos in other classes throughout the curriculum. 34% thought that this would have probably helped. Overall, 94% of students would like to see similar educational tools introduced in other courses. Being asked which courses they believe this kind of tool could be helpful for, almost all clinical courses of the medical master's program are being cited. This shows the need for creating bridges from theory to practice for all subjects individually in addition to addressing overall preparedness for practice through tools like the e-learning approach discussed in this study.

The qualitative data analysis of 65 pages of students' comments facilitated by the use of an affinity diagram resulted in twelve main themes, which are outlined in the final digitalized affinity diagram below. This digitalized final affinity diagram can be found in higher resolution in appendix 7.



The three main themes that constitute the findings of this study shall be outlined on the following pages.

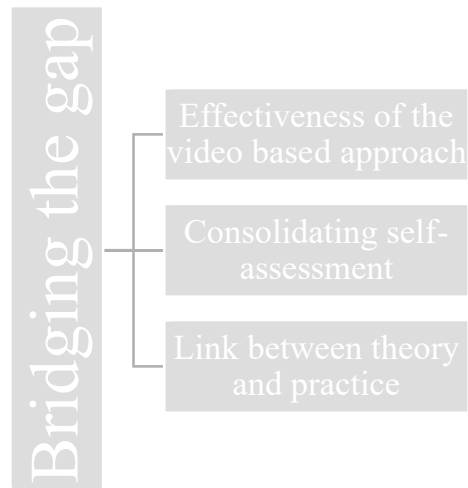


Figure 1: overview of the three main concepts found through the qualitative analysis

Firstly, the majority of students commented on the usefulness of using videos and technological tools in a broader context with regard to clinical training. Secondly, they indicated that self-assessment helped consolidate their knowledge. Thirdly, students perceived this learning tool as a bridging element between theory and practice and reported a learning impact during clinical training.

(1) Effectiveness of the video-based approach

The first concept that was clearly crystallized from the students' comments was the usefulness of the videos as a complementary teaching tool. The following points show the main features that were important and appreciated by the students.

Videos as a didactic tool

Students appreciated the videos as a didactic tool mainly due to three components: the videos' consistently systematic approach to each topic, the content that conveys the essential notions that every future clinician has to know and the videos' easy accessibility during daily practice.

While the vast majority of comments appreciated the didactic dimension of the videos, it was specifically the systematic approach to each videos' topic that made the videos so meaningful as a teaching tool.

“The introductions at the beginning of the video are clear and already explain the overall thread of the video and the conclusions at the end remind us of the information to remember. Very good point!”

This systematic approach can be divided into two sub-categories: firstly, each video contains a clear and structured approach to the given clinical problem. Secondly, each video is following a clear framework with an introduction, stating the objectives of the learning unit, and concluding the video with the key messages to remember. This simple but effective strategy was noticed and appreciated by many students, as it seems to make it easier for them to get oriented and understand the most important points of each video. However, as one student pointed out

“Objectives explained at the beginning are sometimes not included in the final conclusions.”

this strategy was not always respected, and, in the future, more attention should be paid to the congruence of the structural framework, especially since it seems to be a meaningful factor on a didactic level.

The second and probably most important point for students with regards to the didactic quality of the videos is that the videos are designed to limit the information they convey. Each video contains the strict minimum of key elements that are necessary for every student to get a good overview of the clinical management of the given problem. The information is strictly essential and follows a clinical hierarchy that facilitates understanding and memorization.

It was appreciated because it allows students to review essential concepts in a short period of time and to get a good overview of the topic without having to go through all the notes from a specific class.

“This kind of learning is really beneficial as it allows me to integrate information more quickly”

“Fast information that is useful in clinical practice for every future resident. In addition, the video format makes it possible to add visual components (seeing the patient and the clinical examination) which make us memorize [the information] better”

It is important to note however, that because only core information is given, good and reliable references are needed for those who want to go into further detail and learn more, as lecture notes alone may not always be reliable.

Furthermore, the videos are designed to remind students of the essential notions to remember in a clinical setting. This “essentiality” of the information was mentioned and commended by the majority of students, especially in the context of them having had to ‘digest’ big amounts of written data and being ‘overloaded’ with too much information for five years.

“The videos are short and make it possible to insist on essential points of the subject. Sometimes in the lectures we get too much information and it's hard to balance things between what's really important and what's less important, and we get to deal with the consequences of that during rotations. The videos allow to answer simple questions that arise during rotations and for which we do not easily find the answer in our lecture notes. The videos also show clinical examinations of patients and this is very useful because it is difficult to remember what was shown in one lecture.”

“It is true that the courses tend to be too detailed and I often have trouble distinguishing between what is important and what is less, so these videos are very useful!”

“Good transversal summary of all our different clinical classes that integrate the most important points in clinical management that all doctors need to know”

The third component that was appreciated by the students concerning didactics was that the videos provide fast and useful information. They are easily accessible during daily practice due to their short length and easily digestible information. Watching a video of a few minutes allows the student to get a solid overview of the actions required for the cases they face.

[Question: Do you think the videos would have been helpful to you early on during your internships?] “Yes clearly because they are short videos and easy to watch during a break.”

“Being able to watch them whenever you want, it's very useful when you are in clinical training”

“[This approach is] didactic, [is] practical, [is] clinically oriented, saves time, makes us a lot more active during clerkships”

Impact of the video-based approach on the students' learning process and outcome

This point seems to be essential to many students. Many responders mentioned that watching the videos had an impact on their long-term memory of the topic. Five different aspects make the learning videos impactful according to the students' comments.

Firstly, the videos constitute a pleasant and fun way of learning.

“I think that medical studies and more generally [higher education studies] should tend towards [using] these new types of learning. The videos are enriching, it's fun, much more captivating than an audience of 600 people. Combining new technologies and traditional teaching is essential for me to innovate and improve the quality of teaching.”

Secondly, using audio-visual media instead of written text for studying was a welcome change to many students. It was described as a “*stimulating learning tool*”.

“[This tool] lets you approach the subject in another way, more practical and more "playful", I find that one learns and retains better faced with real situations.”

“Visual and auditory content is much more relevant [to the learning outcome] than white sheets with written text.”

Thirdly, the visual learning component played a big role for several students. As mentioned in the quote of one student above, the videos allowed students to visualize tasks that they formerly had only heard about (for example administering opioids) or seen a demonstration once during class, not leaving enough time to remember it correctly (for example certain kinds of clinical examination).

“[The videos] allow to put an image on the theoretical knowledge, especially for the practical aspect of things (hence my preference for topics such as cardiac arrest for example). For 8 minutes videos, they are well done”

Visualizing seemingly “banal” tasks like administering a treatment, setting up the consultation space or communicating appropriately with the patient before starting rotations made a difference to students who watched the videos as they reportedly felt more at ease later on in a clinical setting.

It is important to note however, that students also mentioned that the easiest way to learn practical tasks like clinical examination was through hands-on workshops in small groups:

“For some practical things (CPR, placement of devices, manipulations, clinical examination etc), learning in practice with experienced people in small groups remains essential in my opinion”

As a fourth point several students mentioned that they identified with the actors on screen who were themselves medical students and health professionals, and that this stimulated their reflection about the clinical problems at hand. Being able to stop the video and think about what they would do in the same situation made students feel more actively engaged with the video and their own learning process.

“When the professor asks questions in the video, I try to answer them by myself before hearing the answers, at my own pace”

“[The videos] push us to think at the same time as our fellow students in the video and to correct our mistakes right away if we had the wrong reasoning”

Lastly, as already mentioned before, the flexibility of using the learning tool whenever and wherever the student prefers was seen as a great advantage, as it promotes a successful learner-centred educational process.

“Learning can be done at home, in a quiet environment conducive to concentration, with the option to pause, listen again, personally it suits me perfectly”

Videos as a complementary tool to traditional lectures

As mentioned in the overview of the quantitative data, students insisted on keeping the videos complementary to traditional auditorium lectures and not to have them replace those lectures. For many students, the active study of the lectures’ contents was a prerequisite to making the video-tool impactful. As the presented tool only touches upon the key messages for

each topic, it is important to have studied and understood the underlying pathophysiological processes beforehand in order for the videos' content to add on previous knowledge and to help moving it to long-term memory.

"[...] they should be provided at the same time as the courses to be able to study the complementary elements provided by two different teaching methods parallelly in an optimal way."

"Personally I prefer to have written course materials. And I think it's important that some teachers update theirs. Beside up-to-date written supports, this [video-based approach] could be useful."

Having studied medicine for five years already, the students find that the videos refresh essential knowledge and help remembering it in the long term. They also mentioned that having watched the videos helped accessing the knowledge and key messages faster when they experienced similar clinical situations as the ones shown in the videos.

"The physiopathology is to be studied alone in a room, that one does not leave before knowing all the mechanisms. These videos are in turn a way to discuss, reflect and reintegrate abstract courses into real practice."

"The learnt material is well memorized and it's easier to put into practice later on"

Technological advantages when using videos for learning

Interrogating a cohort of ‘millennials’ makes it impossible not to mention the technological advantages of this tool. Students appreciated four specific technological characteristics of this video-based learning tool.

Firstly, the flexibility, namely being able to watch the videos wherever and whenever it fits the student best, was commended several times, as it opposes the rigid structure of a lecture schedule. Secondly, and complementary to the flexibility, is the fact that the students are able to choose their preferred and best learning environment, making this approach a learner-centred one. A third important point for students was the adaptability of the learning speed which they found to be learner-based: the student can decide to re-listen or pause at any given moment. They can also watch the video faster or slower, depending on their personal needs.

“It allows us to watch the videos whenever we wish, in the best conditions, and to watch again if necessary. Also, some points are much easier to remember with a visual support like videos.”

“We can watch them several times so it complements the TPs [clinical skills workshops] well.”

As a last point, the maximal length of ten minutes of each video was appreciated, as students believed longer videos to be discouraging. There were, however, several comments demanding for more detailed videos, but also admitting at the same time that the videos should not be made longer.

“Maybe sometimes certain things are less clear, [...] but I find that the length of the videos is perfect and should not be longer”

“They sometimes lack a little detail in differential diagnoses, treatments, imaging but it's true that we do not want 20-minute videos either ...”

(2) Self-assessment to consolidate knowledge

Concerning the auto-evaluation tests after each video, students left a number of comments, explaining why the self-assessment was useful to them, and how they would like to see it improved.

Importance of self-assessment

Students appreciated the auto-evaluative quizzes for a number of reasons.

Firstly, several students mentioned that it was helpful to be able to get feedback on their own learning process. This is something that students at our university are not used to, as they tend to study for a whole semester and have one final evaluation in the end, without being able to assess their knowledge in between to get feedback on their learning process.

“Students are keen and eager for continuous feedback. Exercises [like this] are always welcome.”

“Good feedback on what has been learned”

Secondly, they found that assessing themselves and their new or refreshed knowledge after watching a video helped anchor the key messages and made the learning process more active as they were pushed to reflect on a number of issues.

“This [self-assessment] allows for deeper reflection and prevents you from watching the videos in a superficial manner”

This goes hand in hand with the fact that students felt like they were watching the videos more attentively as they knew that they would have to answer questions afterwards.

“Knowing that you are being evaluated afterwards, allows you to better focus your attention”

The auto-evaluative questions themselves reportedly stimulated clinical reasoning and the reflection of students about the problem at hand.

As the key messages of the videos were specifically repeated and assessed during the auto-evaluation, students said they memorized the key points better and were able to access this crucial knowledge in an actual clinical setting later on.

“The exercises made it possible not only to know but to actually understand the messages of the video. This is of course more interesting [for our learning process]”

Improving the auto-evaluative exercises

Students left a number of suggestions for the improvement of the self-assessment part of this video-tool. They asked for more exercises and questions and specifically wished for more difficult questions.

“[Add] more questions because it's a good way to sum up the [key messages of the] video”

As they explained, the students would like to be challenged more with clinical cases that do not correspond one to one to the cases seen in the videos, in order to push them to transfer the clinical reasoning they learned in the video to a similar, but different situation.

“Maybe ask more questions to which the answers are not in the video, in order to make us reflect and think more and apply the gained knowledge to a new situation”

Finally, several comments suggested to use this video-tool and its self-assessment questions throughout the year, in parallel to traditional lectures and courses in order for students to measure their personal progress. Students wished for a similar self-assessment for other lectures, too, and hoped that this kind of online tool may be made available throughout all of the clinical years of medical studies, and not just during the last year.

“But they should be provided at the same time as the courses to be able to study the complementary elements provided by two different teaching methods parallelly in an optimal way.”

(3) Link between theory and practice: easing the transition

While it was the goal of this qualitative analysis to find out more about the usefulness of the videos and the self-assessment in the eyes of the students, a third point revealed itself through the responders' comments. Indeed, many students commented on how for them, the videos

constituted a link between theoretical teaching and clinical practice, easing their transition towards working in a clinical environment and ultimately helping them in bridging this gap.

Our findings from this part of the qualitative analysis allow us to get a better understanding of what the transition from theoretical knowledge to clinical practice means for medical students at the UCLouvain. Consequently, it resulted in the authors rethinking and reorienting the framework of this study towards the theme of the transition which seems to play a crucial role for the students and may be a determining period for the evolution from university student to young clinician.

This part can be divided into three observations. The first one is the actual bridge between theoretical knowledge and clinical practice: the possibility for students to get an idea of everyday hospital work that they aren't very well acquainted with yet, and learning how to apply their theoretical knowledge in practice. Secondly, the actual reported impact in clinical practice of having watched the videos. And thirdly the fact that the videos not only address scientific medical knowledge and procedures, but also other features that are important when practicing the art of medicine, like soft skills.

Bridging from theory to practice

For several students, the videos constituted a welcome way of helping them to align their theoretical knowledge with what they learned during clinical training.

“They combine our lessons and clinical practice in one video while we are divided between our clerkships where we are always in action, and the evening or the weekend where we study our theory. These videos are an excellent bridge between theory and practice.”

Several students reported having experienced the same situations as seen in the videos later on during clinical training. This authenticity of the clinical cases from the videos was helpful for students to put a picture on their theoretical knowledge and to find out how to actually apply it in clinical practice. According to the students the videos helped to add concrete and practical notions to their previously mainly theoretical knowledge, easing the way into everyday hospital work by giving them the capacity to ‘juggle’ between theoretical knowledge and clinical practice.

“[This tool] makes it possible to better prepare for internships and residency because the videos present real clinical situations showing patients and their complaints and the kind of immediate care that can already be administered”

“[The videos help] to be able to juggle between theory and practice and especially to have a CLEAR and concise diagnostic and therapeutic approach”

Additionally, having an insight into what it is like to work in a hospital as a member of a team with different players was important to several students, as this is something that traditional medical education does not tend to cover. Throughout the videos, it was interesting for students to see the points of view of the different actors, like the residents and their supervisors.

“These videos, didactic and concise, were enriching as for the reflection together with the actors and allowed the one who was watching to walk together with you [in the hospital]. Zooming in and showing the X-ray / ECG / parameters allows us to dive in and to journey [through the clinical situation] with you.”

Impacting the experiences during rotations

Some students mentioned the different ways they believe that the videos impacted their experience during clinical practice.

As many students explained, the situations shown in the videos were authentic situations that they later experienced in a clinical setting. Students thought that had they been given the videos earlier on, this tool would have helped greatly to reduce stress and give them more confidence, especially for the first days and weeks of rotations.

“[Question: Do you think the videos would have been helpful to you early on during your internships?]

ABSOLUTELY!!! They must be watched before the internships and even sometimes in parallel with certain lectures (emergency medicine classes, physical medicine classes on lower back pain, ...); I think students will be much more comfortable in internship after seeing these videos!”

“Before the beginning of the clerkships, it would have helped to reduce the stress of the first days ...”

During clinical work, according to the students, the videos often helped demystify certain tasks and situations that interns might be afraid of, by practically showing all the steps to a certain procedure. This demystification made it easier for students to understand what to do in the actual practical situation, since they visualized the concrete process in the video. This applied specifically for tasks that are difficult to learn just in theory.

“[The videos give] insight into real situations, [and] let you better understand the gestures instead of just memorizing them for the exam and then forgetting them later.”

“They demystify tasks that are actually simple such as morphine dilution or oxygen delivery.”

Consequently, students reportedly felt more confident during their clerkships, especially when they had to perform tasks they had seen in the videos beforehand. Some students believed that had they had the video-tool earlier on they would have been able to become autonomous faster for certain tasks as well as for clinical cases similar to the ones from the videos.

“This [tool] would obviously be more useful before the internships ... However, demystifying clinical management in emergency situations gives us more confidence.”

“Some essential gestures that I learned through trial / error (via my supervisor's remarks) could have been learned earlier (and faster) through these videos.”

“Seeing a specific clinical management before having to perform one ourselves without supervision [is helpful]”

Realising that there are other dimensions in medicine

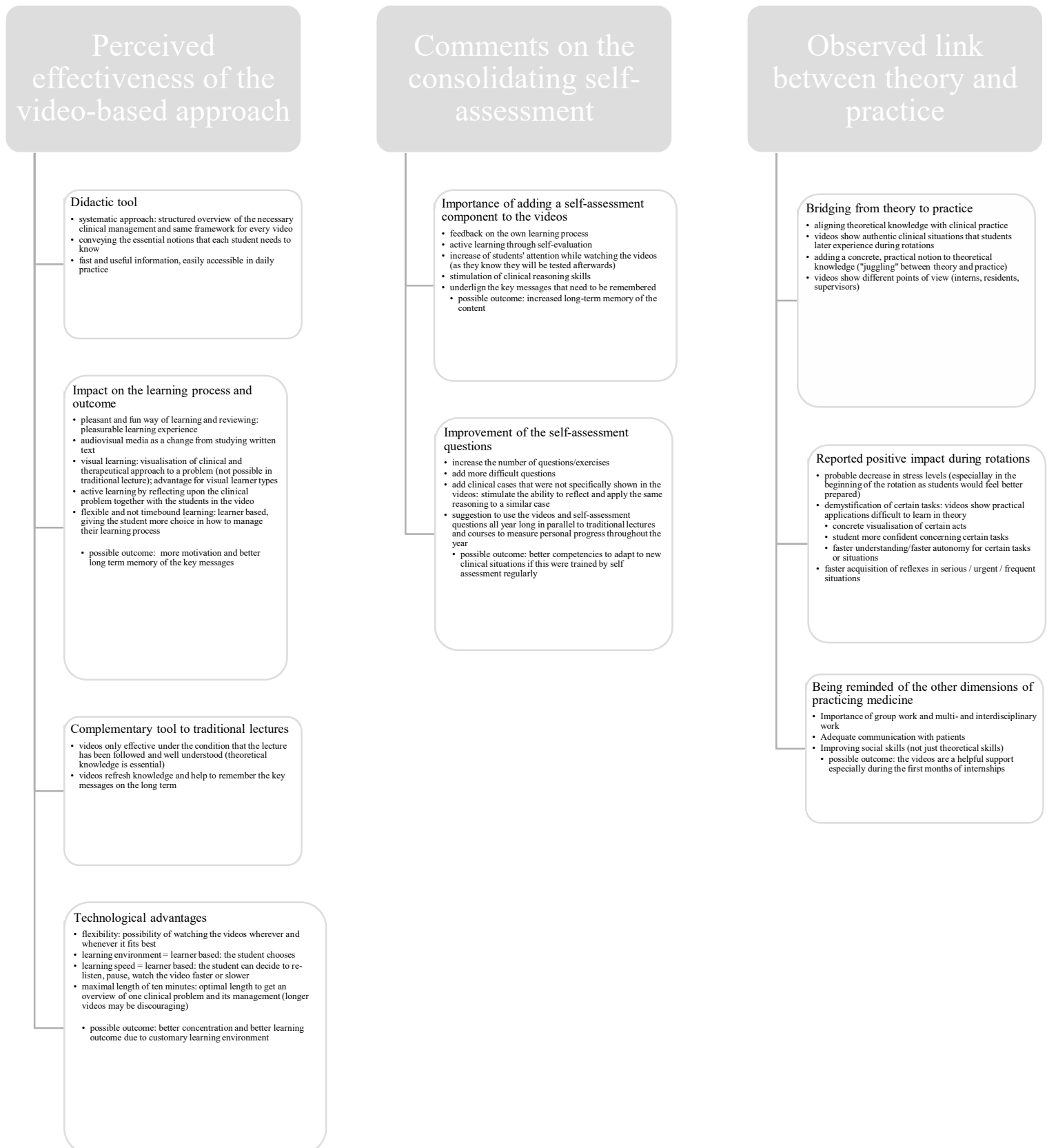
Apart from showing practical clinical skills and case management, the videos also focus on another important aspect: communication. Students appreciated that a non-negligible part of the videos showed how to properly communicate and act around a patient.

“In the majority of cases, our classes do not teach us how to take care of the patient as a whole but only his/her illness. These videos (as well as the emergency medicine course) show that we must not neglect the other dimensions of the patient.”

Consequently, students mentioned that they felt the videos might help improve their social skills around patients and other healthcare personnel.

„I also liked that each video is useful not only to improve our theoretical skills but also social skills!”

Figure 2: detailed overview of the three main findings and their sub-themes



Discussion

On the following pages, the findings from this study shall be discussed and integrated with prior findings from scientific research.

The results from this study open up to many new questions. A major question, for example, is how an educational approach like the one we used can benefit the overall goal of training future-ready healthcare professionals and guaranteeing a high standard of care. We therefore will discuss the relevance of our learning tool for students, for those responsible of the curriculum, for the safety of patients and for the quality of care.

Doing so, we will shed light upon different factors involved in making our learning tool a success. Taking a closer look at the field of learning theories, we will discuss how concepts like Bloom's taxonomy or dual coding can help students increase the quality of their learning process. Explaining the importance of reflective practice and formative feedback and taking a look into the current advances in neurosciences, we will explain how knowledge can be anchored in the long-term memory in a way as to make it available more quickly when it is needed in a clinical context. Broadening our view of successful educational interventions, we will reflect on the fact that a multidisciplinary approach to the transition from theory to practice is necessary in order to make the transitional process a successful learning experience. We will also look at other ways of preparing students for practice, some of which have already been successfully implemented at our faculty. As a final comment on medical education in general, the topic of millennials as a learner group with specific needs will be discussed.

On the following pages we will start the discussion by summing up the results of this study, then leading over to integrating them with prior findings from scientific research.

Summary of results

Our analysis revealed three findings:

The first finding is that the final year medical students appreciated the effectiveness of the video-based learning. They mentioned the systematic approach to each video, the content limited to key knowledge and the easy accessibility of this tool. As for their learning experience, students reported that there was an impact on their long-term memory after watching the videos. The reasons for better memorization mentioned were that it was a fun and novel way of learning,

that they appreciated the visual component and often identified with the actors on-screen. Additionally, they were able to learn using the videos wherever and whenever they wanted, benefitting from an increased learner-flexibility. The videos were appreciated as a complementary tool to traditional lectures as they helped to refresh knowledge and remind students of the most important concepts to know for the clinical cases encountered during rotations. Finally, the technological advantages, mostly the flexibility of learning, the possibility of studying in their preferred learning environment and of being able to pause and relisten to certain parts, were important advantages in the responders' opinion. They liked that the videos do not exceed a maximal length of ten minutes, while at the same time demanding for more detailed videos. This dichotomy was noticed and commented on by a number of students, concluding that it would be better to keep the videos shorter rather than increasing detail and length. A length of ten minutes per video is supported by the findings of Prober and Khan in 2013 as they are "sensitive to the typical peak learning period for adults" (28).

The second finding is that a self-assessment can serve as an effective learning tool to make the learning process an active one and anchor new knowledge in the long-term memory. The sub-themes summarize the students' opinions on the self-assessment that was coupled to the videos. The auto-evaluative quizzes were appreciated for their features of giving immediate feedback to the students' performance, anchoring the key messages through reflective practice and stimulating clinical reasoning skills. Students reported that, because they knew they would be evaluated afterwards, they watched the videos more attentively and were able to actively remember the key messages in similar clinical situations later on. The responders also left a number of recommendations for improving the self-assessment. They wished for more questions and a more difficult level of assessment. Furthermore, students requested to get the opportunity of applying the new knowledge to clinical situations different from the ones seen in the videos, in order to challenge themselves and to learn how to transfer the newly gained knowledge. Finally, they stipulated that it would be helpful to have access to this tool throughout the academic year, next to the official lectures on emergency medicine, to be able to get continuous feedback on their learning process. They wished for similar approaches for the other clinical courses too.

The third finding that was crystallized from the students' comments outlines the way in which this video-based learning tool acts as a bridge between theoretical teaching and clinical

practice. In this third point, students mentioned that the videos helped them to align their theoretical knowledge with what they learned in a clinical setting, supporting them in the process of ‘juggling’ between the two and making meaningful links. Furthermore, it was helpful for students to see the points of view of different clinical actors. The videos, showing authentic clinical cases, impacted the students’ experience in the clinical setting especially when they experienced the same situations as seen in the videos. They felt reportedly less stressed and more confident during their hospital work, stating that the videos demystified certain tasks that they were formerly afraid of. They felt that had they had the videos earlier on during their rotations they could have been autonomous faster for certain actions. Finally, the videos put an emphasis on soft skills like patient communication, which the students noticed and appreciated as a dimension of practicing medicine that should not be neglected.

This third finding was important to the researchers, as it went beyond the mere evaluation of a learning tool which this study was initially intended to be. In consequence to this finding, the topic of this paper was aligned with the general theme of the transition from theory to practice.

Benefits in a clinical setting

The first and most obvious part of the discussion revolves around the benefits that result from the novel e-learning approach that we introduced to final year medical students at the UCLouvain. In the following chapters first the advantages for students, then for patients and finally for the overall healthcare institutions will be outlined and discussed.

Benefits for students

Less stress, more confidence

Especially the first days of a new internship can be extremely stressful for students, with them having to navigate a new environment, getting to know a new team and having to manage patient encounters in a new setting (29,30).

In their comments, many students say that had they had the videos earlier on, they would have felt more confident and less stressed especially in the beginning of their clerkships. Having watched videos that explain, using visual and auditory input, how to deal with specific clinical

situations that are often encountered in practice may help to alleviate stress during those first days and weeks. The student can re-watch the video at any time, even during a short break, and may feel less dependent on their coworkers during the first days of their internship. Decreasing stress also leaves more cognitive space for meaningful educational experiences. Using the video-tool may help the student to decrease stress, focus on their learning goals and become autonomous for typical student tasks and procedures faster than they would without having prepared their internships using this video-tool.

It is important to remember that, on the other hand, a certain amount of stress can also be beneficial to learning. Atherley et al. interpret Mezirow's findings from 1978 on perspective transformation saying that "stressful experiences can trigger transformative learning" (8,31). Transformative learning ultimately leads to more self-reflection and active learning. We can conclude that starting clerkships with less stress is good for students to adapt and settle into their new learning environment, but ultimately some struggles and stressors can also stimulate active reflection and learning. The videos help in reducing the first gap to cross in order to successfully start the internship. In relieving the first stress for students, they leave more cognitive space for important learning opportunities.

Faster achievement of key competencies

The different students' comments lead us to believe that, having watched the corresponding video before encountering a certain clinical situation will result in the student achieving certain key competencies easier and faster. This may notably be true for the 15 Entrustable Professional Activities defined by our faculty and which the videos are based on. These EPAs have recently been introduced as an evaluation tool for clerkships at our university. Unfortunately, it is unclear if students actually understand their advantages and how to use them to make the most out of their internships. As the name suggests, to use EPAs, a climate of trust has to develop between the student and their supervisor, with both parties needing to understand the requirements and implications of the entrustment and the following assessment. As mentioned in the introduction, it is important for learners to play an active part in this entrustment process, developing their own individual learning plans to achieve a certain level of competence for each EPA (20).

Having an additional training of the supervisors on how to observe and give feedback for those 15 EPAs in a clinical environment should be a complementary step to making sure students achieve a satisfactory level in each of those key competencies by the end of their studies, and understand which competencies they still need to work on. It may also be a good idea to supply the corresponding videos to the supervisors, in order for them to be on the same page as students when it comes to applying key competencies in clinical practice. Summing it up, videos can play an important role in familiarizing students with the competencies that they have to acquire during their internships (32), and impact achievement of key competencies during clerkships.

Soft skills and interprofessional education

With the videos putting an emphasis on proper patient communication and soft skills like teamwork, students are reminded of taking the time that each patient needs. Indeed, the videos are useful for not forgetting about the patient as a whole, as opposed to seeing only their disease. The author believes that there is a general lack of teaching soft skills in medical school, and it has been proven that students' empathy levels decrease with every year of medical school they attend (33). As this video-tool can only remind students of using proper communication methods with their patients but not practically teach them, it would be a good idea to organize simulations and role plays, challenging students to adopt constructive communication techniques. Reacting towards strong emotions like sadness or aggressiveness is not something a student 'just knows'. These kinds of skills should be taught in medical school in order to prepare the future doctors in the best way for their practice. Organising simulations around soft skills would allow for students to learn and to internalise the right techniques to employ with different kinds of, sometimes, difficult patients.

The same applies for interprofessional education. Interprofessional education means that students of different healthcare professions study or work together on projects. This way they learn to appreciate the perspectives and competencies of the other profession. Through active interprofessional education, hopefully there will be an impact on the work of those future healthcare professionals and their collaboration in- and outside of the hospital structure, ultimately leading to an increase in quality of care. Again, these skills and collaborations can be presented and reminded about through videos, but not taught. It seems important to include more

common projects for the different healthcare students of our university to improve future collaboration. Summing it up, our video tool is a good start in order to remind students that proper patient communication and interdisciplinary collaboration are cornerstones of successful clinical practice. To take it further, and to make sure students are well equipped for their clinical rotations, practical trainings involving role play are advisable.

Benefits for patients

Patient safety

During clinical rotations, students are challenged to learn how to perform certain procedures that they never had the possibility to practice before through trial and error. In some cases, students are ‘unleashed’ on patients without always knowing how to exactly perform different procedures. Having clear instructions through videos for the most important tasks a student might have to perform may possibly increase patient safety. Secondly, one of the major factors to decreased patient safety is inappropriate communication among healthcare personnel (34). Students who do their clerkships in environments with a lack of communication and investment from the supervisor are at risk of misunderstanding tasks and putting the patient at risk.

Interns learn from the example of the supervisor who always also is a role-model. Without good role-models, we may ask ourselves how the students will become well communicating healthcare professionals and supervisors themselves. This leads us back to the videos’ emphasis on proper communication and interdisciplinary collaboration which could have a small impact in improving patient safety when students apply what they learned to their work in the clinical environment.

However, it clearly stays preferable to have good training and instruction of the supervisors, and to make sure that students are always under supervision when performing a procedure for the first time. Similarly, training supervisors in communication techniques and in giving appropriate and constructive feedback in a clinical environment may help to accelerate the learning curve for students and increase patient safety.

Quality of care

The final goal of each medical curriculum is to produce healthcare professionals that can provide a good quality of care to their patients (35). Several publications show “that the quality of care provided during a physician’s training program is predictive of the quality of care provided throughout his or her career” (36–39). It is therefore important for supervisors and hospital staff to be ‘models’ of high-quality patient care, showing the right way of delivering care to the students.

Making sure that students know how to perform certain procedures and are confident with their knowledge and skills is a prerequisite to, in return, maintaining a good quality of care inside of the healthcare structure. Especially in teaching hospitals, it is important to have constructive supervision of students and to make sure they understand and know how to perform their tasks in order to maintain a good level of patient care (36). Additionally, it is important for the hospital to provide clear guidelines for patient care, and for employees to respect them. A previous study found that students often experience feelings of insecurity and uncertainty due to the fact that supervisors and other clinical staff in the same workplace demanded different approaches to patient care (9). This, a situation the author has experienced herself, can be very confusing, detrimental to the learning process and the patient care, and results in students trying to please everybody by adapting their care according to who supervises them.

While the videos included in our learning tool may be helping to make students more active learners and to achieve certain competencies faster, we believe they are not enough to actually improve patient care. An educational tool that has proven to improve patient care on the other hand, is simulation-based education (40–42). Introducing regular simulations into the curriculum, for example once weekly during the last year of theoretical teaching, might have an impact on quality of care later on.

Finally, the author believes that in order to sustainably improve patient safety and quality of care, a comprehensively structured curriculum is needed that prepares students to actively engage in the challenge and transformative process of becoming young clinicians. This curriculum could have a framework based on CBME and EPAs and should offer a multitude of active learning opportunities with interventions on different levels. So far it has not been possible to evaluate the impact of an EPA-based curriculum on quality of patient care (20). This remains an important topic to research in the future.

We can conclude that this learning tool, by reminding students about important factors to increase patient safety and maintaining a good level of quality of care, may contribute to protecting patients and making sure they receive appropriate care.

Benefits for the healthcare setting

The ultimate goal of any healthcare institution is to deliver excellent quality of care and to provide absolute patient safety. We stipulate that our e-learning tool might make a small contribution towards this goal by making sure students have increased competencies and know how to communicate appropriately. Indeed, having better collaboration between all the different stakeholders and actors inside and outside the hospital by promoting soft skills and interprofessional education saves time and prevents medical errors from happening. This may ultimately increase the overall efficiency of the healthcare institution.

Furthermore, if young doctors have more tools and competencies to deal with this challenging transition, they may be less susceptible to stress and burnout. This results in less days of sick leave, more productivity and an overall better functioning of the healthcare institution (43).

Review of the tools' impact according to educational sciences

After discussing benefits for the different stakeholders around the videos, it is important to look at the outcomes of this study from an educational point of view. The following sections will shed light on different topics that are of importance when opting for a successful learning process. In the first chapter, the benefit of combining visual and auditory input, called dual coding, as well as its limits, will be discussed. Secondly, the advantages of active learning, reflective practice and formative feedback will be outlined. As a third point, the very important taxonomy devised by Bloom, revolving around a ladder of cognitive skills, will be explained and related to the videos. Finally, some interesting advances in neurosciences and their relation to educational sciences and e-learning will be discussed.

Dual coding: integrating visual and auditory learning

Neural plasticity means that when a neural pathway is used it will be strengthened, whereas inactivity will result in a weakened pathway. In learning, when both visual and auditory input are presented at the same time, plasticity occurs both in the visual and auditory cortex (44). Compared to a podcast or audio record, videos have the advantage of adding a visual stimulus, showing the gestures of the actors or the professor and improving audio-visual integration of the information. Foster et al. cite Clark & Mayer who stipulated in 2011 that “from a cognitive psychology perspective, encoding information inputs from both the visual and verbal channels makes it easier for students to retain and then retrieve this knowledge at a later date” (44,45).

Mayer and Moreno empirically proved this concept of the “dual-processing model of working memory” already in 1998 and found in a study that associating visual input with spoken words enhances the learning experience (46) as opposed to only having visual or auditory input.

We therefore infer that the videos’ structure, both offering comprehensive visual and auditory input, increases the chance for students to remember the key messages that they need to retrieve later on in clinical practice. This structure, however, is not much different from the structure of a traditional lecture which may also offer visual and auditory input. The learning process stays passive, until the videos are coupled with comprehensive self-assessment questions. As we will see in the next chapter, the self-assessment is in our case the key component that helps to make the learning process an active one, addressing other learning preferences than just visual and auditory ones, and challenging students to reflect on their knowledge and think critically.

With this tool combining visual with auditory learning input, it may be suitable for many students that learn best through both of these learning styles. According to the theory of learning types, it will never be a great learning tool for 100% of the students however, as in any given population of students there are other learner types like the reading/writing or kinesthetic learners. For learners who prefer reading, scientific publications have been added to all of the new videos in order for those learners to get the opportunity to broaden their knowledge by reading. Finally, the auto-evaluative part of the tool may also compensate for lack of reading and writing in the videos, but overall the videos remain a tool that is not adapted to all kinds of learners.

It is important to note, however, that the theory of learning styles has recently been refuted as an “urban legend” by Kirschner and van Merriënboer in their article “Do Learners Really Know Best? Urban Legends in Education”. They stipulate that there is no scientific evidence supporting the effectiveness of a learning style approach and that “it is probably more fruitful to focus on the fundamental things that learners have in common than on the myriad of styles on which they may be different from each other” (47).

We conclude that our e-learning tool is helpful because of its dual coding aspect, which has been empirically shown as effective, and which helps to ease the integration of information into the working memory. Whether it is easier for certain students or learner types than for others to use the tool for learning remains unclear, as the theory of learning styles has been refuted.

Active learning encourages reflective practice and formative feedback

To this day, many medical school curricula are based on passive learning, feeding knowledge to the students through lectures without feedback or further questioning. Teachers are often rather ‘sage on the stage’ than the ‘guide on the side’. This may be due to many factors. An important one seems to be that most professors and teachers in medical school are academics that assume that in order to be a good teacher one must simply be excellent in the own field of work. As McLeod et al. describe in their work about which pedagogical concepts clinical teachers should know, “many develop teaching behaviours based on a combination of their own experiences as learners as well as general conceptions of teaching derived from personal experience and observation (48) but few have studied the art and science of medical education (49).” (50)

Through educational sciences it has become increasingly clear that passive learning must make way to more active teaching techniques, in order to make students active stakeholders in their own learning process and improve learning outcomes. Graffam stipulates that “intentional engagement and active learning pedagogies change the nature of learning, while simultaneously improving knowledge gain and recall abilities”. He goes on to say that for there to be active learning, students need to practically do something themselves and then reflect on what they are doing. (51)

In this learning tool, we tried to make the learning process an intentionally active one in two ways.

First of all, the videos were edited in a way to stimulate students to actively participate in reflecting on the issue at hand. This was done by asking students to stop the video at specific moments to think about a certain problem themselves. Additionally, student actors in the videos are being questioned by their supervisors, leaving space for the student learner to reflect together with them. This gives learning students the opportunity to practice their own clinical reasoning and receive an immediate feedback. This practice of actively involving the student in an otherwise passive learning module has been shown to “promote deeper engagement” of the student (32).

Secondly, each video was complemented by a set of self-assessment questions with the goal to have students repeat the new knowledge, apply it and reflect on it by working on clinical problems and answering different questions. For students who are used to absorbing big amounts of information, this e-learning tool is a welcome change in their learning pattern, inviting them to discuss, reflect and reintegrate what they learned during their lectures.

These features, which both promote active learning, touch upon two important topics that are pivotal when it comes to preparedness for practice: reflective practice and formative feedback.

As Imel explained already in 1992:

“Reflective practice [...] involves thinking about and critically analysing one's actions with the goal of improving one's professional practice. Engaging in reflective practice requires individuals to assume the perspective of an external observer in order to identify the assumptions and feelings underlying their practice and then to speculate about how these assumptions and feelings affect practice.” (52)

Critically reviewing the things one has learned and putting them into the context of a clinical encounter, thereby adapting the knowledge to the needs of the actual situation, is a competency that the author deems very important for every future doctor to possess.

It seems however, that through passive learning in lectures and summative assessments, reflective practice is not stimulated very much. Through the videos, that are actively questioning the students, and the self-assessment questions, that invite students to adapt their knowledge to other situations, this online-learning tool makes a start and stimulates reflective practice in students. In order for all students however to be well prepared for clinical practice, and to make

clinical decisions on their own, this is not enough. It would be interesting for all professors to make their passive lectures more active, and to include exercises stimulating critical reflection. As Graffam explains, “lectures (passive learning) can be adapted into active learning engagements with no loss of content material”(51). Challenging students to think differently and reflect on what they learned instead of just accepting what they learned as given facts is crucial in order to make the transition into practice easier for students.

Apart from the reflective practice that we found students engaged in throughout their work with the video-tool, there were several positive comments about the formative feedback that is provided by the self-assessment part in particular. Formative feedback happens when students engage in an educational activity, often an ungraded assessment, and get results that will help them reflect on their own learning process and evaluate their acquired knowledge and skills. It is opposed to summative feedback which is often administered in the form of a final exam at the end of the semester. Summative assessment often withholds the opportunity for students to learn from their mistakes and improve in the subject, as it constitutes the end of a certain subject, and once a student passes, even if it's with only half the right answers, they don't need to look back and find out where they went wrong. Formative feedback on the other hand can be interesting to the student in order to find out about the personal learning process throughout the semester, as well as to the teacher who can evaluate the discrepancies between the different students' learning processes in order to adapt the teaching schedule to the overall students' needs.

In the case of the self-assessment questions coupled to the learning videos, students were happy about this opportunity to anchor and evaluate their knowledge right after watching the videos. It gave them the possibility to make new links with old knowledge, and therefore helped them to enhance their long-term learning. A few mentioned that it might be interesting to get the option of evaluating their own knowledge next to lectures in a more general way and throughout the semester, instead of just having one final exam, a single summative assessment, in the end. Offering possibilities of engaging with continuous self-assessment and formative feedback seems like a way of encouraging self-directed learning in medical students, a competency which they will need for the rest of their lives (53). Teaching students such methods of lifelong learning should be an overall goal of every medical faculty.

Summing it up, we may conclude that students increase their preparedness for practice by learning how to critically reflect on their own learning process and by engaging in self-directed learning, tapping into their own curiosity and motivation. This video-based learning tool is not enough, however, to equip students with enough practice and competence in these fields. Therefore, it seems of utmost importance to introduce practices of active learning, reflection and feedback into other courses throughout medical school, as well as during clinical rotations.

Moving up Bloom's Taxonomy

As we have understood from the students' comments on the self-assessment questions, they wish to be challenged more, in order to be better prepared for facing different clinical situations. It becomes clear that students want to learn how to be doctors, and not just how to pass an exam. It is the responsibility of the teachers to accompany students through the different levels of learning and to make sure they have integrated what was taught into their knowledge database. In order to support this learning process, from getting the information to applying it and finally evaluating it, Bloom's taxonomy is an interesting tool to orient the learning process and make sure that every learning step on the ladder is achieved before passing on to the next level. Leaving out one step or only teaching the first steps but not the higher ones may have an influence on the quality of what has been learned.

As Adams describes it:

“Bloom's taxonomy differentiates between cognitive skill levels and calls attention to learning objectives that require higher levels of cognitive skills and, therefore, lead to deeper learning and transfer of knowledge and skills to a greater variety of tasks and contexts.” (54)

The revised Bloom's taxonomy has six steps: remember, understand, apply, analyse, evaluate and create. These steps are well detailed and explained by Krathwohl in his article “A Revision of Bloom's Taxonomy: An Overview” (55). An overview of the revised taxonomy and its steps can be found in appendix 6. In order to get to the level of cognitive skill that makes it possible to transfer knowledge and to apply it to different situations, other, lower, cognitive levels need to be achieved and consolidated first.

As we noticed from the students' comments in our survey, the videos coupled to the self-assessment questions help the learners to consolidate several steps on Bloom's revised scale, in particular the step of 'understanding'. It becomes clear that many students study their theoretical lessons to remember the content, but often fail to understand its implications in practice. This later on has an impact on the application of the knowledge in clinical practice.

Applying Bloom's Taxonomy to our online learning tool, we can say that the videos help students pass the steps of remembering and understanding, while they get to practice those steps and further apply, analyse and evaluate their knowledge through the self-assessment questions. There are different ways of incorporating the taxonomy into auto-evaluative questions. For the level of remembering for example, students may be asked to cite different facts about the clinical problem they just learned about. For the level of understanding, students could fill in a gap text about the topic and associate patient characteristics with certain actions to take. For application and analysis, students could receive longer clinical cases and give their own diagnostic hypothesis as well as the fitting actions to take or to not take, according to the clinical context.

In the best case, moving up Bloom's ladder will allow students to move the new knowledge into long-term memory faster. To help with this, it is important to repeat the key messages, use scenarios and clinical cases and encourage students to actively retrieve their existing knowledge through exercises that go beyond what the video taught. This may increase neuronal connections between old and new knowledge (44) and therefore help to create consolidated knowledge loops, making it easier to transfer knowledge to new situations later on.

The pilot videos and self-assessment questions that are evaluated in this study were not intentionally structured to fit Bloom's Taxonomy. The new videos and specifically the self-assessment part, however, have been aligned with all of the different levels that Bloom found, allowing the students a more effective and less time-consuming learning process.

Integrating findings with recent advances in the neurosciences

It has been shown through neuroscientific research that a significant part of the long-term memory consolidation process happens at night, during sleep. Newer research suggests that especially the knowledge that is known to be necessary for retrieval later on will be stored in long-term memory (56). This means that when students know that they will be tested, they will

have a greater long-term consolidation of the new knowledge during the night. As different students' comments have shown, the knowledge of being evaluated later on helps them to better pay attention to the new information they receive, and later on to retrieve the newly learned facts.

It further has been discussed in recent years what role retrieval plays in learning and cognitive sciences. It seems that repeated retrieval, for example through testing, yields better results in terms of long-term retention than repeated studying. Karpicke states that “every time a person retrieves knowledge, that knowledge is changed, because retrieving knowledge improves one's ability to retrieve it again in the future” (57).

In the recent neuroscientific study ‘Repeated retrieval during learning is the key to long-term retention’, the authors found that the best results for long-term memory consolidation occur when students alternate studying the material and testing themselves on the new knowledge, with a focus on repeated testing (58). This supports the effectiveness of the video-tools' set-up, having the video as the main studying unit and several auto-evaluative questions that each give direct feedback and explanations to the student after answering, thus constituting small consecutive testing units.

The findings about repeated retrieval stimulating long-term memory align with the information provided by Foster et al., stipulating that it is essential to the learning process for the new knowledge to connect to already existing, prior knowledge. This is called the prior learning activation (44). With learning as a continuously constructive process, students sometimes have difficulty finding the points to build on during a lecture, because they simply didn't have the time to integrate everything that was said and link it with their own existing knowledge. This is where learning videos have an advantage because the student can go back in the video, re-listen and find the associations and links that are necessary for them to build on their previous knowledge, thus making the learning process a much more effective one.

The theory of prior learning activation also stipulates that it is easier to learn when a personal, maybe even emotional, connection between the learner and the subject can be made. The author believes that the personal identification with the fellow students seen on-screen that was appreciated by several survey responders, was an important factor for the good learning outcomes that students reported.

Additionally to the concept of prior learning activation, other studies research long term memory consolidation in association with cognitive overload theory. Cognitive load is the space

taken up by the working memory during any learning process. Cognitive overload happens when too much information is presented at once and as a result, learning is inefficient and information is lost (59). To avoid cognitive overload in multimedia learning Dong and Goh cite two neuroscientific studies:

“The structure of the video should facilitate students’ ability to organize content into a coherent cognitive structure, to integrate it with relevant prior knowledge, and to apply the information in new situations to solve problems” (32,60,61)

Through their feature of keeping a short and clear structure, and conveying only the most essential key messages, the learning videos developed at our university minimize cognitive overload and help to stimulate cognitive integration of their content.

Another approach of the neurosciences to the concept of long-term memorization found that spaced learning patterns provide students with better long-term learning outcomes (62). Spaced learning is a teaching concept where information is taught in short intense units, providing a break of about ten minutes after each unit in which students engage in other, distracting activities. This learning concept has proven very efficient to move knowledge faster into long-term memory, and students who were taught using spaced learning performed better on final examinations than their peers that were taught with classical teaching methods (62).

These neuroscientific findings have interesting implications for teaching medicine, as they suggest that it would be better to cut learning experiences into chunks, and to provide students with frequent small tests and retrieval exercises instead of lots of studying followed by one summative assessment in the end of the semester.

The research on repeated retrieval further supports the demand of students to get access to continuous self-evaluation exercises throughout the semester, which would increase formative feedback and reflective competencies, as well as help anchor the knowledge longer than other studying techniques would. Foster cites several studies that show “that tests motivate students to review their notes, and that review or practice is essential for retention” (44,63–65).

We can conclude that introducing formative feedback in the form of continuously offered self-assessment exercises is an effective way of accompanying the students’ learning process throughout a course. It may therefore be helpful to establish online quizzes and tests for all

subjects throughout the curriculum, aside from this video-based tool. Furthermore, it might be interesting to consider running a trial using spaced learning patterns. All of these interventions could further increase the students' preparedness for practice as they promote long-term memorization and cognitive integration of the learnt topics. The author acknowledges that this video-based tool has a limited impact compared to what an actual systems change could do to help students with their learning process and in the end with their transition from theory to clinical practice.

Other ways of accompanying the transition

Having discussed the many advantages of the e-learning tool that we introduced for final year medical students, it is also important to acknowledge that it has its limitations. It is certain that a video learning tool can only be effective for medical students in the context of a variety of learning opportunities, multiplying the learning effect and consolidating prior knowledge. In the following paragraphs, different complementary learning activities will be outlined and their importance for preparing students for their transition to clinical practice will be discussed.

Clinical skills center

Even if the option to work with eLearning tools and digital innovation exists, we must not forget that one of the best ways to learn how to do practical things is to practice them hands-on, in real life. As explained before, the author believes that the video-tool is only useful if used as a complementary tool to the other established teaching activities at the UCLouvain. Especially the clinical skills center, the 'centre de compétences cliniques (CCC)' should be used extensively to practice again and again essential clinical procedures as well as soft skills, clinical reasoning and diagnostic ability. Only by supervised practice can we make sure that students are prepared to reason appropriately and perform certain procedures autonomously in a clinical environment. Especially the practice of using simulations for teaching medical students has proven very effective in recent years, with many renowned universities publishing their stories of success. Simulations using mannequins have already been introduced in the CCC and could be taken further. Having for example one clinical simulation per week for one year before starting rotations could be a good way for students to not just get a rough idea of how a certain procedure

is performed, but to internalize the mechanism and move it to their procedural memory. This may considerably increase preparedness for specific medical tasks, and certainly decrease stress in students. It would probably also result in a positive impact on quality of care and patient safety, as students are better trained to perform the procedures they practiced through simulation.

Additionally to the workshops and simulations that already exist in the CCC, it might be interesting to introduce an OSCE (Objective Structured Clinical Examination) framework to assess skills before students start clinical practice.

As Zayyan explains

“The Objective Structured Clinical Examination is a versatile multipurpose evaluative tool that can be utilized to assess health care professionals in a clinical setting. It assesses competency, based on objective testing through direct observation. It is precise, objective, and reproducible allowing uniform testing of students for a wide range of clinical skills.”(66)

OSCEs have proven their educational value for several years now and can be used in many different ways. Especially formative interventions and assessments seem useful for clinical teaching at our university. In some countries like Switzerland, the US or Canada, OSCEs are even a part of a nationally standardized final exam for all medical students, making sure that all medical graduates have the same baseline level of clinical competencies.

Student-led projects

As mentioned in the introduction, many students feel like they are not involved at all in building their own curriculum. This causes substantial frustrations, as students do not feel heard many times when they believe that certain points should be addressed and changed. The author firmly believes that long-term learning outcomes and preparedness for practice could increase if students get a say in building their curriculum and if they believe that the way they learn is the most effective one for them.

Firstly, it may be a good idea to increase student participation when it comes to curriculum design. This could be in the form of a student focus group, interviews, or inviting several medical education student representatives to each relevant meeting and establishing a system in which their opinions are valued and included into the final decision.

Secondly, it may be interesting to involve senior students in teaching activities for younger students. It has been shown that peer-to-peer teaching, teaching what previously has been learned to other students, increases the learning and understanding of the subject substantially (67). Teaching relevant information and skills could therefore help to anchor crucial knowledge further and make sure that it can be retrieved in the corresponding clinical situation, thus better preparing the student for practice. An approach like this may later on be especially beneficial to new residents, who have to coach and assess students during their internships. Teaching has to be learned too, so having students teach their peers could be a good method for preparing new physicians for their future role as educators, a role which is also defined by the CanMEDS framework (68,69).

A multitude of successful student-led interventions have already been conducted in medical schools around the world. They include, but are not limited to, simulations, quality improvement projects, reviewing and rewriting assessment methods, teaching teamwork and leadership skills, and organizing prevention projects.

Formative feedback – training the supervisors

The merits of formative feedback through self-directed learning and self-assessment have already been discussed above. However, an important place for formative feedback that really makes a difference in the lives of students is the clinical environment.

As mentioned above, the educational outcome of clerkships largely depends on the framework of supervision that is put in place in the different hospitals and departments.

In her article “Medical education – giving feedback to doctors in training” Kelly and Richards explain that “being observed and receiving feedback prompts reflection and constructive modification of skills” and “when delivered well, feedback improves doctors’ and students’ skillsets and establishes lifelong learning” (70). It is also important to note that in order for the EPAs to be a meaningful tool, close clinical observation and feedback are required.

Up to this day, most supervisors are supervisors because they are experienced clinicians. Only a minority of supervisors has received training in how to effectively supervise and educate future doctors. As much as preparative videos may help to apprehend common clinical situations, they can never replace a proper clinical supervision. It should therefore be one of the key focus points of faculty staff to make sure that supervisors learn how to effectively supervise

students in a clinical environment, maximizing their learning experience by providing constructive feedback.

In conclusion, receiving appropriate feedback seems to be the best way for students to get the most out of their clinical experience and to increase their preparedness for autonomous clinical practice. As Kelly and Richards point out, giving feedback is also formative for the supervisors, who will engage in lifelong learning themselves by going through the feedback process together with different students who have different learning needs.

Adapting Medical Education to a Generation of Millennials

This final chapter of the discussion goes as far as to look at medical education from a generational point of view. While researching literature for this paper, the author noticed that in the 21st century, the characteristics of the current generation of learners are linked more than ever before to their learning patterns and learning preferences. This is why the author chose to dedicate a whole chapter to medical education and millennials, as this is a topic which is essential to understand for all medical educators who wish to create effective learning opportunities for their students.

With today's learners coming from generation Y, or the millennial generation, and today's educators mainly coming from generation X, discrepancies and disagreements on teaching and learning methods are bound to arise between teachers and students. While it is normal for generations to change their focus and to be influenced by their times' events and innovations, it seems to be specifically difficult for older generations to adjust to the lifestyle and expectations of millennials. This may be due to the fact, as Hopkins et al. explain, that "millennials prioritize diversity in their experiences over depth of focus, which is a contrast with Generation X, who typically demonstrated longstanding commitment and depth of experience in a small number of activities"(71). Students that come from generation Y prefer personalized learning, simulations, workshops and online learning over traditional lectures. Hopkins et al. review in their paper different teaching styles, explaining that "millennial learners seek instruction that is technology enhanced, convenient, personalized, and linked to relevance and societal meaning" (71). They mention e-learning methods, the use of flipped classroom frameworks, delving into simulation and gamification, making use of peer-to-peer teaching, and adding social media to the ways of teaching medicine. In their paper they conclude however by

showing evidence that traditional didactics are still a good basis for learning medicine, and that they should not be simply replaced by computer-based learning, but that a blended framework, offering multiple domains of learning, would be preferable (71). Desy et al. stipulate that millennials are the perfect target group for competency-based medical education, including concepts like milestones and entrustable professional activities (72). While CBME failed to gain momentum in the end of the 20th century, failing to find support among members of the generation X, it has more than reached its momentum in recent years, answering to the new and different learning needs of generation Y.

With regard to our video-based learning tool, which is based on CBME and EPAs, and judging from the students' comments, we can conclude that this kind of learning opportunity is definitely appealing to the current generation of learners, as it fits in their conceptualization of effective learning. Especially the appreciation of the 'fun' part of using videos for learning purposes leads us to believe that using a kind of 'edutainment' can be a powerful way of motivating students of newer generations to learn and prepare for clinical practice. This assumption is confirmed by the results of Steffes and Duverger's study "Edutainment with Videos and its Positive Effect on Long Term Memory" (73).

We agree however, that these kinds of methods should stay complementary to traditional teaching and other teaching activities, offering a range of different learning opportunities to students with different learning styles and needs. Creating a teaching framework based on the principles of CBME, and embedding and streamlining all the different learning opportunities, seems to be the right way to go in order to create a curriculum that fits the learning needs of generation Y.

Finally, it may be a good idea for all medical educators to make an effort to understand the concepts of generational differences and the characteristics and needs of millennials. A helpful paper that can be used to develop teaching frameworks for millennials is the publication "Twelve tips for facilitating Millennials' learning" by Roberts et al. (74).

Initiatives to improve the learning tool

Since this evaluation of the first seven videos of the learning tool was conducted, there have been many changes and improvements to the videos and the project itself. A link to one of the new videos can be found in appendix 5.

As mentioned before, after the qualitative analysis of the data regarding the pilot videos, the researchers realized that this tool may be helpful to accompany the transition of medical students from theory to clinical practice. The new videos all specifically address this transition and are designed to be especially useful to final year medical students during their year of rotations.

In the last two years, and with the help of a university grant, two educational assistants were hired who continuously develop new videos and collect more feedback from the new generations of students that use this tool to prepare for clinical practice. At the date of printing of this thesis the university's Moodle platform offered in total 37 learning units for students to use and link their theoretical knowledge to medical practice. Each learning unit contains a 10-minute video coupled to a number of self-assessment questions which are designed according to Bloom's taxonomy. The new videos constitute interviews with different stakeholders on a certain topic. There always is an introduction to the topic, showing interns or young residents and their questions regarding the topic. Afterwards, one or several specialists explain the concrete steps to approaching this specific problem. In certain cases, a clinical situation with actors is added to increase visualization of the tasks. Below each video the student can see at which time which topic is being addressed. This helps if a student wants to go back to a specific point in the video. Within the videos, a few more visual adaptations are being made, with key words and key information like drug doses appearing in pop-up windows to increase memorization. Additionally to the self-assessment, all videos now have a specifically selected array of complementary reading and literature, as well as a forum for discussion in which students can ask questions and get answers from their peers or a professor. One very important change is that the self-assessment, which was formerly comprised of different questions and exercises about the topic of the video, has been modified to fit the ladder of Bloom's taxonomy. The self-assessment now goes beyond the information available from the videos to challenge students and stimulate their thinking out of the box as well as using more resources to find information. For each video there is at least one exercise that corresponds to each step of Bloom's taxonomy, facilitating

cognitive patterns and the overall learning process. Finally, an initiative involving the app ‘Wooclap’ has been set up, mixing the questions from all videos together into one big pool of questions and allowing students to get tested at random on all of the different subjects. For students who have watched all videos, this is an excellent exercise to practice their knowledge and retrieve it again and again, thus stimulating their long-term memorization.

Limitations

Non-response bias

The AAPOR suggests that in recent years, the overall response rate of a study has become less important to the significance of the data, with response rates declining across all modes of survey administration. It is rather the non-response bias that determines if the data resulting from a given survey may be seen as representative of a given population or not.

When it comes to non-response bias, Phillips et al. suggest in the AMEE Guide No. 102 that “*A relationship must exist between the reason people did not respond and the questions being asked on the survey. Therefore, a low response rate does not in itself confer any bias.*”(75).

As Groves summarizes in his meta-analysis of studies researching non-response bias in public interest surveys, there are several factors associated with nonresponse-bias, while others are not (76). The only one of the five factors defined by Groves that might play a role concerning the nonresponse-bias of the 66% of final year students who did not answer our questionnaire is that the questions were mainly attitudinal type questions. This means that the questions did not target objective facts, but rather asked for the subjective opinion of the responders. The author of the present study believes however, that the main reason for not responding to the survey was that students were either busy preparing their final exam or on vacation after graduating from medical school. In this regard, no significant non-response bias was detected with the means that were available of comparing responders to non-responders.

Having a representation of one third of the last year medical students’ opinions with only one factor of non-response bias at play may suggest in this context that the resulting data is representative of this specific population.

Even though we may conclude to a limited non-response bias, we suspect a certain proportion of response bias that shall be outlined in the following paragraph.

Response bias

As with many settings in which students are being asked their opinion, there exists a response bias.

“Response bias is a general term for a wide range of tendencies for participants to respond inaccurately or falsely to questions. These biases are prevalent in research involving participant self-report, such as structured interviews or surveys. Response biases can have a large impact on the validity of questionnaires or surveys.”(77)

In the present case, namely the issues of exaggerating the perceived truth and giving especially desirable answers in order to please the evaluator might have an influence on validity. The risk of having a response bias may be increased especially if the students’ relationship with the teaching staff responsible of the survey is generally good, as is the case in this study. The author therefore remains cautious as to the overall results of the quantitative questions, which yield mainly answers of extreme satisfaction on the students’ side. These may be due to a bias. Indeed, the person sending out the surveys was the professor who created the video-based tool and who has been involved with previous innovation in medical education at the UCLouvain. Had the coordinator of the survey been an independent researcher the answers might have been different.

Finally, a limiting factor to the bias of social desirability in our case is the anonymity of the questionnaire.

Limitations of the study

First, we may assume that a certain response bias exists, due to the professor who developed the videos being the survey coordinator and being widely appreciated by the student population at our university. We therefore conclude to a certain bias, possibly tainting the results of this study.

Secondly, there is a lot of discussion around the ‘qualitativeness’ of open survey questions in the research community. Some studies suggest that answers to open questions in questionnaires may not constitute real qualitative data, for numerous reasons (78) . The author admits that in further studies on this project it may be judicious to use other strategies of collecting qualitative data, namely interviews or focus groups. This first questionnaire-based

study may however give a good overview of the students' thoughts and opinions and can be considered as a steppingstone for further qualitative research on this subject.

Limitations of this video-based tool

Even though the students widely appreciated the new teaching tool, we believe, not only because of the possible response bias, that there are certain limitations to the tool itself that should not be forgotten.

The framework of the videos, mentioned positively by the students as being a helpful structure, may also be seen as repetitive, and even predictable, after watching many videos. It may therefore deter students from watching more videos if they start feeling bored by watching clips that are all structured in the same way. The format has the strength of being well structured, but the disadvantage of staying the same.

It is important to note that this video-based tool, developed to help students with their transition from medical theory to clinical practice, is not a substitute for lectures nor for hands-on clinical workshops. It is not created to be a single and complete source of information, but rather adds on to the general knowledge of each student. The author chooses to rather see this video-based tool in the bigger picture of the overall curriculum, as a piece of the puzzle that will, once finished, constitute a young clinician. This piece of the puzzle is supposed to bring clinical practice closer to students who feel like they are still very far away from it. At the same time, it is very important that these students study their lectures and attend their workshops, in order for the puzzle to be complete and for them to be well prepared for practicing clinical medicine.

Transferability of findings

These results apply to the students of the UCLouvain and the curriculum that is applied there. However, as there are not many universities that are specifically addressing the transition from theoretical knowledge to clinical practice, we believe that this kind of video-based approach could be helpful for medical students from other universities too, provided it is adjusted to the local curriculum. Additionally, with the millennial generation having grown up with electronic gadgets and the internet, the majority of students worldwide are well equipped to properly use online tools and maximize their own learning outcome. In terms of access, there would therefore probably not be any barrier. Furthermore, the needs in terms of education can be

considered to be the same for students everywhere, as they are based on cognitive function and not on local culture.

Conclusions

Concluding this paper, we found that this e-learning project is relevant to the students' feeling of preparedness for clinical practice and for their integration of EPAs into daily clinical work. It is an effective learning tool that is very accessible to students who spend most of their time in the hospital. The videos and the coupled self-assessment questions help to anchor important clinical knowledge and assist in moving it to the long-term memory. The tool also helps to demystify clinical work for many students and it certainly relieves some of the stress of the first days and weeks of internships. After arrival in the hospital, it helped the young clinicians to 'juggle' between their theoretical knowledge and their new clinical skills, increasing their ability of making meaningful links between those two stages of training. By adding a self-assessment component to the learning videos, we create an active and reflective learning experience, giving the students the opportunity to engage with formative feedback when they feel the need for it. This further fosters long-term memorization and stimulates the students to learn in a self-directed manner, a skill that will be useful for the rest of their lives. Overall, this e-learning tool provides the students with more ownership of their own learning-process.

Concerning attitudes around student-patient interaction, we remind students of the importance of appropriate patient communication as part of the encounter between clinician and patient, and its importance for the success of the treatment process.

To sum it up, these results make us confident that there are ways of making sure that students have an easier start into their life and role as clinicians, and that it is indeed possible to bridge this gap that many students are so afraid of.

This video-based approach, basing its content on frequent clinical problems and EPAs, gives students specific knowledge that is easy to apply during clinical practice. It can be regarded as a first step in the right direction for preparing students for clinical practice and helping them to safely bridge the gap that they have to cross in order to become clinicians ready to face the future. In order to move towards a broader program of accompanying the transition from medical theory to clinical practice however, it is important to provide students with opportunities in a multitude of ways. The focus should not only lie on clinical skills, but also on the capacity of the student to face change, and on their readiness to integrate with completely new and ever-changing teams of healthcare professionals.

Coming back to the “critically intensive learning periods” that Kilminster describes (12), Atherley et al. suggest that the transition should not only be addressed from an educational perspective, but also from a social and a developmental perspective (8). Instead of being regarded as a struggle, the transition could be seen as something positive, an obstacle which presents an opportunity for growth. By seeing the positive aspects of the transition and by making it a successful learning experience, we allow the student to pass through the process of transformation from intern to healthcare professional.

Atherley et al. further explain that the overall focus throughout the transition should lie on student empowerment, instead of trying to reduce the struggle that is so often mentioned in the literature (8). In order to create a successful learning experience, it is important to accompany and empower the students throughout their transformational process, providing them with different opportunities of growth. We propose a few concrete measures to take in the next paragraphs.

An important topic to focus on is to make sure that students have access to different means of receiving constructive feedback. Self-assessment could be one, and another one a training of the supervisors to give the right kind of feedback that will help the student with their growth and learning process. Indeed, having a positive workplace feedback culture improves learning and job performance (79).

From an educational angle, tools like simulations have proven to have an impact on preparedness for practice. This is where the concept of the formative OSCE gets its importance, constituting a kind of safe space or ‘playground’ for the student to make mistakes that can later be avoided during clinical practice, ultimately resulting in a better quality of care and higher patient safety.

Several universities have implemented another, multifocal approach to bridging the gap and making the transition easier. This kind of intervention, which is called transition-to-clerkship course (TTCC), consists of conducting different themed sessions like panel discussions, skills teaching sessions, problem-based workshops and simulations over the course of a few days up to several weeks, before the beginning of clerkships. This approach has been shown to significantly increase preparedness for practice and students’ performance during clerkships (80).

Through the process of this project and its evaluation we got an increasingly better idea of what this transition period means for students, and how much of a crucial role it plays in them

becoming young doctors. Aside from the transition period that we addressed in this paper, the one from medical theory to clinical practice throughout the final year of the medical curriculum, there is a second crucial transition period in this short lapse of time which defines the end of medical school: the transition from young graduate to junior doctor. During this transition, former students pass from being interns to becoming residents, having their workload and responsibility increased by a subjective 150%. Even though this later transition was not the subject of this paper, we believe that it too, is a “critically intensive learning period” as described by Kilminster (12) and requires increased supervision and feedback.

We believe that there is a need to address the different transitions at the end of medical school in a broader way, through a multitude of different learning opportunities, as videos alone will never be enough to entirely prepare students for bridging the gap.

It would also be interesting to research the impact of a program around the different transitions on the prevalence of burnout among medical students and residents. We believe that with our videos we have a positive impact, reducing stress and increasing student autonomy during clinical practice. Currently, one out of two medical students experiences burnout (81). This significantly impacts work efficiency, as Shoji et al. show in their recent meta-analysis on job-burnout and its impact on self-efficacy (82). Longitudinal studies, comparing burnout prevalence before and after introducing a program to help ease the transition and to help make it a successful learning experience, could guide us towards new ways of accompanying the young graduate throughout the different transitions at the end of medical school and the beginning of residency. Assessing the presence of the three major symptoms of burnout, which are respectively emotional exhaustion, depersonalization and personal accomplishment, in students and young doctors, may lead to further findings helping us to make the transition an easier one and to make sure that our healthcare professionals stay healthy and can deliver safe care of a good quality to their patients.

To conclude, the challenging period that is the transition from medical theory to clinical practice seems to be a pivotal moment in motivating and training medical students for their future practice and probably has an impact on patient safety and quality of care. In the future, more qualitative research like focus groups or interviews could be conducted to find out what the students feel is the most helpful to equip them for dealing with their own transition. On the long

term it would be interesting to research the actual impact that a program around the transition has, or not, on quality of care and patient safety.

In the case of our study, we successfully evaluated the usefulness of an e-learning tool and in doing so found valuable information on how students experience the transition from medical theory to clinical practice. The findings of this study leave us encouraged as for the usefulness of our e-learning tool and give us first insights into the transition that medical students at our faculty go through, opening up a number of new questions that require further in-depth research. We see this study as a start into the direction of getting to know the transition period better, and of making sure our students are well equipped to make their internships a successful learning experience.

Finally, we believe that interventions in medical education and specifically around crucial transition periods throughout medical school may have an impact on both quality of care and patient safety. Findings of educational studies and the resulting interventions in the curriculum could help create a healthier and safer environment for healthcare professionals and patients alike, making sure that quality of care remains our number one priority when training young doctors.

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Abbreviations

AAMC: Association of American Medical Colleges

AAPOR: American Association for Public Opinion Research

AMEE: Association for Medical Education in Europe

CBE: Competency-Based Education

CBME: Competency-Based Medical Education

CCC: Centre de compétences cliniques (clinical skills center)

CPR: Cardio-Pulmonary Resuscitation

EPAs: Entrustable Professional Activities

GMC: General Medical Council (UK)

OBE: Outcome Based Education

OSCE: Objective Structured Clinical Examination

TP: Travaux pratiques (clinical skills workshops)

TQM: Total Quality Management

TTCC: Transition-To-Clerkship Course

UCLouvain: Université catholique de Louvain

UK: United Kingdom

US / USA: United States of America

Tables

Table 1: overview of quantitative results to the general questionnaire

Results

N°	Question	Options/Number of answers				Total responses
		Not at all useful	Moderately useful	Useful	Very useful	
1	In general, do you find the content of the videos useful regarding your learning outcome? Open commenting space	1 51 comments	7	51	92	151
2	Overall, were the objectives of the different videos clearly understandable for you? Open commenting space	Never 0	Rarely 2	Often 38	Always 110	150
3	Did the videos simplify complex learning tasks? Open commenting space	1 30 comments	4	79	66	150
4	Did the videos help you complete the notes you took during class? Open commenting space	3 38 comments	40	73	34	150
5	Did they try to cover too much material or introduce too much detail? Open commenting space	102 27 comments	48	1	0	151
6	Did the videos miss any relevant information?	38	89	13	8	148

N°	Question	Options/Number of answers				Total responses
	Open commenting space	27 comments				
7	Did the videos meet your expectations?	0	4	79	67	150
	Which expectations have not been met by the videos?	17 comments				
8	Did you find the auto-evaluation questions at the end of each video useful to your learning process?	0	4	48	97	149
	How could these exercises be improved?	49 comments				
		Definitely not	Maybe	Probably	Definitely	
9	Do you believe the videos prepare you well for your final exam?	3	41	48	54	146
	Open commenting space	42 comments				
		Yes		No		
10	Do you think the videos would have been helpful to you early on during your internships?	144		5		149
	Open commenting space	33 comments				
11	Did you find the videos useful as a complementary teaching method to the traditional lecture teaching style?	148		4		152
	Open commenting space	30 comments				

N°	Question	Options/Number of answers				Total responses
		Definitely not	Probably not	Probably	Definitely	
12	Do you think it would have been helpful for your learning progress to use this kind of learning-videos in other classes throughout your curriculum? Open commenting space	1	6	52	92	151
		37 comments				
		Yes		No		
13	Would you like to see educational tools like this introduced in other courses, too? If yes: Which classes do you think of specifically? Which classes would benefit most of this kind of learning tool?	139		8		148
		127 comments				
	Open questions	Number of answers				
14	These video clips are a new, original project at UCLouvain. What are for you the positive aspects of such a project in your medical training?	120 comments				120
15	How could the videos be improved?	99 comments				99
16	At the end of this questionnaire,	89 comments				89

N°	Question	Options/Number of answers	Total responses
	would you like to add a general comment on the pedagogy of medical education that you received during your studies?		

Note: Number of answers to the general questionnaire with Likert-type questions, yes/no questions and open questions

Figures

Figure 1: main themes crystallized from 65 pages of qualitative data

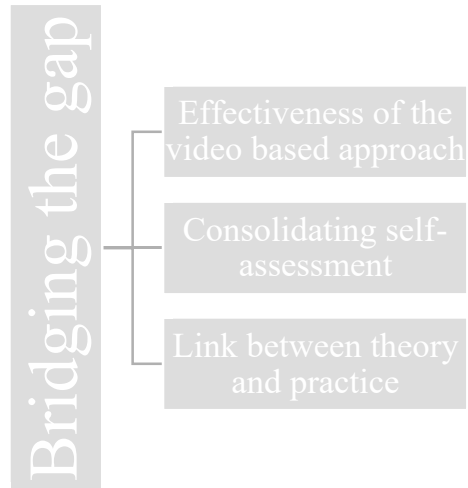
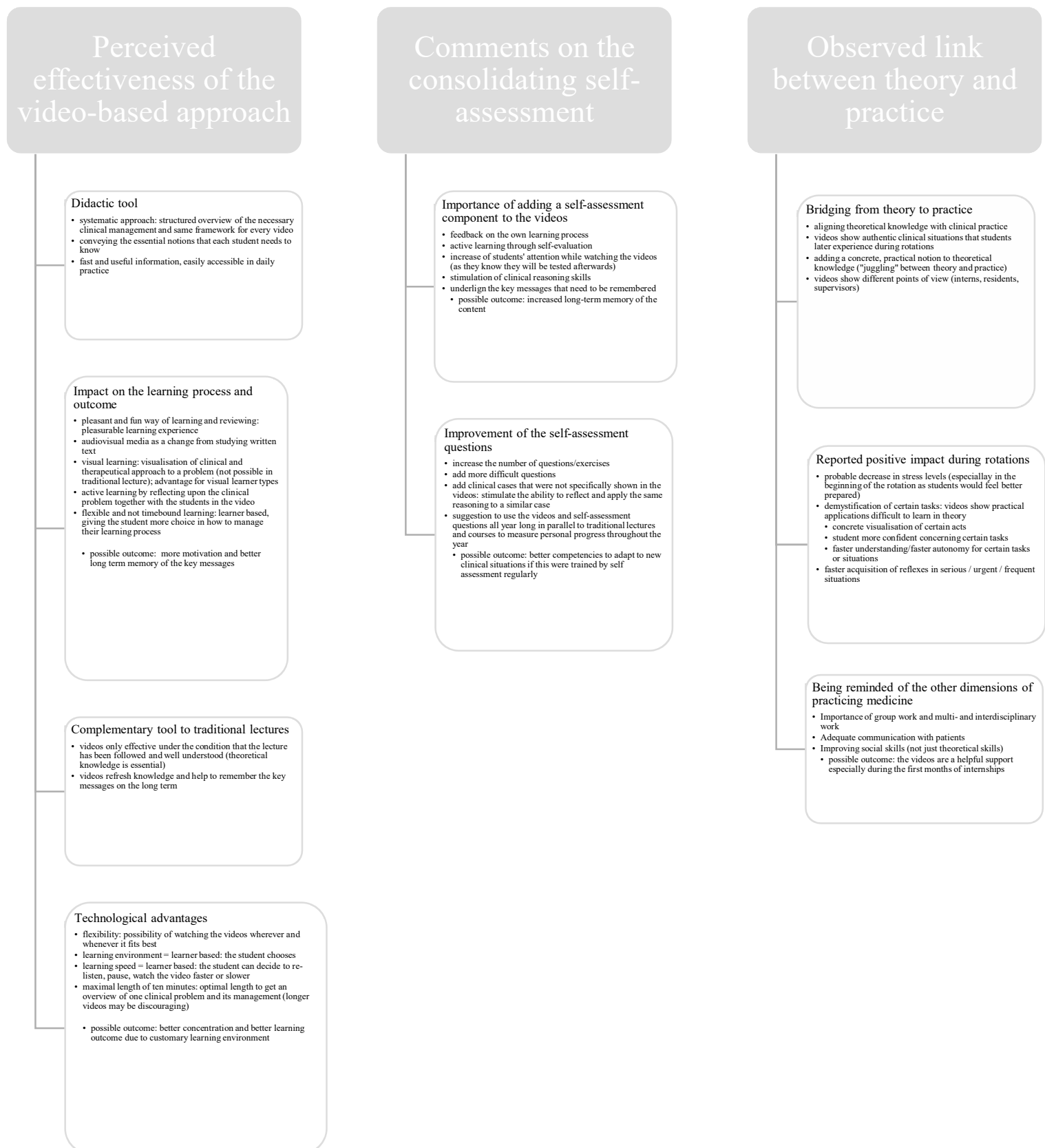


Figure 2: main themes and sub themes crystalized from 65 pages of qualitative data



Appendices

- 1) CanMEDS framework
- 2) List of EPAs defined by the faculty of medicine at the UCLouvain
- 3) Swiss Catalogue of Learning Objective for Undergraduate Medical Training
- 4) Links to the seven pilot videos
- 5) Link to one of the new videos
- 6) Bloom's revised taxonomy
- 7) Final digitalized affinity diagram

1) CanMEDS Framework

Link to the full updated framework from 2015:

<http://www.royalcollege.ca/rcsite/documents/canmeds/canmeds-full-framework-e.pdf>

Roles defined by the framework

Medical Expert

As Medical Experts, physicians integrate all of the CanMEDS Roles, applying medical knowledge, clinical skills, and professional values in their provision of high-quality and safe patient-centred care. Medical Expert is the central physician Role in the CanMEDS Framework and defines the physician's clinical scope of practice.

Source:

<http://www.royalcollege.ca/rcsite/canmeds/framework/canmeds-role-medical-expert-e>

Communicator

As Communicators, physicians form relationships with patients and their families that facilitate the gathering and sharing of essential information for effective health care.

Source: <http://www.royalcollege.ca/rcsite/canmeds/framework/canmeds-role-communicator-e>

Collaborator

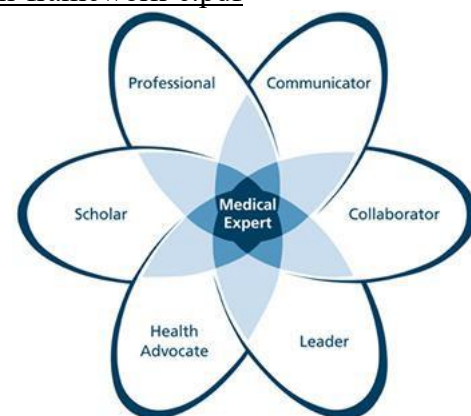
As Collaborators, physicians work effectively with other health care professionals to provide safe, high-quality, patient-centred care.

Source: <http://www.royalcollege.ca/rcsite/canmeds/framework/canmeds-role-collaborator-e>

Leader

As Leaders, physicians engage with others to contribute to a vision of a high-quality health care system and take responsibility for the delivery of excellent patient care through their activities as clinicians, administrators, scholars, or teachers.

Source: <http://www.royalcollege.ca/rcsite/canmeds/framework/canmeds-role-leader-e>



CANMEDS

Picture source:

<http://www.royalcollege.ca/rcsite/canmeds/canmeds-framework-e>

Health Advocate

As Health Advocates, physicians contribute their expertise and influence as they work with communities or patient populations to improve health. They work with those they serve to determine and understand needs, speak on behalf of others when required, and support the mobilization of resources to effect change.

Source: <http://www.royalcollege.ca/rcsite/canmeds/framework/canmeds-role-health-advocate-e>

Scholar

As Scholars, physicians demonstrate a lifelong commitment to excellence in practice through continuous learning and by teaching others, evaluating evidence, and contributing to scholarship.

Source: <http://www.royalcollege.ca/rcsite/canmeds/framework/canmeds-role-scholar-e>

Professional

As Professionals, physicians are committed to the health and well-being of individual patients and society through ethical practice, high personal standards of behaviour, accountability to the profession and society, physician-led regulation, and maintenance of personal health.

Source: <http://www.royalcollege.ca/rcsite/canmeds/framework/canmeds-role-professional-e>

2) List of EPAs Defined by the Faculty of Medicine at the UCLouvain

1. Gather a History
2. Perform a Physical Examination
3. Recognize a Patient Requiring Urgent or Emergent Care and Initiate Evaluation and Management
4. Prioritize a Differential Diagnosis Following a Clinical Encounter
5. Document a Clinical Encounter in the Patient Record
6. Provide an Oral Presentation of a Clinical Encounter
7. Recommend and Interpret Common Diagnostic and Screening Tests
8. Enter and Discuss Orders and Prescriptions
9. Perform general procedures of a Physician
10. Form Clinical Questions and Retrieve Evidence to Advance Patient Care
11. Communicate Appropriately with Patients and Families
12. Collaborate as a Member of an Interprofessional Team
13. Give or Receive a Patient Handover to Transition Care Responsibility
14. Obtain Informed Consent for Tests and/or Procedures
15. Contribute to a Culture of Safety and Improvement of the Quality of Care

EPAs based on the 13 Core Entrustable Professional Activities for Entering Residency by the AAMC

AAMC Toolkit for EPAs:

<https://www.aamc.org/system/files/c/2/484778-epa13toolkit.pdf>

More information and resources:

<https://www.aamc.org/what-we-do/mission-areas/medical-education/cbme/core-epas/publications>

3) Swiss Catalogue of Learning Objective for Undergraduate Medical Training

Version 2008: http://sclo.smifk.ch/downloads/sclo_2008.pdf

New version 2017 „Profiles“: http://www.profilesmed.ch/doc/Profiles_2017.pdf

More information (as well as an implementation guide):

<https://www.profilesmed.ch/>

4) Links to the seven pilot videos (French language)

- a) Cardiac arrest (arrêt cardiaque):

https://www.youtube.com/watch?time_continue=16&v=X6ryrPMqXWk&feature=emb_logo

- b) Shock (choc):

https://www.youtube.com/watch?v=V522VU68PJA&feature=emb_logo

- c) Respiratory distress (détresse respiratoire):

1: https://www.youtube.com/watch?v=LnY5cQkHDsg&feature=emb_logo

2: https://www.youtube.com/watch?v=mf_RWt1zjyI&feature=emb_logo

- d) Chest pain (douleur thoracique):

https://www.youtube.com/watch?v=EYWrT-fPS8E&feature=emb_logo

- e) Dyspnea (dyspnée):

https://www.youtube.com/watch?v=nYiA52RPGuM&feature=emb_logo

- f) Lower back pain (lombalgies):

https://www.youtube.com/watch?v=CRxnXYqMgwo&feature=emb_logo

- g) Trauma (patient traumatisé):

<https://moodleucl.uclouvain.be/course/view.php?id=12443§ion=31>

5) Link to a new video (French language)

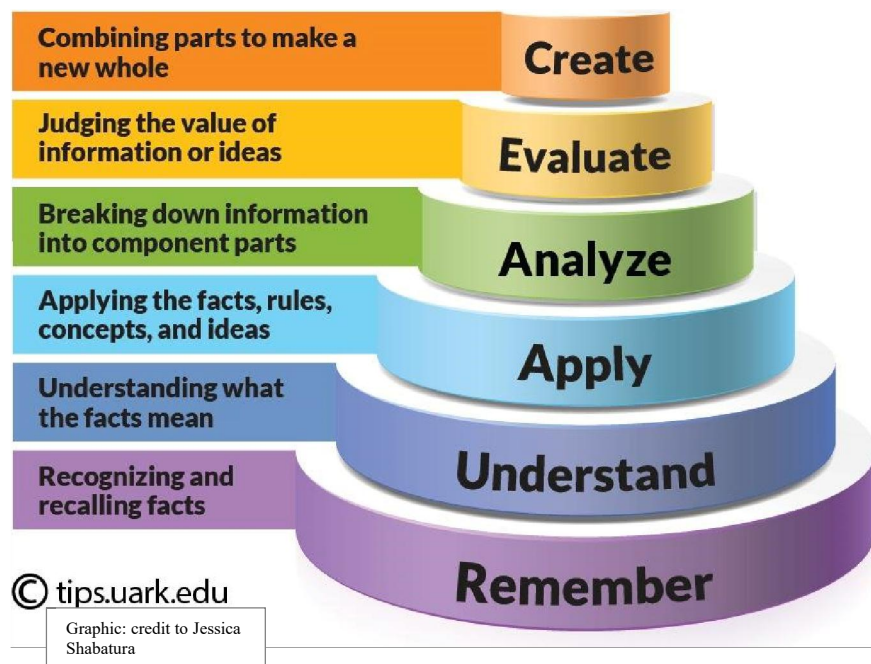
Anaphylaxis (anaphylaxie):

https://www.youtube.com/watch?time_continue=1&v=SjVru9-FE10&feature=emb_logo

6) Bloom's Revised Taxonomy

Bloom's Taxonomy is a classification of the different objectives and skills that educators set for their students (learning objectives). The taxonomy was proposed in 1956 by Benjamin Bloom, an educational psychologist at the University of Chicago. The terminology has been recently updated to include the following six levels of learning. These 6 levels can be used to structure the learning objectives, lessons, and assessments of any course :

1. **Remembering:** Retrieving, recognizing, and recalling relevant knowledge from long-term memory.
2. **Understanding:** Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.
3. **Applying:** Carrying out or using a procedure for executing, or implementing.
4. **Analyzing:** Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.
5. **Evaluating:** Making judgments based on criteria and standards through checking and critiquing.
6. **Creating:** Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.



Source (text and graphic): <https://tips.uark.edu/using-blooms-taxonomy/>

7) Final Digitalized Affinity Diagram

