

# Training Interprofessional Communication within Clinical Reasoning Processes – E-Learning Cases

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## Abstract

E-Learning methods have shown a great number of advantages compared to traditional lectures and classroom settings. These include lower total cost, an increased temporal and spatial flexibility as well as taking individual interests and learning style preferences into account. We present a newly implemented case-based E-Learning program at the Vienna Medical University (MUV) for medical students. With over 110 interactive cases, in which learning objectives are aligned with two thirds of the MUVs medical curriculum. In future we aim to examine possible quantitative differences in exam grades and an improvement in knowledge or skills after using E-Learning versus using traditional methods.

**Keywords:** Interprofessional communication; Collaboration; Learning; Low-level/high-level cases

## Introduction

E-Learning-Programs are more frequently used as learning resource by medical students. These learning resources provide a host of advantages compared to traditional classroom and lecture hall methods including lower total costs and an increased temporal and spatial flexibility for both student and teacher [1]. Additionally, e-learning supports a transfer of knowledge with increased flexibility, adapting more towards individual interests and learning style preferences. In literature the majority of training participants report their skills and knowledge have improved due to the use of e-learning programs [2,3].

A further development of E-Learning is Case-Based-Blended-Learning (CBBL). The concept of CBBL is to facilitate the transfer from students' declarative to procedural knowledge. The transmission of declarative knowledge commences with frontal lectures, textbooks, and small group seminars followed then by interactive online cases. CBBL aimed to increase the transfer from declarative to procedural knowledge by integrating explicit knowledge into working algorithms in clinical reasoning paradigms, using and adapting existing clinical guidelines by extracting knowledge from a standard or archetypical clinical case.

At the Vienna Medical University (MUV) the implementation of a CBBL [4] program commenced in 2014. In this study we present the concept of CBBL, with an aim of improving the implementation of e-learning resources.

## Methods

The aim of this study is to introduce the implementation of CBBL at MUV and its structure, to improve it with the help of literature research and determine future necessary implementations.

The implementation of CBBL started with voluntary cases in the fields of Psychiatry (PS), Microbiology and Laboratory Medicine (ML) and Orthopaedic Surgery (OS). Due to the high participation of the courses (58-66%) [5], we widened the scope of CBBL cases to other fields.

With over 110 cases created so far, in which learning objectives are aligned with two thirds of the curriculum at MUV. The ethics committee and data protection committee of the Medical University Vienna gave their approval for this study.

## Results

### Structure

The e-learning case is defined as a set of data structured in an archetypical or clinical standard framework (patient data and structured like it would be in hospital and in outpatient care); the platform used, Moodle, is an open source learning management system. There are two separate environments for testing and production, secured by controlled levels of access, supervised and maintained by technical as well as teaching staff [4]. Case owners/creators select patient data based on learning objectives and after having formal approval by the patient; data is extracted from the hospital information system, anonymized and automatically transferred to the testing environment in Moodle. Medical data of patient is anonymized, modified to support learning objectives, enriched by Multiple Choice Questions (MCQ), references to learning resources including e-books and other supporting documents. Examples for learning objectives might be in a low-level case differential diagnoses at abdominal pain and in a high-level case the inter-professional thinking and procedure at a patient admitted with somnolence and beginning shock symptoms with suspected bacterial meningitis. In the low-level case learning objectives would include to learn the most common reason for abdominal pain and to be able to exclude life-threatening ones. In the high-level case learning objectives would include differential diagnoses and procedure in somnolence, basic knowledge in neurology, microbiology, intensive care and hygiene and extended knowledge in pathophysiology, treatment and prophylaxis of bacterial meningitis.

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**Received** September 07, 2016; **Accepted** May 06, 2017; **Published** May 10, 2017

**Citation:** Seitz T, Turk B, Seidman C, Löffler-Stastka H (2017) Training Interprofessional Communication within Clinical Reasoning Processes—E-Learning Cases. J Health Med Informat 8: 261. doi: [10.4172/2157-7420.1000261](https://doi.org/10.4172/2157-7420.1000261)

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## Integration of learning resources and quizzes

Integrated learning resources allow access to learning documentation, e.g. e-books, lecture slides, thus the user can read up or catch up on missing or forgotten explicit knowledge. MCQs are included to keep the cases interactive. Different types of questions are implemented:

The level of the questions is grouped in comparison to “United States Medical Licensing Examination” (USMLE) equivalent Steps 1 and 2, as described by the “National Board of Medical Examiners” NBME. While Step 1 questions (called recall items) test basic science knowledge, “items on Step 2 provide a patient vignette” and tests higher clinical reasoning skills. Step 2 questions require the application of knowledge items and may require complex clinical guideline interpretation from the student.

To provide high stake quizzes “elaborate items” were included. “Elaborate Items” were defined as questions with detailed answer possibilities, including their explanations. This categorization reflects the number of cognitive processes needed to answer a question and estimates the complexity of association of a MCQ [6].

## Feedback for students’ reflection

Caspar et al. has shown that learning is more successful, and further students clinical professionalism (demeanour as physicians) if the trainee has to reflect on him/herself regularly during the learning process [7]. Therefore after every decision the student makes in an MCQ, feedback is given online automatically: why the answer is wrong or right and which clinical reasoning process would have been more appropriate.

## Adaptation to user’s knowledge

We distinguished between low-level-cases containing the most common diseases or symptoms, which should teach students basic pathophysiology and diagnostic procedures and high-level-cases with more complex, even inter-disciplinary problems.

## Symptom oriented learning and differential diagnostics

Students often are overstrained facing a real patient complaining of a couple of symptoms, this may be because of linear or organ/discipline specific curriculum structures allowing few inter disciplinary differential diagnoses of symptom constellations. Therefore the chief complaint (symptom constellation) and initial presentation is paramount in our case to improve students’ differential diagnostic thinking.

## Real life cases

We use anonymized real patients taken directly from the wards in order to prepare students for clinic rotations. The patient data was extracted from the hospital information system and automatically anonymized by the system at transfer in Moodle. However, before going online the whole case was checked for lack of anonymization.

Students aim to internalize different steps in diagnosing and excluding the most common diseases related to symptom constellations and most importantly are able to exclude life-threatening diagnoses. They are also tasked to work and think on a progressively interdisciplinary level and find evidence-based clinical reasoning decisions. The references in the cases must be updated regularly to reflect the current state of the art.

## Example of a high-level-case

An example for a high-level case is an eighty year old woman with acute pain in her right shoulder, which turned out to be an infectious arthritis by the end of the case. At first all possible differential diagnoses of shoulder pain are discussed, repeating knowledge about degenerative, infectious, autoimmune and traumatic causes. Information that the patient suffers from Multiple Myeloma and Von-Willebrand-Syndrome has to be included in the differential diagnostics e.g. the increased tendency to bleed at Von-Willebrand-Syndrome represents a predisposition of a bleeding, the increased activation of osteoclasts at Multiple Myeloma can lead to pathological fractures or the increased cell turn over at Multiple Myeloma predisposes hyperuricemia which can cause gout.

The crucial information that the symptoms started after infiltration of cortisone in the shoulder limited the differential diagnoses to bleeding and infectious arthritis. After physical examination and the detection of bacteria in the synovial fluid, the diagnosis of an infectious arthritis could be confirmed. Using MCQs students should then demonstrate knowledge about the microbiology and treatment of an infectious arthritis with focus on indications, advantages and disadvantages of conservative versus surgical treatment.

## Discussion and Conclusion

The example demonstrates the Case-based-Learning-concept. The complexity of the high-level cases requires interdisciplinary thinking. Case creators are also challenged to create didactically approachable learning paradigms for interdisciplinary cases by collaborating with other colleagues from different fields. This may facilitate both learning and execution of clinical reasoning for high level interdisciplinary cases; furthermore a multi-step MCQ approach (basic science and clinical reasoning) may generate multiple approaches from different fields in understanding complex pathophysiology. This is in accordance with international teaching aims, e.g. the CANMeds, and mainly in order to train interprofessional collaboration, which is an underrepresented skill in many students.

We propose to implement or/and extend the offer of E-Learning and CBBL at medical universities. However, not only medical students may benefit from the offer but also persons from other fields of study, for example nurses, pharmacists. Advantages compared to “classic learning resources” are the transfer of declarative to procedural knowledge, increased flexibility for both student and teacher [1,8,9]. Furthermore it leads to an adaption more towards individual interests and learning style preferences leading to higher interest and curiosity [2,10-12] The parameters of curiosity and interest may prove to be one of the primary affects which have been shown to arouse intrinsic motivation. This is crucial to maintaining the endeavour of lifelong learning, as an essential aspect for every physician.

Furthermore our pilot study [5] showed a high participants’ satisfaction of 65% (range: 59-85%) and interest for further E-Learning cases. Current literature is inconclusive as to whether E-Learning-resources lead to improvement of skills and higher knowledge among users compared to traditional textbook and classroom learning as measured by exam outcomes. Some authors claim that using e-learning leads to an increase of knowledge amongst users and a significant improvement of skills [2], while others suggest that there is no difference regarding the knowledge or the skills gained [13]. In our pilot project [5] more than half of the students felt more prepared for the end of year exam and 70% stated that the entire project was a

profitable and affectively involving learning experience. However, we acknowledge that the implementation and expansion of E-Learning is a costly and time-consuming process which probably will meet with resistance, however literature [1] showed that it is cost efficient over a longer period. However, further studies have to be performed to assess cost issues.

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**Citation:** Seitz T, Turk B, Seidman C, Löffler-Stastka H (2017) Training Interprofessional Communication within Clinical Reasoning Processes–E-Learning Cases. *J Health Med Informat* 8: 261. doi: [10.4172/2157-7420.1000261](https://doi.org/10.4172/2157-7420.1000261)

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