High Efficacy and Students' Satisfaction After Voluntary vs Mandatory Use of an e-Learning Program in Traumatology and Orthopedics—A Follow-up Study

David Alexander Back, MD,[*,†,‡] Nicole Haberstroh,[§] Kai Sostmann, MD,[†] Gerhard Schmidmaier, PhD,[‖] Michael Putzier, MD,[§] Carsten Perka, MD,[‡,§] and Eike Hoff, MD[‡,§]

[*]Department of Orthopedics and Traumatology, German Armed Forces Hospital, Berlin, Germany [†]Dieter Scheffner Center for Medical Teaching and Educational Research, Charité—Universitätsmedizin Berlin, Berlin, Germany; [‡]Julius Wolff Institute and Berlin-Brandenburg Center for Regenerative Therapies, Charité–Universitätsmedizin Berlin, Berlin, Germany; [§]Department of Orthopedics, Center for Musculoskeletal Surgery, Charité—Universitätsmedizin Berlin, Berlin, Germany; and [‖]Department for Orthopedics, Traumatology and Paraplegiology, University of Heidelberg, Heidelberg, Germany

INTRODUCTION: Within the last decade, e-learning has gained a consistent place in surgical teaching. However, as the use of new programs is often voluntary, more information on the implications of the data regarding user acceptance and knowledge with mandatory use is desirable, especially in the context of the long-term developments of courses.

MATERIALS: Starting in 2009, the e-learning program Network for Students in Traumatology and Orthopedics was offered in a voluntary blended learning context. Students' satisfaction and increase in knowledge were evaluated using questionnaires and written tests. With proven effectiveness, the program became a mandatory part of the curriculum, and students' attitudes and gain of knowledge were re-evaluated in 2010 and 2011 to detect differences in voluntary vs mandatory use.

RESULTS: In the evaluation questionnaires ($n = 108$ voluntary vs $n = 361$ mandatory), the overall appreciation regarding the offerings remained high. Significantly more students felt better prepared for clinical situations ($p < 0.001$) and asked for e-tutoring ($p = 0.025$) with mandatory use. In written tests, both voluntary ($n = 70$) and mandatory ($n = 147$) users showed significantly increased knowledge ($p < 0.001$). Starting with a lower base level ($p < 0.001$), mandatory users had a significantly higher absolute increase compared with voluntary users ($p = 0.015$), leading to a similar final level.

DISCUSSION: The presented blended learning concept was an efficient way to teach students orthopedics and traumatology. Data can support the assumption that even if the voluntary evaluation of e-learning offerings might be subject to a selection bias, the results can serve as a representative impression for the students' overall mood and their gain in knowledge. However, as changes would have to be anticipated when shifting to mandatory use, users' perceptions should be constantly evaluated. (J Surg 71:353-359. © 2014 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: e-learning, blended learning, traumatology, orthopedics, program evolution

COMPETENCIES: Patient Care, Medical Knowledge, Practice-Based Learning and Improvement

INTRODUCTION

Within the last decade, the introduction of e-learning contents[1] in medical and surgical teaching has undergone a vast expansion from conventional CDs or online texts to podcasts, wikis,[2] and virtual patients.[3] High approval among students and good acquisition of knowledge have been achieved when combining e-learning with face-to-face teaching as blended learning.[4-7] A particular potential of e-learning can be seen in extending the means of teaching by supporting students' preparation and learning process beyond face-to-face

Correspondence: Inquiries to David Alexander Back, Department of Traumatology and Orthopedics, German Army Hospital, Scharnhorststrasse 13, 10115 Berlin, Germany; fax: 0049-30-2841-1909; e-mail: david.back@charite.de

  1931-7204/$30.00 http://dx.doi.org/10.1016/j.jsurg.2013.11.007

seminars or classic textbooks[8] with tools such as videos,[9] podcasts,[10,11] x-ray diagnosis,[12] or virtual patients.[3]

However, many aspects regarding the use of e-learning offerings and blended learning concepts are still unknown.[13] Even though students' approval and their gains in knowledge are often evaluated,[12,14-17] many of these studies present preliminary results during the implementation period where participants voluntarily used the new programs.[14,16,17] It might be questionable if these data are representative for the whole group of potential users. The impending interference might be a selection bias, showing only interested students using voluntary offerings.[14,18-20] A subsequent mandatory use of the same concept for the whole group of recipients could reveal a decrease in users' satisfaction and learning outcome, when students are included who are not convinced by that offering, or e-learning in general. Only few long-term studies are available where efficacy and satisfaction in "daily use" as well as the e-learning program's further development are described.[21-23]

The aim of this study was the long-term evaluation of a surgical e-learning program by recording students' opinions toward it and measuring their gain in knowledge regarding its voluntary vs mandatory use. The program was initially introduced as a voluntary blended learning adjunct to the face-to-face teaching in traumatology and orthopedics. After being positively evaluated by students[24] and having shown to significantly increase users' knowledge as compared with nonusers (data in submission), it became a mandatory component of the faculty's curriculum. Hereafter, students' perception of the program and their gain in knowledge were reassessed to answer the following questions:

(1) Does students' approval of and satisfaction with the e-learning offering change with mandatory use?
(2) Does objectively gained knowledge change with mandatory use?

Additionally, the approval ratings of the offered e-learning tools were evaluated among mandatory users to further adapt the offering to the students' needs.

MATERIALS AND METHODS

The e-Learning Program

The learning management system Blackboard Academic Suite was used with the components Learning-, Community-, and Content-System (Blackboard Inc, Washington, DC) to provide an e-learning component named Network for Students in Traumatology and Orthopedics (NESTOR). Via a welcoming and navigation webpage, students could choose either learning materials (examination videos, podcasts of diseases, interactive radiological cases, or virtual patients), relevant data about the curriculum (e.g., data of courses or lectures, but also PowerPoint-slides and podcasts of the lectures) or further data about NESTOR, links to relevant topics online, or content-related subjects within Blackboard.[24]

Development Period

In the summer semester (SS) of 2008, the decision was made to offer a supplemental e-learning component in the orthopedics and traumatology curriculum, as the need was seen to enhance students' preparation in clinical and radiological diagnostics. The e-learning tools were designed by a core team of doctors and students, and first reviewed by senior clinical specialists followed by voluntary students in the winter semester (WS) of 2008/09.

Phase 1—Introduction for Voluntary Use

The e-learning component was then introduced into undergraduate teaching in a voluntary blended learning context in SS 2009. All students were informed about the new offering at the beginning of the semester.

Phase 2—Mandatory Blended Learning Component

The voluntary NESTOR users highly approved of the project.[24] Among the users, 80% to 90% evaluated the provided teaching tools as useful to improve their learning, enjoyed learning with NESTOR, and were satisfied with the content. More than 95% supported the further offering of NESTOR in future teaching concepts. Additionally, they showed a significantly higher increase in knowledge than nonusers (unpublished data). Thus, the decision was taken to implement e-learning as mandatory component of a firm blended learning concept for traumatology and orthopedics. From WS 2010/11 onward, all students first had to use an e-learning unit (with an examination video, 2 radiological cases, and multiple-choice questions) followed by corresponding seminars and bedside teaching. Other offers such as podcasts and further radiological or virtual patient cases remained for voluntary use.

Study Design: Evaluation and Tests for Gain of Knowledge

All students who participated in this study were in their fourth (of 6) year of medical school at our university and attended a required course in orthopedics and traumatology. It was their first contact with those subjects in their curriculum, even though voluntary clerkships might have been completed before. At the end of SS 2009 and WS 2009/10, students evaluated the program using a 5-point Likert-scaled questions and free texts.[24] At the end of WS 2010/11 and SS 2011, the same questionnaires were provided with additional questions regarding the approval of e-learning in general and the mandatory offer. Mandatory users were also asked to rate their approval of the single tools with a 5-point Likert-scale. Additionally, students' knowledge gained through the new concept was evaluated by