

# Superior Gain in Knowledge by Podcasts Versus Text-Based Learning in Teaching Orthopedics: A Randomized Controlled Trial

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**OBJECTIVE:** Digital learning (e-learning) has become a firm part of surgical undergraduate education. However, there is still a lack in analyzing e-learning tools in experimental settings without potentially biasing curricular influences. This study should compare students' learning outcome with podcasts versus book texts under laboratory conditions in the field of orthopedics.

**METHODS:** Voluntary medical students were randomly assigned for learning either with a book chapter or a podcast about common orthopedic diseases in an isolated computer room. Before and after intervention, students answered multiple-choice tests and questionnaires about their attitudes and satisfaction. The study was conducted from November 2012 to February 2013.

**RESULTS:** Totally, 130 students were included (55 text users and 75 podcast users, 52 males and 78 females). There was a significant increase in the overall knowledge for both groups ( $p < 0.001$ ). Podcast users scored significantly better in the posttests ( $p < 0.021$ ) and achieved a significantly higher gain of knowledge compared to text users ( $p < 0.001$ ). The evaluation also showed a significantly higher approval of podcasts regarding comprehensibility, teaching efficacy, or fun learning with it ( $p < 0.05$ ). Females gained significantly more knowledge by the use of texts than males did ( $p = 0.04$ ), without any sex difference when using podcasts.

**CONCLUSIONS:** This study showed a significantly higher gain of knowledge and higher satisfaction from learning with podcasts compared to book texts among students. Podcasts seem to be beneficial when teaching defined orthopedic topics to medical students. Sex plays an additional independent role in the impact of e-learning tools on students' learning outcome. (J Surg Ed ■■■■-■■■. © 2016 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

**KEY WORDS:** e-learning, podcast, textbook chapter, orthopedics, traumatology

**COMPETENCIES:** Medical Knowledge, Patient Care, Professionalism

## INTRODUCTION

The use of digitally supported learning strategies (e-learning) in medicine has increased tremendously in the last decade,<sup>1</sup> supported by a high approval of the modern generation of students.<sup>2-4</sup> The efficacy of e-learning tools has been proven by positive evaluations and a superior gain of knowledge compared to "traditional" methods for knowledge transfer.<sup>5</sup> However, e-learning encompasses a high variety of different tools.<sup>2,3,6-8</sup> Some of these were rather a transfer of pre-existing teaching methods into Internet-based learning contents, such as textbooks,<sup>6</sup> videos,<sup>2</sup> or interactive radiology cases.<sup>3</sup> Other tools have been invented and spread over the age of the Internet itself, such as podcasts, wikis, blogs,<sup>8</sup> or virtual patients.<sup>7</sup> Depending on the medical discipline and course, these tools have been

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adapted to the individual needs of the medical educational approaches.<sup>2-5</sup> However, discipline or course<sup>5,9</sup> as well as factors like students' sex<sup>10</sup> may also influence the learning outcome with certain digital tools.

Among the existing learning tools, texts can be regarded as "classical" way for the acquisition of knowledge apart from face-to-face teaching in medical faculties.<sup>11</sup> As online texts, they were among the first sources available as e-learning<sup>12</sup> and have shown their efficacy on improving learners' knowledge in various studies.<sup>13,14</sup> Beyond the use of computers or notebooks, modern mobile devices increasingly enable students to access learning texts underway.<sup>15</sup> Besides the development of various other learning sources, book texts are still a highly preferred source of learning for many students.<sup>16</sup>

As an invention of the Internet era, podcasts can be regarded to be among the "newer" means of teaching and knowledge transfer. They were introduced from 2004 onwards and quickly integrated into medical teaching.<sup>8</sup> Downloadable to mobile devices, they were praised to be used anywhere, anytime—also for educational purposes.<sup>17</sup> Usually consisting of at least an audio component, studies have revealed that students prefer a combination of these with a visual element.<sup>18</sup>

Concerning the subjective benefit, it could be shown that podcasts are appreciated learning tools for students, and that they can enhance the learning experience in different subjects positively.<sup>18-20</sup> However, besides an uncontrolled voluntary use of podcasts, many studies lacked any recordings of the gain of knowledge as important parameter for students' objective learning benefit.<sup>18,19</sup> Of those who did, no significant enhancement of knowledge was reported in some studies,<sup>9,14,20,21</sup> whereas others were able to show a beneficial effect.<sup>5,22-24</sup> In all but one of those successful cases, podcasts were combined with further methods of teaching, which is why it can be difficult to discriminate study results from biasing influences.<sup>22-24</sup> Another important aspect is that podcasts were tested only rarely in experimental settings apart from existing course structures to analyze their utility.<sup>20</sup> Although the main part of studies in the field of e-learning and podcasts is based on curricular needs or questions, most are also performed embedded into curricular settings.<sup>14,19,21</sup> This goes along with potential biases such as the use of Internet sources or communication with peer students for answering tests, lack of control when or how long e-learning offers are used, or the interruption by other influences—all of which can be excluded in laboratory settings.

This study was designed to evaluate differences in the gain of knowledge and appreciation of students when learning only with podcasts versus book texts for common orthopedic diseases in an experimental laboratory setting. As a secondary aspect of the study, gained data were also analyzed regarding effects of sex on the gain of knowledge by the offered tools.

## MATERIALS AND METHODS

### Study Design

The study was performed as a randomized controlled trial comparing 2 groups. One group of participants was assigned to read book chapters (group text) for learning about 4 orthopedic diseases, and the other group was assigned to podcasts for the same topics (group podcast). Approval was gained from the local ethical committee of the university (Ethikkommission, Ethikausschuss 1 am Campus Charité—Mitte; reference number: EA1/090/12). The study was conducted from the beginning of November 2012 until the end of February 2013.

### Participants

Participants consisted of students from one German medical school. They were recruited until the eighth semester (out of altogether 12 semesters forming the undergraduate medical studies in Germany) at a curricular level where the single topics had not yet been taught in regular classes. They were asked for their voluntary anonymous participation and recruited either via student mailing lists or by direct approach on the campus. They were informed that they would be tested without any pass or fail criteria. Participants gave their written informed consent for participation.

### Learning Tools

The podcasts were produced for teaching purposes by the faculty of orthopedics and traumatology, and covered the topics Achilles tendon rupture, radius head fracture, scoliosis, and shoulder dislocation. All podcasts consisted of PowerPoint presentations (Microsoft Corp., Redmond, WA) which were connected to voice-over narratives by Camtasia Studio software (TechSmith Corp., Okemos, MI). As a comparison, suitable chapters were taken from 2 established textbooks on orthopedics and traumatology,<sup>25,26</sup> and digitalized for standardized presentation. Before starting the study, it was assured that both the length of the podcasts as well as the extent of the book chapters were well manageable over a maximum time of 20 minutes.

### Tests and Evaluations

To detect both the initial knowledge and also the finally gained knowledge, pretests and posttests with multiple-choice questions were designed, following the principles of Haladyna et al.<sup>27</sup> The questions had a diverging fineness from a simple detection of knowledge up to a complex clinical vignette with a range of 10 to 12 questions for the pretests and 22 to 26 questions for the posttests. Some questions also used anatomical or radiological images. The contents followed a list of clinically relevant issues covering background knowledge, diagnostics, examination, and treatment of each disease. The items of the list were

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