



A review of online platforms in training and surgical education

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Summary

Introduction The use of technology in surgical education has rapidly evolved. Blended learning refers to provision of online instruction platforms by international technology companies, prompting a combination of face-to-face teaching with computer-mediated tuition. This nonsystematic literature review focuses on online teaching platforms with applications for potential use in future surgical education.

Methods A literature search was performed using PubMed, Embase, OVID, and Google Scholar. To identify studies on online platforms in surgical education, the following search terms were used: “online platform,” “online learning,” “surgical education and online learning,” and “surgical education and blended learning.” The search was limited to citations in English from 1998 to 2018. The first author performed the detailed literature search. The final list of the articles was included by consensus between authors. Search items were studied from the nature of the articles, country of origin, date of publication, and aims and findings in relation to use of online platforms surgical education.

Results Altogether 279 relevant citations were reviewed, of which 22 articles met the inclusion criteria: 19 papers (ten original research, two review items, seven Internet articles) and three books were found to be relevant for this study. Their analysis comprised

models of platforms along with their applications in surgical education. Data on the advantages and disadvantages of online platforms as well as authors’ personal experience of this instruction manner in surgical education were extracted. Problems with determining, analyzing, and integrating reading matters in a nonsystematic literature review comprising different teaching methods combined with the use of online platforms in surgical education were discussed and resolved.

Conclusion Online platforms were introduced by international technology companies to encourage paperless blended learning in schools. We envisaged the use of online classrooms in surgical education because of its simple format, easy access, low costs, and interaction-inspiring nature between teachers and students in professional surgical education.

Keywords Online platform · Blended learning · Online learning · Surgical education · Surgical training

Introduction

In surgical education, the use of technology has evolved during the past three decades. Audio cassettes constituted a modest technical starting point that quickly evolved into video tapes and films of operative procedures [1–3]. A technological advance was realized in the conversion from analogue to digital lines, which constituted a low-cost improvement of the quality of the recordings. Also, computer technology evolved in parallel with an increase in the use of the Internet, which substantially changed the set of circumstances for surgical education. Hence, Internet platforms and pioneering devices were incorporated in novel teaching methods. An online learning platform is constructed toward innovating professional training for, e.g., surgical procedures [4]. Moreover,

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it is inexpensive compared with face-to-face teaching methods and it releases students from time and distance restraints [5].

Online teaching platforms that blend online media with traditional classroom methods, such as Google and Microsoft classrooms, are encouraged by international technology companies. Platforms come in various types and shapes ranging from local websites to international companies generating massive revenues. Schools are revolutionized by online paperless teaching [6]. Furthermore, medical education, with an emphasis on surgical education, endorses online learning for undergraduate students with a few recommendations for postgraduates.

We aimed to review the literature about online teaching platforms, from their methods of applications to their future potential use in professional surgical education.

Methods

Recommendations for the review

The best practice recommendations for formulating nonsystematic reviews have previously been defined [7]. This nonsystematic narrative literature review plays the role in surgical education of providing readers with state-of-the-art knowledge about online platforms to facilitate future education in this area. Unlike systematic reviews, a narrative review does not profit from guidelines such as PRISMA because there are no formal guidelines, but only recommendations.

A nonsystematic literature review normally holds back from describing the methodological approach that would permit reproduction of data as well as abstain from providing specific answers to *quantitative* research questions [8]. Uncharacteristically, we present in Fig. 1 our databases although a narrative review article does not typically list the types of databases and methodological approaches used or evaluation criteria for inclusion of retrieved articles [9].

Search terms, inclusion and exclusion criteria

Search terms

The search terms were as follows: “online platform,” “online learning,” “online learning and surgical education,” “surgical education and blended learning.”

Inclusion criteria

Using the search terms we identified citations about online platforms in surgical education in English (Fig. 1). Online platforms are considered contemporary technology ranging from the oldest relevant paper from 1998 to the most recent paper from 2018. The included references existed in the form of published papers, Internet articles, reports, and books.

Exclusion criteria

Citations not related to surgical education were omitted. Likewise, search items not available in English were left out. Specific articles in nonmedical or educational fields such as business administration or other specific nonsurgical medical fields like internal medicine or anesthesia were also excluded (Fig. 1).

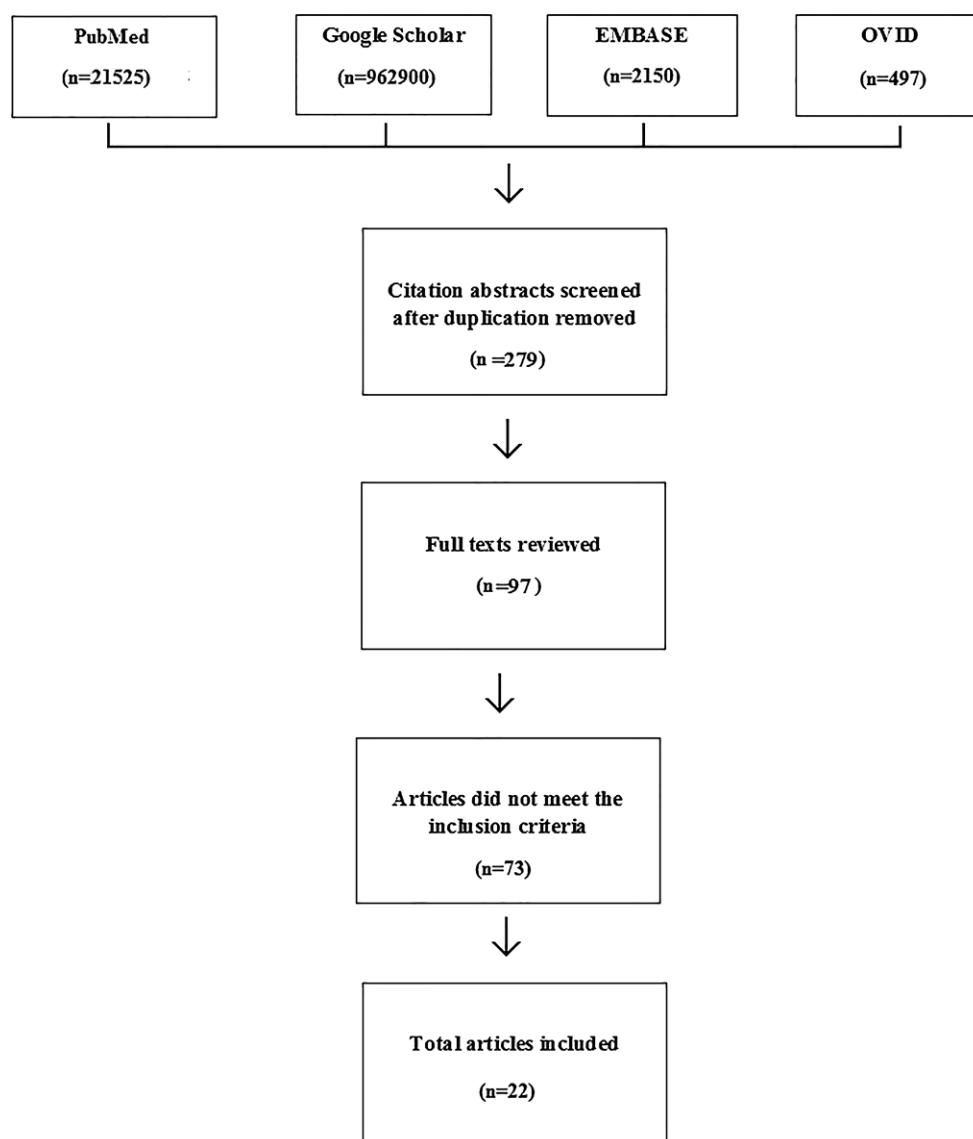
Analysis

The procedure comprised two authors' inspection of titles, abstracts, and full-text papers, which were reviewed against the inclusion and exclusion criteria. The first author performed the detailed literature search. The final list of citations was completed by all authors. Search items were studied from the nature of the article, country of origin, date of publication, and aims and findings in relation to online platforms. They were scrutinized regarding models of platforms, about applications in surgical and health-care education, about advantages and disadvantages from students' perspective of surgical education, as well as about personal experience in using online platforms in surgical education. Future directions were articulated based on the results along with limitations of the method as well as of the limitations and strengths of the full paper.

Results

Altogether, 279 relevant citations were identified and reviewed for this study (Fig. 1). After reading the titles and abstracts, the full texts were read for further assessment. In total, 22 articles remained, of which 19 papers (ten original research, two review articles, seven internet articles) and three books were relevant to the subject matter and met the inclusion criteria. The search items were read in English and the country of origin of the papers is shown in Table 1.

Blended learning was the main topic of the articles. In a blended-learning program, for example, students might attend a traditional classroom with the teacher's face-to-face instruction, while also independently completing online components of the program outside of the classroom [29]. The papers with a focus on blended learning identified the principles and effectiveness of this kind of teaching. The same articles recommended a shift over the next decade toward the use of the very blended approaches in higher education and workplace professional environments. In other words, online teaching platforms with applications are going to affect the future academic education in professional surgery. Moreover, eight articles confirmed the effect of online learning and determined that it is a valuable tool for surgical education. One article studied the application of media in medicine and health care. This article concluded that professionals have a starting point in engaging with social media in a safe and ethical manner while

Fig. 1 Study selection procedure

pointing out the benefits of upcoming explorations to understand the synergies between social media and evidence-based practice. Four Internet articles were found to describe the use of online platforms in education from student–teacher communication, submission of assignments, and providing feedback. Improved teacher–student communication was also of interest.

Discussion

In the present nonsystematic or narrative literature review, the following research question was posed: “How do online teaching platforms with applications affect future academic education in professional surgery?” The answer was qualitatively elaborated and thereby bestowed the reader with state-of-the-art knowledge about models of platforms along with its applications in surgical education. Also, the advantages and disadvantages of online instructive plat-

forms viewed from the surgical trainees’ perspective were elucidated and focused on. Personal experience from online platforms in surgical education was shared for the reader’s benefit. Future directions were presented relative to the current topic.

Models of platforms

The concept blended learning is normally applied to the practice of both online and in-person learning when teaching students [12]. In 2006, blended learning referred to a combination of face-to-face teaching with computer mediated instruction [13]. The report “Defining Blended Learning” indicated that blended learning appoints the possibilities presented by combining digital media with classroom instruction that require the physical presence of teacher and students [20]. In agreement, blended learning was thought to require the physical presence of teacher and students [15, 16, 18, 20, 21].

Table 1 Selected articles in the online platforms review

Author (Year)	Country	Type of search item	Aims	Findings
French, D. & Hale, C. (1998) [10]	USA	Book	To introduce Internet-based learning as a framework for higher education	A hands-on introduction to acclimatizing materials and teaching styles for the Web or creating a virtual course. The teachers gradually apply Internet technology as their skills develop. It complements traditional teaching with Internet options; uses modules as building blocks for Web-based learning; and shows how the Internet enhances communication between teacher and student and addresses the variety of learning styles
Khine, M. S. & Lourdasamy, A. (2003) [11]	Singapore	Journal	To study blended learning in teacher education, by combining face-to-face instruction, multimedia viewing, and online discussion	Combining face-to-face instruction, multimedia viewing, and online discussion to deliver a module in the teacher education program received positive feedback from the trainee teachers
Oliver, M., & Trigwell, K. (2005) [12]	United Kingdom	Journal	To understand whether blended learning can be redeemed	The term “blended learning” is ill-defined and inconsistently used. While its popularity is increasing, its clarity is not
Bonk, C.J. & Graham, C.R. (2006) [13]	USA	Book	To study the benefits and challenges of blended learning environments	Provided an overview of blended learning environments and the common benefits and challenges identified in the research literature. Authors recommend a shift over the next decade toward the use of blended approaches in both higher education and workplace environments
Bell, R.H. (2007) [14]	USA	Journal	To provide a new organization for graduate surgical education and identify its responsibilities	SCORE plans to examine issues such as the assessment of technical competency, the role of simulation in surgical education, the teaching and assessment of professional behaviors, the practicing surgeon’s view of the adequacy of residency training, faculty development, and the attrition of residents from surgery residencies
Garrison & Vaughan (2008) [15]	Canada	Book	To identify the framework, principles, and guidelines of blended learning	Blended learning is consistent with the values of traditional higher education institutions and has the confirmed potential to improve both the effectiveness and efficiency of meaningful learning experiences
Stacey, E. & Gerbic, P. (2009) [16]	Australia	Internet: https://eric.ed.gov/?id=ED505464	To study the effectiveness of blended learning practices	Providing insight into the practice of blended learning in higher education
Larvin, M. (2009) [17]	United Kingdom	Journal	To review e-learning in surgical education and training	Electronic and distance learning became more attractive than previously. The UK Department of Health has made medical e-learning a priority and it is now the largest e-learning provider in Europe
Yeh, Y.C., Huang, L.Y. & Yeh, Y.L. (2011) [18]	Taiwan	Journal	To identify the knowledge management in blended learning and the effects on professional development	Blended learning, guided practice, observational learning, group discussion, peer evaluation, and feedback are all important mechanisms underlying the successful professional development
Schmitz, C.C. et al. (2011) [19]	USA	Journal	To identify the preliminary findings from the SCORE portal pilot study	Trainees had easy onsite access to the Internet and used it heavily for immediate purposes. Programs are advised to consciously integrate the SCORE curriculum and portal into residency training and faculty development
Friesen, N. (2012) [20]	USA	Report	To define the term “blended learning”	Blended learning designates the possibilities presented by combining Internet with classroom forms requiring the physical presence of teacher and students
Staker, H., & Horn, M. B. (2012) [6]	USA	Report	To classify K-12 blended learning	Providing blended-learning taxonomy and definitions
Lothridge, K. et al. (2013) [21]	USA	Journal	To study blended learning efficiency and cost effect	Successful development of a model in using a blended approach that helped to offset a consistent lack of funding for training needs experienced by publicly funded laboratories and agencies
Grajales III, F. J. et al. (2014) [22]	Canada	Journal	To review the applications of social media in medicine and health care	Professionals have a starting point to engage with social media in a safe and ethical manner. Future research is required to understand the synergies between social media and evidence-based practice

Table 1 (Continued)

Author (Year)	Country	Type of search item	Aims	Findings
Kerr, D. (2014) [23]	No country	Internet: https://www.cnet.com/news/google-unveils-classroom-a-tool-designed-to-help-teachers/	Google looks to grade with a new tool, i. e., teachers can assign and collect homework paperlessly, communicate with students in and out of class, and organize their curriculum	Dubbed Classroom, the free tool integrates Google Docs, Drive, and Gmail so that teachers can assign and collect homework paperlessly, communicate with students in and out of class, and organize their curriculum. Classroom will be offered in the Google Apps for Education suite, which provides the usual lineup of e-mail, calendar, and document creation apps but is geared toward students and teachers
Steele, B. (2014) [24]	No country	Internet: https://www.engadget.com/2014/05/06/google-classroom-preview/	Classroom: a simple system for course work organization. The free software is nestled inside Google Apps for Education and serves up a quick and easy way to create/organize assignments, give feedback, and communicate in real time with students	If you are an educator who is interested in giving it a shot, you can apply to be part of a limited preview. Google plans to release Classroom to any school using its education-minded apps program in September—just in time for the fall semester
Jayakumar, N. et al. (2015) [25]	United Kingdom	Journal	To systematically review e-learning in surgical education	E-learning has been proven to be an effective method of surgical education. Future work must involve well-designed randomized controlled trials comparing e-learning against standard teaching
Bamford, R. & Coulston, J. (2016) [26]	United Kingdom	Journal	To study e-learning in surgical education and identify how it can be enhanced for future development	High educational standards with relevant content are essential to ensure that e-learning is a valuable tool for surgical education
Banditvilai, C. (2016) [27]	Thailand	Journal	To study the effect of blended learning on enhancing students' language skills	Online practice is directly beneficial to enhance the language learning skills as well as works on learners' motivation
Liu, Q. et al. (2016) [28]	China	Journal	To review the effectiveness of blended learning in health professions	Blended learning appears to have a consistent positive effect compared with no intervention and appears to be more effective than or at least as effective as non-blended instruction for knowledge acquisition in health professions
E-learning for healthcare (2017–2018)	United Kingdom	Internet: e-Learning for Healthcare https://www.e-lfh.org.uk/programmes/surgery/	To inform about e-surgery as a free e-learning resource supporting trainees in their early years of surgical training	E-surgery learning resource will provide a broad theoretical knowledge common to all surgical specialties and help trainees develop the basic knowledge and skills required of a surgeon
RCSI Royal College of Surgeons in Ireland (No date)	Ireland	Internet: (www.msurgery.ie) https://www.rcsi.com/dublin/	To inform about m-surgery is a custom-built site for all mobile devices that contains the “just in time” essential information for surgical trainees	M-surgery contains videos on surgical procedures and skills, access to the online mobile medical books, links to other useful sites and more. This site is accessible by all doctors throughout Ireland

Blended learning models included *face-to-face driver*, which is a type of learning in which technology is used alongside traditional in-class teaching. In this model, the teacher supports the driven instructions with digital tools. *Rotation* is known to be one of the most common models of blended learning. Students go through a fixed duration of time learning online and spend the remaining time with face-to-face classroom instruction, which is the traditional method, when teaching and learning take place at the same time in the presence of both the teacher and the student. With *flex* most of the curriculum is taught through an online platform, while teachers are available for face-to-face support. *Labs* is another model in which the whole teaching curriculum is delivered via a digital platform but in a traditional classroom. *Self-blend* is when students choose to add some online course work with their traditional learning. By contrast, *online driver* is when students complete a whole course through a digital platform

with online teachers' supervision, and face-to-face meetings are only scheduled when necessary [6, 6].

A blended learning model can be made up of different components, such as instructor-delivered content, e-learning, webinars, conference calls, live sessions with educators, and other media like Facebook, e-mail, chat rooms, podcasting, Twitter, YouTube, Skype, and Web boards [27]. It is also important to note that blended learning models can be combined as a learning strategy [11].

Applications in surgical and health-care education

Blended learning is claimed to be more effective than nonblended instruction or as effective as the same for the acquisition of knowledge in health-professional education [28]. Health-care professionals use social networks to spread peer-to-peer information and to manage institutional knowledge. By using a medical social networking website all the users are assessed

against the state-licensing board-list of practitioners [30]. In addition, new trends emerge with social networks to support a group of members with various physical and mental illnesses in a safe and ethical manner [22]. Blended teaching and e-learning have become fixed features in higher and professional education and are prioritized by universities around the world, as well as by surgical royal colleges. Trainees are likely to be used to virtual learning environments and they expect a similar delivery for their postgraduate studies [17].

The primary organizations involved in American surgical education founded the Surgical Council on Resident Education (SCORE), whose goal is to improve the education of trainees in general surgery and its related subspecialties [14]. SCORE created a Web portal for residency programs called the General Surgery Resident Curriculum Portal. This Web portal provides an educational online curriculum to general surgery trainees and their training programs and ensures that all trainees have online access to the same educational materials and resources [19].

The efficacy of the e-learning method has previously been demonstrated [25]. The majority of National Health Service (NHS) trusts now offer online learning tools and modules for continual professional development [26]. Within surgical training, the Royal College of Surgeons of England supports online learning modules and the Royal College of Surgeons of Ireland encourages their surgical trainees to use online learning management system [31, 32]. In addition, the General Medical Council (GMC) and the UK Department of Health support the use of e-learning as an element of a blended learning process for all NHS staff [33, 34].

Advantages of online platforms

The major advantage of online or blended learning consists in less costly teaching and time-saving approaches to deliver better than the face-to-face methods. Blended learning offers a wide range of flexibility for availability by allowing students to have access to materials from anywhere at any time. Furthermore, students are likely to interact more with each other as well as with their teachers without the restraints that physical interactions would demand. Online platforms comprise interactions between students and teachers via e-mails, discussion boards, and chat rooms. Students can track their progress and receive feedback on their accomplishments. They can also learn through a variety of activities that apply to different learning styles via, for example, videos, graphs, Multiple choice questions (MCQ), and extended matched questions (EMQ). Moreover, students acquire beneficial skills from using the Internet and computer technology and while learning they have unlimited access to up-to-date articles available via the Web. Additionally, students often gain

and enhance their skills in time management, critical thinking, and problem solving.

Disadvantages

We believe that some students will be hesitant to change from traditional face-to-face teaching methods to online platforms because of unfamiliarity with and reluctance to use novel technology. In addition, to benefit from online platforms, access to electronic devices and fast Internet connections for large data admittance are obligatory. These requirements can be unaffordable for less economically fortunate students.

Personal experience in using online platforms in surgical education

Google Classroom decided to tie Google Drive, Google Docs, Sheets and Slides, and Gmail together to assist educational institutions to change their traditional teaching methods to a paperless system [35]. Google Calendar was also an addition to support with assignment due dates [23]. Assignments can be stored and graded on Google's suite of productivity applications that allow for the collaboration between the teacher and the student, but also solely between the students [24]. On the other hand, teachers have the option to attach files to the assignments and to monitor the progress of each student on the project, whereby the teachers can edit and comment on it. After having been graded by the teacher as well as having received the instructor's comments, the student on their part can revise and return the study task. Announcements can be posted by teachers to the class stream, which can be commented on by students allowing for a two-way communication between the teacher and students [36]. Different types of media such as YouTube videos and Google Drive files can be attached to the posts to be shared. The classroom can also be accessed anywhere on the Web or via the Android and iOS Classroom mobile applications.

In May 2017, we created a free Google classroom and called it *surgical tutorials*. Trainees in a major teaching hospital were invited per e-mail to join. Four general surgery consultants participated weekly in the surgical tutorials classroom and contributed as teachers for 20 surgical trainees. A teacher posted weekly a new case study followed by several questions about the diagnosis and management plan options or in the form of multiple-choice questions. Also, YouTube videos explaining surgical procedures and anatomy graphs were routinely posted followed by several interactions between trainees and a short feedback from the teachers. The active participation of trainees reflected their general satisfaction with the new learning experience.

Future directions

We asked how online teaching platforms with applications will affect future academic education in professional surgery. Altogether, 52% of the current search items comprised blended learning and identified its principles and effectiveness. In these articles a shift was suggested to take place in the near future toward the employment of blended approaches in higher education and workplace environments. In other words, educators in surgery benefit from being trained in the use of online platforms and need to acquire a wider understanding of the applications and advantages of online platforms in the teaching process. We predict that universities and the royal colleges must introduce more blended-learning format courses, and they need to encourage the introduction of these concepts in health-care systems at teaching hospitals with a special focus on surgical trainees. Teachers' positive attitude toward online platforms make them less fear-provoking for technically indifferent students. On the other hand, the access to the platforms in question can be made portable and less problematic by the construction of mobile applications for mobile phones and tablets.

Limitation and strength of the review

The limitation of writing a nonsystematic or narrative literature review is reflected in the definition of the Latin word *narrare*, that is, to recount, tell, and narrate a selected topic. To recount makes the data selection individual and not reproducible [7]. Therefore, the nature of the nonsystematic literature review method is claimed to be too personal relative to the determination of which studies to include, the way the studies are analyzed, and the conclusions drawn [37]. Selection bias and subjective weighting of the studies chosen for the review may constitute Achilles' heels, whose weaknesses are balanced by the fact that more than one author must agree on the selection.

Nevertheless, we have chosen to write a narrative review that spans over 20 years of development since it seemed to be fruitless to conceive a systematic review about such a novel subject while we are awaiting reports with richer data about blended teaching combined with online platforms in surgical education. Hence, our aim was to introduce these kinds of platforms, models of platforms at hand, current applications in surgical and health-care education, advantages and disadvantages from the students' perspective, as well as to share personal experiences from the use of online platforms in surgical education. Future directions and encouragement for surgical trainees are given. We consider thereby that problems with determining, analyzing, and integrating literature comprising different teaching methods combined with the use of online platforms in surgical education are presently satisfactorily resolved.

Conclusion

Online platforms are introduced by international technology companies to encourage paperless blended learning in schools and higher education. The main advantages of online platforms are consequential less costly teaching and time-saving instruction, more so than the traditional face-to-face technique in surgical education. Teachers in surgery must receive training about online platforms with applications. Moreover, online platforms can be made more user-friendly by the creation of mobile applications. Blended learning can offer a wide range of flexibility for availability to allow students to access the resources wherever and at any time. We predict frequent use of online classrooms in this area of higher education, also with the goal of improving the interactions between teachers and students in surgical education in times ahead.

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Conflict of interest M. El Boghdady, B.M. Ewalds-Kvist, and A. Alijani declare that they have no competing interests.

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