

CASE REPORT

Massive open online courses for educating physiotherapists about spinal cord injuries: a descriptive study

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INTRODUCTION: This was a descriptive study with the primary objective of describing two Massive Open Online Courses (MOOCs) about the physiotherapy management of spinal cord injuries. We sought to determine the number of participants who registered and then completed the MOOCs, and changes in participants' knowledge. The secondary objective was to determine whether the MOOCs increased usage of www.elearnSCI.org. The setting for this study was global and online.

CASE PRESENTATION: Two 5-week MOOCs were run in 2014 and 2016 about physiotherapy management of spinal cord injuries. The MOOCs were based on the physiotherapy module of www.elearnSCI.org. The data were collected on the number of participants who completed the MOOCs. Participants' knowledge was assessed prior to the commencement of the MOOC and upon completion of the MOOC. In addition, Google analytics were used to determine whether the MOOCs increased usage of www.elearnSCI.org over the two 5-week periods in which the MOOCs were run.

DISCUSSION: In total, 3500 and 10 000 physiotherapists and physiotherapy students registered for the MOOC in 2014 and 2016, respectively. Participants' knowledge increased by a median (interquartile) of 15% (5 to 25% for 2014; 0 to 25% for 2016). Lessons from www.elearnSCI.org that formed part of the MOOC were accessed a median (interquartile range) of 8626 (6150 to 10 773) and 17 631 (15 262 to 22 929) times per day during the 2014 and 2016 MOOCs, respectively. MOOCs provide a relatively inexpensive way of providing education about the physiotherapy management of spinal cord injuries, but it is yet to be determined whether they improve clinical skills.

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INTRODUCTION

The International Spinal Cord Society developed an online training package for healthcare professionals. This is housed at www.elearnSCI.org and contains seven modules.¹ Two of the modules are for all members of the multidisciplinary team and five of the modules are for the different professional groups. For example, one of the modules is for physiotherapists. It contains 14 lessons covering key aspects of physiotherapy management of people with spinal cord injuries (SCI). The lessons are interactive and contain over 150 videos and case studies, involving patients and physiotherapists from all over the world. Each lesson has learning objectives and a self-assessment task.

Although www.elearnSCI.org provides a relatively inexpensive way to provide training to healthcare professionals in SCI, it is only useful if it engages healthcare professionals and it is regularly accessed. There are two key barriers to this. The first barrier is ensuring that the healthcare professionals are aware of the resource. The second barrier is ensuring that the healthcare professionals have the motivation to move through the content of the resource. We were interested in addressing these two barriers, and in particular, finding ways to direct physiotherapy students and physiotherapists to the physiotherapy module of www.elearnSCI.org and supporting them to move through the content. We hypothesised that one way to do this was to run Massive Open Online Courses (MOOCs) based on the physiotherapy module of www.elearnSCI.org. Massive Open Online Courses are a relatively recent concept²⁻⁵ but increasingly popular because they are inexpensive to run and provide free education

for all.^{2,4-10} They are 'massive' because they have 1000s of students, they are 'open' because they are free, they are 'online' because the courses are delivered by the web and they are 'courses' because they have a curriculum and learning objectives.⁹ We reasoned that physiotherapists would be most receptive to a relatively short MOOC of 5-week duration that required approximately 3 h of study per week.

Massive Open Online Courses may provide a way to increase engagement with www.elearnSCI.org because they provide students with a start and end point, content that builds and evolves over the duration of the course, and a group of colleagues with whom to complete the course. Massive Open Online Courses with an associated Facebook (FB) group might be particularly helpful because the 'chat' on FB serves to create a sense of community where students can encourage and motivate each other.^{2,7} In addition, it provides a platform to enable students from all over the world to speak, interact and build on the content that they have learnt within the course and to interact with their course teachers. Therefore, the primary objective of this study was to describe two Massive Open Online Courses (MOOCs) we ran to train physiotherapy students and physiotherapists in the management of spinal cord injuries. Specifically, we sought to determine the number of participants who registered and then completed the MOOCs, and the effect of the MOOCs on participants' knowledge. We gauged engagement with the MOOC by looking at the number of posts to the accompanying FB page. The secondary objective was to determine whether the MOOCs increased usage of an existing freely available online-learning

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module created by the International Spinal Cord Society (www.elearnSCI.org), upon which the MOOC was based.

MATERIALS AND METHODS

Study Design

Two 5-week MOOCs about the physiotherapy management of spinal cord injuries were run, one in June 2014^{11–13} and the other in June 2016.¹⁴ The descriptive data were collected to summarise the key characteristics of participants who registered for the MOOCs, the number of participants who completed the MOOCs and the results of the pre-MOOC and post-MOOC knowledge assessments. We also looked at the engagement with the accompanying FB page. In addition, online Google analytic tracking software was used to record daily usage of www.elearnSCI.org from 1 July 2012 until 31 July 2016 to determine whether usage increased when the MOOCs were run.

Details about the MOOCs

A full report of the two MOOCs is available online,^{13,14} and we have previously written about the 2014 MOOC and a randomised controlled trial we embedded within this MOOC.^{11,12} The two MOOCs were designed for physiotherapy students and junior physiotherapists with little prior experience in SCI, but with a general understanding of the principles of physiotherapy. They were 5 weeks long and required students to devote ~3 h per week to various tasks. Some of the tasks involved moving through content on www.elearnSCI.org, whereas other tasks required students to read around a topic. In addition, participants were required to contribute to a closed FB page. Two or three discussion threads were posted to the FB page each week. The threads related to the content covered on www.elearnSCI.org during the week. The course details were housed on a purpose-built website (www.SCIMOOC.org). In addition, participants were emailed at the beginning of each week to provide them with guidance on what they needed to do. Two physiotherapists were the teachers on the MOOCs; both had extensive clinical and academic experience in the physiotherapy management of SCI. The MOOC teachers engaged with participants on the MOOC FB page and posted a video clip at the beginning of each week, in which they spoke to participants about the content of the MOOC. Participants were provided with a certificate at the end of the MOOC upon completion of the post-MOOC knowledge assessment.

Participants of the MOOCs were given opportunities at different stages to assess their knowledge and clinical reasoning skills. This included multiple choice self-assessments and interactive activities dispersed throughout the content on www.elearnSCI.org. In addition, there was a pre-MOOC and post-MOOC knowledge assessment. The assessments consisted of 20 multiple choice questions randomly selected from a pool of 40 multiple choice questions to ensure that the difficulties of the pre-MOOC and post-MOOC knowledge assessments were equivalent. There was an incentive to do well on the knowledge assessments because the score achieved on the post-MOOC knowledge assessment was put on participants' certificates of completion. There was also a course evaluation that consisted of multiple choice questions as well as an opportunity to provide comments (see the full online reports for details^{13,14}).

Data collection

The data were collected on the key characteristics of participants. This included the number of participants in the two MOOCs as well as their level of education and experience in spinal cord injuries. Completion rates were gauged by the number of course participants who completed the post-MOOC knowledge

assessment and course evaluation. Engagement with the MOOC was assessed by determining the number of people who signed up to the accompanying FB page and the number of comments posted each week to threads. Google analytic online tracking software was used to determine whether the MOOCs increased usage of www.elearnSCI.org. This was done by counting the number of times the physiotherapy lessons on www.elearnSCI.org were accessed each day between 1 July 2012 and 31 July 2016. These data were used to derive the median (interquartile range) number of times lessons were accessed in 6 months prior to each MOOC and then over the two 5-week periods when the MOOCs were run.

RESULTS

The MOOCs attracted 3523 participants in 2014 and 9986 participants in 2016. Registration in 2016 was closed prematurely because numbers were capped at 10 000 (14 staff members also registered but their data were subsequently removed). Participants from both MOOCs were from over 110 countries (see Table 1) and included physiotherapy students and physiotherapists with varying experience (see Table 2). The most represented countries in 2014 were USA (718), Australia (482), UK (383), India (185), Canada (172), Thailand (137) and Pakistan (118). In 2016, the most represented countries were India (1819), Australia (974), USA (930), Egypt (901), Pakistan (512) and UK (515).

The pre-MOOC and post-MOOC knowledge assessments were attempted by 2187 and 1506 people in 2014,^{11,13} and by 6294 and 3448 people in 2016,¹⁴ respectively. From these numbers, we have conservatively estimated a MOOC completion rate of 43% (1506/3523) in 2014 and 35% (3448/9986) in 2016. In those participants who completed both the pre-MOOC and post-MOOC assessments, the median (interquartile) results for the pre-MOOC knowledge assessments were 70% (60–80%) for both the 2014 MOOC ($n=1121$) and the 2016 MOOC ($n=3279$). There was a median (interquartile range) increase in knowledge over the two 5-week MOOCs of 15% (5–25%) and 15% (0–25%) for the 2014 and 2016 MOOCs, respectively. The course evaluations were completed by 1029 people in 2014 and by 2050 people in 2016 with participants providing 6986 lines (86 003 words) of free-text comments about the two MOOCs (see the full reports of the two MOOC for details^{13,14}).

Engagement with the FB discussion was good with 2529 people joining the 2014 FB page and 7214 people joining the 2016 FB page (participants from 2014 FB page were not carried across to the 2016 FB page). Some discussion threads in 2016 attracted over 1500 posts.

The number of times per day people accessed lessons on www.elearnSCI.org over the 4-year study period are provided in Figure 1. There was a sharp increase that corresponded with when the two MOOCs ran. The median (interquartile) number of times lessons were accessed per day during the 6 months prior to the 2014 and 2016 MOOC were 629 (425 to 864) and 916 (646 to 1,320), respectively. The corresponding median number of times lessons were accessed per day during the five weeks of the 2014 and 2016 MOOC were 8626 (6150 to 10 773) and 17 631 (15 262 to 22 929), respectively.

DISCUSSION

Online resources such as www.elearnSCI.org have improved access to information, training and educational opportunities. They provide a good medium to educate healthcare professionals about SCI around the world. However, these resources are only useful if they are accessed. The time, effort and money used to generate these resources are wasted if they are not accessed, and it is perhaps ambitious to expect large numbers of healthcare professionals to move through the content of these types of

Table 1. The number of participants from different countries for the 2014 and 2016 MOOCs. The data were missing on two participants for the 2014 MOOC

	2014	2016
Afghanistan	1	27
Albania	—	29
Algeria	1	11
American Samoa	—	2
Argentina	14	60
Armenia	—	1
Aruba	—	3
Australia	482	974
Austria	2	14
Azerbaijan	—	2
Bahamas	2	6
Bahrain	—	7
Bangladesh	41	20
Barbados	7	1
Belgium	6	35
Benin	—	1
Bermuda	1	1
Bhutan	—	1
Bolivia	1	—
Bosnia and Herzegovina	—	5
Botswana	—	3
Brazil	24	370
British Virgin Islands	1	—
Brunei Darussalam	—	7
Bulgaria	2	11
Burma	3	—
Burundi	—	10
Cameroon	3	6
Canada	172	153
Cape Verde	—	6
Cayman Islands	—	2
Chile	13	56
China	16	106
Colombia	9	7
Congo	—	4
Costa Rica	9	34
Croatia	5	15
Cyprus	1	—
Czech Republic	—	3
Denmark	—	7
Dominica	—	2
Dominican Republic	11	25
Ecuador	2	—
Egypt	19	901
El Salvador	—	1
Eritrea	—	1
Estonia	5	15
Ethiopia	10	2
Fiji	—	26
Finland	12	30
France	31	49
Germany	8	19
Ghana	5	1
Greece	30	28
Grenada	—	2
Guam	—	1
Guatemala	—	12
Guernsey	—	1
Guyana	4	6
Haiti	4	10
Hong Kong	3	8
Hungary	19	19
Iceland	5	2
India	185	1819
Indonesia	3	33
Iran	2	1
Iraq	1	2
Ireland	27	41
Israel	15	26
Italy	26	33
Jamaica	91	107
Japan	4	3
Jordan	39	91
Kenya	2	38
Korea	—	13
Kuwait	11	48
Latvia	1	26

Table 1. (Continued)

	2014	2016
Lebanon	3	36
Libya	—	1
Lithuania	—	11
Macao	5	11
Madagascar	18	—
Malawi	—	1
Malaysia	47	379
Maldives	1	2
Mali	—	1
Malta	45	19
Mauritius	4	3
Mexico	41	79
Micronesia	—	1
Mongolia	1	4
Mozambique	—	1
Myanmar	—	163
Namibia	11	9
Nepal	1	44
Netherlands	13	7
Netherlands Antilles	—	1
New Caledonia	1	1
New Zealand	53	145
Niger	50	1
Nigeria	—	207
Norway	31	25
Oman	1	22
Pakistan	118	512
Palestinian Territory	2	78
Panama	2	1
Peru	6	5
Philippines	13	98
Poland	44	5
Portugal	8	41
Puerto Rico	—	3
Qatar	7	85
Romania	4	5
Russian Federation	1	7
Rwanda	47	13
Saint Lucia	—	2
Saudi Arabia	32	250
Serbia	3	2
Seychelles	—	3
Senegal	1	—
Sierra Leone	1	—
Singapore	7	71
Slovakia	—	1
Slovenia	4	20
Solomon Islands	—	1
Somalia	—	1
South Africa	74	204
South Korea	2	—
Spain	49	38
Sri Lanka	46	48
Sudan	1	65
Suriname	1	3
Swaziland	4	—
Sweden	23	8
Switzerland	9	12
Syrian Arab Republic	1	4
Taiwan	1	4
Tanzania	2	3
Thailand	137	8
Togo	2	1
Trinidad and Tobago	1	31
Tunisia	—	1
Turkey	—	10
Turks and Caicos Islands	—	1
Tuvalu	—	1
Uganda	1	13
Ukraine	—	22
United Arab Emirates	14	102
United Kingdom	383	515
United States	718	930
Uruguay	—	2
Vanuatu	—	1
Venezuela	—	1
Vietnam	8	97
Yemen	1	5
Zambia	20	25
Zimbabwe	6	5

resources independently. This requires considerable drive and motivation. We hypothesised that MOOCs would help overcome these barriers and specifically increase usage of www.elearnSCI.org. Our results support this hypothesis and indicate that the two MOOCs increased usage of www.elearnSCI.org and encouraged users to move through its content. This is evident by the marked increase in the number of people per day accessing lessons on www.elearnSCI.org over the two 5-week periods when the two MOOCs were run.

Massive Open Online Courses are appealing to learners because they provide a structure and end point to people's self-learning. Participants of our two MOOCs were provided with discrete tasks for each week with an estimation of the amount of time to devote to a task. This guided participants through the content on www.elearnSCI.org and broke the content into manageable sizes for each week. It also provided a definite end point to the learning experience. So participants knew in advance that they were devoting 3 h per week for 5 weeks to their learning. In addition, participants were regularly encouraged through the FB interactions to finish the MOOC. The FB interactions developed a sense of community and helped ensure that participants felt that they were part of a classroom. The FB interactions also provided a unique opportunity to engage with colleagues from around the world, which was highly valued by some. This all contrasts with the often haphazard approach to learning when individuals are left to move through online resources alone. Motivation can quickly fall if there is no social support or guidance.⁶

Our assertion that MOOCs increase usage of www.elearnSCI.org implies a cause-and-effect relationship between the MOOC and the usage statistics of www.elearnSCI.org. That is, we relied on the relationship between the spikes in usage coinciding with the 2014 and 2016 MOOCs to imply that the MOOCs caused the spike in usage. There are some compelling features of our data to support

this interpretation. Namely, the two spikes in usage nearly perfectly coincided with when the two MOOCs were introduced and the spikes in usage ended at the same time that the MOOCs finished (see Figure 1). In addition, the magnitude of the spikes in usage largely reflected the number of participants who registered for the MOOCs. Specifically, the usage statistics were nearly three times greater during the 2016 MOOC than in the 2014 MOOC. This coincided with almost three times as many course participants for the 2016 MOOC (9986 participants) compared to the 2014 MOOC (3523 participants). These data reinforce our belief that the MOOCs increased usage of www.elearnSCI.org. However, there is always the possibility that some other external factor not related to the MOOCs explains the observed pattern of usage on www.elearnSCI.org. Only randomised controlled trials can conclusively prove cause-and-effect relationships because the randomisation process eliminates all known and unknown confounding factors.

Massive Open Online Courses and other types of online courses are often criticised because they tend to have low completion rates, sometimes as low as 4%.⁶ We are only able to estimate the number of people who completed our two MOOCs from the number of people who completed the post-MOOC knowledge assessments. These numbers indicate a completion rate of 43 and 35% for the 2014 and 2016 MOOC, respectively. These figures probably underestimate the number of people who moved through the content. Regardless, our conservative estimations of our retention rates are far higher than the typical retention rates reported for MOOCs. We would like to think that our reasonably good retention rates indicate that the content of our MOOCs was relevant for the majority of participants. This interpretation is supported by the specific comments provided by participants as part of the evaluations.

Online resources and MOOCs will probably never replace high-quality face-to-face teaching. However, not all physiotherapists around the world have access to high-quality face-to-face teaching in SCI because this topic is not always covered in undergraduate courses, and not all universities have staff with expertise in SCI to teach a SCI curriculum. Online resources and MOOCs fill this gap. Importantly, they provide a consistent learning experience for all regardless of the country and regardless of access to formal classroom style teaching in SCI. They also increase knowledge as evident by the results of the pre- and post-MOOC knowledge assessments. However, future studies need to be directed at determining whether they also improve clinical skills and patient outcomes.

Members of The International Spinal Cord Society devoted 3 years to developing www.elearnSCI.org, which has been freely available since 2012. However, the challenge now is to ensure that healthcare professionals fully engage with the resource. The results of this study show that MOOCs can be used to direct

Table 2. The number of participants who were students, physiotherapists with no experience in SCI, physiotherapists with < 1-year experience in SCI, physiotherapists with between 2 and 5 years' experience in SCI, and physiotherapists with more than 5 years' experience in SCI (one and six participant/s did not provide details in 2014 and 2016, respectively)

Experience	2014	2016
Student (undergraduate and post graduate)	1349	4429
< 1 year experience in SCI	1034	2644
2-5 years experience in SCI	671	1663
> 5 years experience in SCI	468	1244

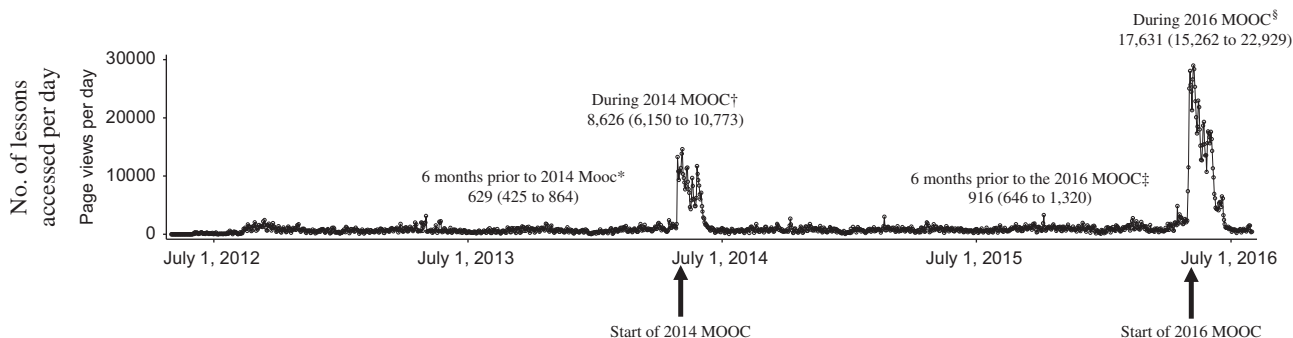


Figure 1. Median number of times lessons from www.elearnSCI.org were accessed between 2012 and 2016. Arrows indicate when the 2014 and 2016 MOOCs started. Also indicated are the median (IQR) number of lessons accessed per day in the 6 months prior to each MOOC and in the 5 weeks during each MOOC. (Legend: * 28th October 2013 to 14th April 2014; † 18th April 2014 to 2nd June 2014; ‡ 18th November 2015 to 18th April 2016; § 2nd May 2016 to 6th June 2016).

people to www.elearnSCI.org and to encourage them to move through its content. MOOCs are therefore a relatively inexpensive way of engaging healthcare professionals with www.elearnSCI.org. Work now needs to be directed at developing similar MOOCs for other professions, determining whether they also engage healthcare professionals with www.elearnSCI.org, and, importantly, whether they improve clinical skills and patient outcomes.

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COMPETING INTERESTS

The two MOOCs were not funded and no one received any financial benefit from being involved. The two MOOC teachers did, however, receive some salary support from the University of Sydney and iCARE for a small portion of the time they devoted to the MOOCs. The University of Sydney also funded the development of www.SCIMOOC.org. Physiopedia received no financial assistance to manage the 2014 MOOC. They did, however, receive sponsorship from Elsevier, which in turn received publicity through Physiopedia. Elsevier may have also inadvertently received publicity through the FB postings. Elsevier and LAH may have indirectly benefited through any sales of the course textbook generated by the MOOCs (even though all course delegates were provided with free online access to the textbook for the duration of the two MOOCs).

REFERENCES

- 1 Chhabra HS, Harvey LA, Muldoon S, Chaudhary S, Arora M, Brown DJ *et al*. www.elearnSCI.org: a global educational initiative of ISCoS. *Spinal Cord* 2013; **51**: 176–182.
- 2 Making sense of MOOCs—a reading list. Available at <http://blogs.worldbank.org/edutech/making-sense-of-moocs-a-reading-list> (accessed on 1 April 2016).
- 3 EDUCAUSE Learning Initiative (ELI) 7 Things You Should Know about MOOCs ii. Available at <https://library.educause.edu/~mmedia/files/library/2013/6/eli7097-pdf.pdf> (accessed on 6 February 2017).
- 4 Ebben M, Murphy JS. Unpacking MOOC scholarly discourse: a review of nascent MOOC scholarship. *Learn Media Technol* 2014; **39**: 328–345.
- 5 Liyanagunawardena TR, Adams AA, Williams SA. MOOCs: a systematic study of the published literature 2008–2012. In: *Int Rev Res Open Distance Learn* 2013, Vol. 14, pp 202–227.
- 6 Cassidy D, Breakwell N, Bailey J. *Keeping them clicking: promoting student engagement in MOOC design*. Available at <http://icep.ie/wp-content/uploads/2013/12/CassidyBreakwellBailey.pdf> (accessed on 1 August 2016).
- 7 Hoy MB. MOOCs 101: an introduction to massive open online courses. *Med Ref Servs Q* 2014; **33**: 85–91.
- 8 Koutropoulos A, Gallagher MS, Abajian SC, deWaard I, Hogue RJ, Keskin NÖ *et al*. Emotive vocabulary in MOOCs: Context and participant retention. In: *Journal of Open, Distance and E-Learning*, 2012. Available at http://www.eurodl.org/materials/contrib/2012/Koutropoulos_et_al.pdf (accessed on 2 September 2014).
- 9 UK Department for Business Innovation and Skills (BIS). *The Maturing of the MOOC: Literature Review of Massive Open Online Courses and Other Forms of Online Distance Learning*. Department for Business Innovation and Skills: London, 2013.
- 10 Zutshi S, O'Hare S, Rodafinos A. Experiences in MOOCs: the perspective of students. *Am J Distance Educ* 2013; **27**: 218–227.
- 11 Harvey LA, Glinsky JV, Lowe R, Lowe T. A Massive Open Online Course for teaching physiotherapy students and physiotherapists about spinal cord injuries. *Spinal Cord* 2014; **52**: 911–918.
- 12 Hossain MS, Shofiqul Islam M, Glinsky JV, Lowe R, Lowe T, Harvey LA. A massive open online course (MOOC) can be used to teach physiotherapy students about spinal cord injuries: a randomised trial. *J Physiother* 2015; **61**: 21–27.
- 13 Harvey L, Glinsky J. Final report: massive open online course on physiotherapy management of spinal cord injuries. run for physiotherapy students and physiotherapy clinicians. Available at http://www.scipt.org/documents/documents_details.php?documentID=162&author_surname=SCIPT (accessed on April to May 2014).
- 14 Harvey L, Glinsky J. Final report: massive open online course on physiotherapy management of spinal cord injuries. Run for physiotherapy students and physiotherapy clinicians. Available at http://www.scipt.org/documents/documents_details.php?documentID=191&author_surname=Harvey/Glinsky (accessed on May to June 2016).