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SNAPSHOT ARTICLE

Online Capacity Building In Anatomy Knowledge for High School Biology Teachers: Community-University Partnerships in Indonesia During the COVID-19 Pandemic

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Abstract

This anatomical program for high-school biology teachers, a university-driven capacity-building exercise, achieved its aims of: (1) determining the participants' profiles; (2) increasing the anatomical knowledge of participants; and (3) evaluating the online program. The webinar program comprised 4 lectures, including discussion, preceded and followed by a test consisting of 19 anatomy questions. Of 867 high-school biology teachers who registered an interest, 222 completed the post-program test and feedback questionnaire; however, only 153 (111 females, 42 males) completed both pre-program and post-program tests and the feedback questionnaire. A significant ($P < 0.001$) increase in the overall post-program scores (88.9%: male $89.5 \pm 16.52\%$; female $88.7 \pm 17.38\%$) compared to the pre-program test scores (56.3%: male $56.1 \pm 15.66\%$; female $56.5 \pm 16.82\%$) was observed, the increase being irrespective of age, level of education or teaching experience. The program attracted participants from throughout Indonesia rather than just those close to the university. There was an overall improvement in test scores, supporting the effectiveness and efficiency of the online anatomy program. More than 60% of participants stated that the program met their needs in terms of the level of anatomy

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knowledge, and that the topics were of interest, well presented and relevant to their teaching. This study may provide useful information for future community-university studies in this area.

Keywords

Community-University Partnerships; Online Programs; Anatomy; High-School Biology, Indonesia

Introduction

In Indonesia, human anatomy is initially taught to science students by high-school biology teachers, with some continuing their anatomy education in health professional undergraduate programs. A knowledge of human anatomy is necessary for students wishing to pursue health science study programs in which they will continue to study human anatomy at a deeper level under the tuition and guidance of university anatomy lecturers ([Hegarty et al. 2009](#); [Schafer et al. 2019](#); [Swinnerton et al. 2017](#)).

Higher education plays a vital role in improving society and academics, as key contributors to higher education, should embrace community engagement ([Kearney, Wood & Zuber-Skerritt 2013](#)). As a result, there has been a notable increase in the literature discussing community-university partnerships' research and practices worldwide ([Baker & Meletzke 2021](#); [Kearney, Wood & Zuber-Skerritt 2013](#); [Northmore & Hart 2011](#)).

In the Republic of Indonesia, Higher Education Institutes are obliged to provide three pillars of higher education (Tri Dharma Perguruan Tinggi) comprising education, research and community service (Law Number 12/2012). Every institution must have a strategic plan for both research and community service (Regulation of the Minister of Research, Technology and Higher Education Number 44/2015) that takes into account the resources available. The Universitas Padjadjaran publishes a plan every five years, the latest being for 2021–2025, which acts as a guide for the development and implementation of community service activities to be undertaken by academics at the university. The strategic plan is also adapted for national priority programs determined by the Directorate of Higher Education, Ministry of Education, Culture, Research and Technology, and supported by the Ministry of Village, Development of Disadvantaged Regions and Transmigration for the development of disadvantaged areas and transmigration. The community service carried out by the Universitas Padjadjaran is a pentahelix collaboration involving the government, society, academics, industry and the media.

The Universitas Padjadjaran employs community-engagement activity as one of the key performance indicators of its academics. Anatomy lecturers at Universitas Padjadjaran come from the Faculties of Dentistry and Medicine. They organise and conduct community-university partnerships, including human anatomy enrichment programs for high-school biology teachers at the university in Bandung. Previous face-to-face programs consistently received positive feedback.

The COVID-19 pandemic changed the educational environment around the world, with face-to-face teaching being largely abandoned and replaced by online learning ([Lei et al. 2020](#)). Anatomy teachers world-wide immediately adjusted their teaching in response to the pandemic ([Cheng et al. 2020](#); [Evans et al. 2020](#); [Franchi 2020](#); [Iwanaga et al. 2021](#); [Longhurst et al. 2020](#); [Pather et al. 2020](#); [Singal, Bansal & Chaudhary 2020](#)). From March 2020, all education providers in Indonesia had to adapt their teaching to online formats following advice from the government. However, in addition to undergraduate health professional programs, there was a growing need for online anatomy courses ([Kelsey et al. 2020](#)).

The pandemic therefore forced us to adapt the outreach anatomy program so as to enable it to be delivered online, and thus continue anatomical training for high-school biology teachers. Because the course was now available online, the target audience was increased to include all 34 Indonesian provinces. However, a number of challenges had to be overcome. These included the time differences across the three time zones

in Indonesia; marketing the program; maintaining attention during the program; differences in the length of work experience and qualifications of participants; use of online learning (video conferencing) and YouTube for synchronous presentation; and differences in internet connection stability in various geographical areas.

In this article we present the findings of the first online anatomy community outreach program for high-school biology teachers conducted in Indonesia. The aims of the study were to: (1) determine the participant profile; (2) increase the anatomical knowledge of the participants; and (3) evaluate the online program.

Results

Of the 867 teachers who initially expressed an interest, 222 completed the post-program test, survey and feedback questionnaires; however, only 153 completed the pre-program test. The 222 participants came from 30 of the 34 provinces within Indonesia, with the greatest numbers being from West Java, East Java, Central Java, Jakarta and Banten provinces. Distribution of gender, age, education level, teaching experience, and the number of biology teachers at the respective institutions are tabulated in [Table 1](#). More detailed information can be found in Appendix 1.

Table 1. Characteristics of the participants

Characteristics	Percent	Characteristics	Percent
Gender (# participants)		Teaching experience (# participants)	
Males	73.4	1–5 years	41.9
Females	26.6	6–10 years	10.8
Total	100	11–15 years	14.4
		16–20 years	11.7
Age (# participants)		> 20 years	21.2
20–30	41.1	Total	100
31–40	18.5		
41–50	25.2	Number of biology teachers at school (# participants)	
51–60	14.9	1	16.0
Total	100	2	32.0
		3	22.8
Education level (# participants)		4	14.2
Diploma	2.2	5	9.1
BSc	73.0	6	5.9
MSc	24.8	Total	100
Total	100		

The methods used to teach biology at the institutes was a mixture of lectures, discussion, demonstrations, project assignments, experiments and tests/quizzes. The majority (88.7%) of participants stated that this was the first time they had taken part in an anatomy capacity-building program.

The mean test scores, expressed as percentages, of the 153 participants who took both tests are shown in [Table 2](#), with the data presented for each age group and gender, as well as the overall pre- and post-program test scores. Independent t-tests showed significant differences ($P < 0.001$) between all pre- and post-program scores, as well as a significant ($P < 0.001$) difference in the pre-program scores between males and females in the 41–50 year cohort. No other differences were observed.

Table 2. Overall pre-program and post-program mean scores (expressed as percentages) for those who took both tests ($n=153$), as well as the scores for males and females within each age range. All post-program test scores are significantly greater ($P < 0.01$) than the pre-program scores.

Age	Sample size (M/F)	Pre-program (%)			Post-program (%)		
		All (\pm SD)	Male (\pm SD)	Female (\pm SD)	All (\pm SD)	Male (\pm SD)	Female (\pm SD)
20–30	62 (22/40)	52.0 (17.27)	52.1 (12.11)	52.0 (19.60)	88.7 (16.72)	88.2 (18.30)	89.0 (16.10)
31–40	32 (8/24)	61.6 (18.19)	65.4 (17.68)	60.5 (18.56)	89.6 (19.43)	92.5 (10.46)	88.8 (21.47)
41–50	41 (9/32)	56.4 (11.64)	44.2* (11.53)	58.4 (10.86)	90.6 (14.41)	86.3 (22.21)	91.3 (14.34)
51–60	18 (3/15)	60.8 (16.58)	66.9 (17.11)	57.9 (15.28)	85.4 (21.30)	92.5 (13.54)	82.1 (23.77)
All ages	153 (42/111)	56.3 (16.06)	56.1 (15.66)	56.5 (16.82)	88.9 (17.43)	89.5 (16.52)	88.7 (17.83)

*Significantly less than corresponding female score

Analysis of the feedback questionnaire ([Table 3](#)) showed that more than 60 percent of participants agreed or strongly agreed that the online program increased their level of anatomy knowledge, and that the topics were well presented, of interest and relevant to their teaching. However, approximately a quarter of participants strongly disagreed. Only 53.6 percent of participants thought that there was sufficient time for discussion.

Table 3. The percentage (%) of responses, using a 5-point Likert scale from strongly agree to strongly disagree, to questions on the feedback questionnaire following the anatomy online program.

Questions	Scale*				
	1	2	3	4	5
Did your knowledge of anatomy increase?	46.8	14.0	4.5	9.5	25.2
Were the presentations of good quality?	42.8	18.4	3.2	9.9	25.7
Were the topics presented of interest?	47.2	14.4	3.2	9.5	25.7
Were the topics relevant to your teaching?	41.0	17.1	6.8	8.6	26.5
Was there sufficient time for discussion?	22.5	31.1	12.6	19.8	14.0

*1 strongly agree; 2 agree; 3 neither agree or disagree; 4 disagree; 5 strongly disagree

A range of topics was suggested for inclusion in future programs, with the three most popular topics being the immune, reproductive and nervous systems, closely followed by the endocrine, intestinal and respiratory systems.

Discussion

Recently, the amount of time undergraduate health professionals spend learning anatomy has decreased, as other topics have assumed greater prominence in modern curricula ([Mitchell & Batty 2009](#)). It has therefore become necessary to provide anatomy teaching for future health professional undergraduates as part of their foundation learning, and high-school teachers are key to this provision. There are currently 65 medical schools and 31 dental schools in Indonesia, each of which offers anatomy modules as part of their curricula. According to the Ministry of Education and Culture, there were 23,083 high-schools in Indonesia in 2020 (Ministry of Education and Culture, Republic of Indonesia 2020).

We believe that anatomy capacity building for biology teachers is performed worldwide. However, there is a lack of publications on this topic. [Doss and Brooks \(2016\)](#) describe the anatomy workshops established for high-school teachers by the University of Alabama, where the program has been well received by participants and been shown to enhance participants' anatomical knowledge. The current program discussed in this paper has also successfully contributed to professional development in anatomical knowledge for high-school teachers. This is notable when one considers the challenges faced by countries such as Indonesia which have a variety of information and technology facilities and a vast geographic area to cover.

Given the reduction in anatomy content in undergraduate professional healthcare programs, there is a need for anatomy workshops/webinars for high-school biology teachers.

In March 2020, the COVID-19 pandemic became a major disruptive factor for education provision in Indonesia as educators were required to operate via online platforms, irrespective of whether they were prepared for this. By the end of March 2020, however, the existing offline anatomy program for high-school biology teachers in Bandung (capital city of West Java Province) was transformed to an online mode and made available to all high-school biology teachers in Indonesia. The current study presents the findings of this online anatomy program. Unlike anatomy modules for professionals and undergraduates, anatomy courses for high-school biology teachers are less well investigated and developed, except by the University of Alabama ([Doss & Brooks 2016](#)).

The interest generated by the online program was high, with just over a quarter (222/867) of those registered showing an interest in participating; however, only 68.9 percent (153/222) took the pre- and post-program tests. Not surprisingly, given that this was the first online anatomy program to be offered and available throughout Indonesia rather than just in Bandung city, 88.7 percent of participants stated that this was the first time they had taken part in such a program. Although participants came from most provinces in Indonesia, the largest number (43.7%) came from five provinces (West Java, East Java, Central Java, Jakarta and Banten). The program thus succeeded in delivering the online program to high-school biology teachers from various geographical regions in Indonesia.

There were more female than male participants; however, whether this reflects the ratio of female to male high-school teachers in Indonesia is not known. The majority of participants had a BSc and were less than 30 years of age, which was not surprising given that younger individuals generally wish to improve their knowledge as an aid to gaining future work or promotion. The program, as developed and delivered, achieved its aim of increasing the anatomical knowledge of the participants as exhibited in the pre- and post-test scores.

Feedback from the program was positive regarding the topic, its presentation and its relevance to the participants' teaching; however, it was generally agreed that more time for discussion would have been useful. The latter point will be addressed in future online programs by either extending the time of each

presentation or devoting more than one presentation to each sub-topic. There was some negative feedback. However, the authors considered that the constructive criticism would positively shape future offerings. It was assessed that the difficulties in time differences, insufficient interaction between participants and the instructors, and being the first online program encountered created the reasons for the negative feedback. The topics suggested for future programs (immune, respiratory and nervous systems) were not surprising given the current pandemic.

Continuing education is an integral part of life-long learning (Wilson et al. 2018). The current study suggests that the online anatomy program should be maintained and possibly expanded, not only to other anatomy topics, but also to other disciplines relevant to the health sciences. In general, the participants agreed that the program enhanced their anatomy knowledge.

It is clear that the pandemic has had a major impact on teaching and learning; however, it should not deter Universitas Padjadjaran and other universities from persevering with or developing online community-university programs and partnerships. Online platforms and learning management systems have been shown to be extremely useful in such situations, as demonstrated in the present study. Based on the current study, future online learning platforms at Universitas Padjadjaran will be developed and evaluated with respect to the needs of the biology teacher community in order to enhance their subject-specific knowledge and, possibly, teaching skills. However, further thought needs to be given to providing asynchronous presentations to overcome the time differences between regions, as well as using platforms that would be available to all, irrespective of their digital skills and access to the Internet in cities and rural areas.

Conclusions

COVID-19 has transformed the way in which capacity building programs are undertaken. Online learning is no longer viewed as an alternative method of presentation, but has become an accepted and, in the current times, the only way of delivering institutional knowledge enrichment. The current program reached a wide audience in terms of age, educational level, teaching experience and location within Indonesia. The program developed for high-school biology teachers was effective in improving their anatomy knowledge; nevertheless, future programs could be enhanced by increasing the duration of each presentation or by devoting more than one session to each sub-topic to allow more time for discussion. Feedback from the program was positive in terms of knowledge improvement, quality of the presentations and relevance to participants' teaching. To maintain the interest of participants and to encourage them to take part in future programs, the themes to be presented should be informed by the participants, but also tailored to the needs of high-school biology teachers throughout Indonesia. This article provides insights into the characteristics of the high-school biology teacher community in Indonesia as the target of engagement, which presumably would differ from similar engagement in other countries. However, it may serve as a blueprint for those who are interested in similar types of community-university partnerships.

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Appendix 1

Profile of all teachers (n=222) who participated in the online anatomy program with respect to age, gender, level of education and number of years teaching: the numbers in brackets are those (n=153) who did the pre-program and post-program tests.

Level of education	Age range (years)	20–30		31–40		41–50		51–60		Total
		M	F	M	F	M	F	M	F	
Diploma	<5	1 (1)	2 (0)	1 (1)			1 (1)			5 (3)
	<10									
	<15									
	<20									
	20+									
	<i>Subtotal</i>	1 (1)	2 (0)	1 (1)			1 (1)			5 (3)
BSc	<5	23 (16)	52 (36)	2 (1)	3 (1)					80 (54)
	<10	3 (3)	4 (3)	4 (3)	8 (6)		2 (2)			21 (17)
	<15			3 (2)	10 (10)	3 (2)	7 (6)			23 (20)
	<20				1 (1)	2 (1)	13 (8)		1 (0)	17 (10)
	20+						7 (6)	3 (3)	11 (8)	21 (17)
	<i>Subtotal</i>	26 (19)	56 (39)	9 (6)	22 (18)	5 (3)	29 (22)	3 (3)	12 (8)	162 (118)

MSc	<5	2 (2)	5 (1)		1 (1)				8 (4)
	<10				2 (1)		1 (0)		3 (1)
	<15			1 (1)	4 (4)		3 (3)	1 (1)	9 (9)
	<20					5 (2)	4 (3)		9 (5)
	20+				1 (0)	6 (4)	7 (3)	12 (6)	26 (13)
	<i>Subtotal</i>	2 (2)	5 (1)	1 (1)	8 (6)	11 (6)	15 (9)		13 (7)
TOTAL	29 (22)	63 (40)	11 (8)	30 (24)	16 (9)	45 (32)	3 (3)	25 (15)	222 (153)