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How useful is YouTube in learning heart anatomy?

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How useful is YouTube in Learning Heart Anatomy?

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Running title: YouTube – Heart Anatomy

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Tel.: +61 7 55954411
ABSTRACT

Nowadays more and more modern medical degree programs focus on self-directed and problem-based learning. That requires students to search for high quality and easy to retrieve online resources. YouTube is an emerging platform for learning human anatomy due to easy access and being a free service. The purpose of this study is to make a quantitative and qualitative analysis of the available human heart anatomy videos on YouTube. Using the search engine of the platform we searched for relevant videos using various keywords. Videos with irrelevant content, animal tissue, non-English language, no sound, duplicates, and physiology focused were excluded from further elaboration. The initial search retrieved 55,525 videos, while only 294 qualified for further analysis. A unique scoring system was used to assess the anatomical quality and details, general quality, and the general data for each video. Our results indicate that the human heart anatomy videos available on YouTube conveyed our anatomical criteria poorly, whereas the general quality scoring found borderline. Students should be selective when looking up on public video databases as it can prove challenging, time consuming, and the anatomical information may be misleading due to absence of content review. Anatomists and institutions are encouraged to prepare and endorse good quality material and make them available online for the students. The scoring rubric used in the study comprises a valuable tool to faculty members for quality evaluation of heart anatomy videos available on social media platforms.

Key words: gross anatomy education; e-learning; heart anatomy; medical curriculum; problem-based learning (PBL); self-directed learning; web-based learning; anatomy videos, YouTube
INTRODUCTION

The digital era has been characterized by a boom in access to free flowing information. Anatomy education changed state from a static science and since then had benefitted greatly with continuous evolution (Reidenberg and Laitman, 2002). Modern medical education has an increasing focus on self-directed learning, small group teaching, and problem-based learning (PBL) which directs students to seek information on the Internet due to its ease of access, quantity of material available, and low cost (Johnson et al., 2012). The Internet being more readily available to a vast number of people has changed the way students learn, communicate, and share information. However, in many occasions the retrieved information is obscure, biased, and lack peer-review (Clifton and Mann, 2011; Pant et al., 2012).

YouTube is a website platform that allows everyone who has access to it, to view, upload, and share originally created videos. YouTube (YouTube, LLC, San Bruno, CA) was launched in May 2005, since then, it has grown tremendously to be one of the most popular websites in contemporary society. It has more than 800 million unique visitors who watch over four billion hours of videos per month, while 72 hours of new videos are uploaded every minute (YouTube, 2012a). The success of YouTube can be attributed to its easy sharing of videos via upload, or emailing a link, or embedding to websites, user friendly publication environment, and the service being completely free of charge (Marcus and Perez, 2007).

To upload videos one must sign up for a YouTube account. Once an account holder uploads a video, they can add video description and use the video editor and annotator functions. Videos are given a category and tags to aid in search retrieval by other users. Account holders can also comment on the uploaded videos that have the comment function unlocked, and similarly state their opinion on videos by clicking the “Like” or “Dislike” option on videos. The uploader can classify educationally relevant material to Science & Technology category for ease of retrieval. A novel service named YouTube EDU has been
introduced recently giving access to a broad set of academic lectures and inspirational speeches endorsed by institutions and universities and replaced the previous Education category (YouTube, 2012b).

Learning the structure and function of the heart has been a fascination for human beings for centuries. Aristotle, in the 4th century BC, dissected animals to give an accurate description on the cardiovascular anatomy. Galen’s works followed in the 2nd century AD and Leonardo da Vinci’s, much later, in the 15th century AD. Da Vinci used drawings and models as a standard method to convey anatomical information. His anatomical drawings on sections, transparencies, and prosections significantly aided our current understanding about superficial and internal features of the heart (Shoja et al., 2013). Our insight on structure and function of the heart has continued to evolve with the arrival of modern medical imaging modalities. Multi-detector computed tomography scans can show surface rendered reconstructions, whereas tensor-diffusion magnetic resonance imaging is precise enough to show fiber tracts of the heart and to relate better the structure of the heart to its function (Shaffer, 2004).

Unexceptionably, audiovisual material is an excellent medium for medical education. The amount of videos containing medical information on YouTube is growing every day. There are videos available on many disciplines such as basic life support and cardiopulmonary resuscitation (Tourinho et al., 2012), cardiac auscultation and sounds (Camn et al., 2013), physical examination (Azer et al., 2012), surgical skills (Koya et al., 2012), dentistry education (Knösel et al., 2011), and nurse education (Clifton and Mann, 2011). Additionally, there are videos focusing on complimentary training for otolaryngology, dermatology, neurosurgery and anesthetic registrars (Hughes and Quraishi, 2012; Koya et al., 2012; Rössler et al., 2012), while there are videos available for the lay person on hot topics
such as immunization (Hayanga and Kaiser, 2008), and myocardial infarction (Pant et al., 2012).

Today, the demand for learning human heart anatomy is high due to integration of anatomy in medical, nursing, physiotherapy, exercise and sport science, and biomedical science curricula. Furthermore, the millennial generation of students has high standards in quality of digital resources, having embraced web-based technology from early school years (DiLullo et al., 2011; Marker et al., 2012; Platt, 2010). There is a limited availability of scientific literature discussing about YouTube’s value as a module for learning anatomy. A recent study has demonstrated that the videos for learning surface anatomy on YouTube contained insufficient information (Clifton and Mann, 2011). The same author recommended that institutions need to endorse high yield videos to ease students finding good sources of information (Azer, 2012). Such an example is a YouTube channel led by an anatomist in an effort to support self-directed learning in PBL curriculum contexts (Jaffar, 2012).

To the best of our knowledge, the availability and usefulness of YouTube for learning heart anatomy has never been assessed so far. The aim of our study was to evaluate the content and quality of the human heart anatomy videos on YouTube using our unique scoring system and appraise their benefits for the students’ learning experience.

**MATERIAL AND METHODS**

For the purpose of this study, YouTube search engine was assessed from 13 July to 31 December 2012 for videos relevant to human heart anatomy. Keywords such as cardiac anatomy, heart anatomy, heart cadaver, heart lecture, heart model, and gross anatomy of the heart were used. Initially, a total of 55,525 videos were retrieved. Of these, 294 were included in the study, after discarding videos with irrelevant content, animal tissue, non-
English language, no sound, duplicated, or being solely physiology focused. The 294 videos were further assorted to autotelic videos (55.8%) and videos in parts (44.2%).

For each of the 294 videos analyzed an Anatomical Content Score (ACS), a General Quality Score (GQS), and General Data (GD) information were recorded (Table 1). The ACS assessed seven criteria: position of the heart, external morphology, vascular features, atria, ventricles, nerve supply, and physiology of the heart. One point was awarded for each criterion covered per video. A maximum score of 7 was allocated in ACS and a score ≥ 5 was regarded as a “pass”. The GQS assessed 13 criteria including: suitability for undergraduate learner, topic well covered, complex formations well covered, sound quality, appropriate use of English/pronunciation, appropriateness of the quality of material used, image quality and cinematography, constructive video comments by viewers, and appropriate category and tags.

The rubric for “complex formations” coverage was used to spot those videos which their creators avoided to describe complex anatomical features and relationships and focus mainly on simple identification of anatomical structures. A maximum of 13 points was allocated in GQS and a score ≥ 8 was regarded as a “pass”. Similarly to ACS, one point was awarded for each criterion covered per video. No half points were allocated in the scoring system. The scoring was performed by the two authors independently, while any differences were reconsidered by a third rater to ensure credibility of the results.

To gain an overall pass score, a video had to pass ACS and achieve a minimum ≥13 across the sum of ACS and GQS. The collected general data included the type of material used (lecture, cadaver, plastic model, plastinated specimens, illustration, or animation), duration of video, date uploaded, number of views, average views per day, and opinion input by YouTube account holders (“Likes” and “Dislikes”). We calculated the mean and standard deviation values for ACS and GQS according to type of material for all elaborated videos.
Analysis of the data performed with Microsoft Excel spreadsheet software (Microsoft Corp.,
Redmond, WA).

RESULTS

Of the 294 videos analyzed, 54.4% were plastic models, while cadaveric material was used in
20.7%. Lectures made up 12.9% of the videos, whereas illustrations, animations, and
plastinated specimens composed 9.2%, 1.7%, and 1%, respectively. The videos altogether
achieved a total of 2,023,420 views. Videos utilizing plastic models had the highest total
views (613,640) followed by illustrations (551,105), and cadavers (522,233). Lectures had a
low number of views (73,647), while plastinated specimens a mere 433. Plastic models had
the most “Likes” (1490) followed by cadavers (1066) and illustrations (420). On the other
side, Illustrations had the most “Dislikes” (87) followed by plastic models (38) and Cadavers
(30). Advertisements and non-educational links were found in 6.8% of videos. A rundown
analysis of the data is presented in Table 2.

Fifty-one percent of the videos (n = 149) were uploaded between January 2011 and
September 2012. No human heart anatomy videos were uploaded since the launch of
YouTube to 12 February 2007. The first video uploaded was a “Basic gross anatomy of the
human heart” tutorial using a schematic drawing and had a duration of 9’57” (iDE4, 2007). A
graphical representation of the number of human heart anatomy YouTube videos included in
the study and the year they were uploaded is presented in Figure 1. The majority of the
videos (86.7%) were uploaded by individuals, while only 13.3% were endorsed by
institutions. Institutions had uploaded six cadaveric videos and eight lectures representing 2%
and 2.7% of the total videos elaborated, respectively. Almost half of the videos endorsed by
institutions used plastic models as material. Of the videos uploaded by an individual, 55.3%
of them used plastic models, followed by cadavers (21.6%), and lectures (11.8%).
An overall pass was achieved by 25.9% of the videos. Lectures had the highest overall pass rate (44.7%). Cadavers had the second highest overall pass rate (29.5%) followed by Illustrations (22.2%). Animations and plastinates had the lowest overall pass rates, thus 20% and 0%, respectively. Across the 294 videos, the mean ACS (x̄ = 3.75, SD ±1.5) and the mean GQS (x̄ = 7.33, SD ±2.0) was below the pass mark threshold. When considering videos according to type of material used, the highest mean ACS was achieved by lectures (x̄ = 4.53, SD ±1.0). Animations achieved the second highest mean ACS (x̄ = 4, SD = 1.4), whereas illustrations achieved the lowest mean ACS (x̄ = 3.48, SD ±1.70). Animations also achieved the highest mean GQS (x̄ = 8.8, SD ±0.4). The second highest GQS was achieved in plastinated material (x̄ = 8, SD ±1.7). Illustrations had the lowest mean GQS, (x̄ = 7.19, SD ±1.5). Top ten video series, representing a total of 24 YouTube human heart anatomy educational videos are presented in Table 3.

DISCUSSION

Since the launch of YouTube in February 2005 the number of human heart anatomy videos has continually increased every year with a boom in recent years (see Figure 1 updated on 31 December 2012). The increasing availability of the Internet, video recording mobile phones, other video recording devices, and video editing tools might have influenced this rise. Increased focus on self-directed learning in modern undergraduate curricula could have pushed the demand for these videos, which in return encouraged the production.

As we see in our data, most users prefer plastic models to make anatomy tutorial videos for YouTube. This can be due to video makers readily having access to the plastic models in their anatomy labs. Viewership of this type of videos was more popular than cadaveric videos. This could be influenced by a few factors. The students prefer to view a model instead of a cadaver due to simplicity and ease of recognition of structures. The other...
reason may be due to the poor quality of the cadaveric videos. From our analysis, we observed that most cadaveric videos were recorded by students using their portable mobile devices, thus a poor cinematography and image quality was noted. This is reflected in the poor mean GQS of cadaver videos. Additionally, we assume that many lay people are accessing YouTube to learn heart anatomy for their personal interest. In this case, a simple plastic model is easier to comprehend and is less confronting to the eye than a cadaveric dissection. Modern world has censorship-free access to the internet and that requires a high sense of responsibility for those making accessible gross anatomy material to the general public (Raikos et al., 2012). Plastination is a novel cadaver/specimen preparation technique in which structures can be preserved in excellent clarity for teaching. Plastinated specimens were the least utilized material, which demonstrates the relative novelty of this type of material used in anatomical education. However, we believe plastinated specimens have an excellent potential as a learning resource due to these videos having the second highest mean ACS in our study.

For every “Dislike” there was 18 “Likes” in our study. This is consistent with a trend on YouTube. People prefer to communicate when they like something rather than when they do not (YouTube, 2012a). Plastic models and cadavers had the highest number of “Likes” which reflects viewers’ preference over these videos and the fact they are abundant on YouTube. Illustrations had the highest number of “Dislikes”. We suspect the poor quality and over-simplification of schematic drawings minimized their educational yield. Institution endorsed videos made up to 13.3% of uploads in our study. Azer’s study on YouTube surface anatomy videos found no institution linked videos (Azer, 2012). Most of these uploaded videos had a high ACS. Some were old videos; University of Michigan, School of Dentistry heart anatomy video was created in 1974 (Huelke, 1974; Table 3, No. 7). Some recently created videos demonstrated excellent video quality and earned high GCS (Garg, 2011; Table
For example University of Sharjah College of Medicine’s video had excellent image quality, cinematography, and sound quality (Jaffar, 2011; Table 3, No.1).

In a faculty led survey, 92% of the students who used the faculty’s YouTube videos strongly agreed that it helped them learn anatomy (Jaffar, 2012). This reflects the potential of institution led educational videos on YouTube for being a source of high yield learning. However, most of the institution endorsed videos are difficult to retrieve on YouTube among the vast number of videos without entering specific search keywords or the title. Despite the high quality, they have lower views. This is in contrast to Azer’s study who found that videos useful for learning surface anatomy had higher viewership than non-useful videos (Azer, 2012). We noticed that many videos had similar or too general titles. This makes it further difficult to spot good quality videos. YouTube’s algorithm for information retrieval tended to favor highly viewed material in combination to the applied keywords.

Only 25.9% of the elaborated videos succeed to attain the pass mark score in our scoring system. That is a strong indication that YouTube videos alone are an insufficient source to learn heart anatomy. Similarly, Azer observed that only 27% of the studied videos deemed useful for learning (Azer, 2012). The low pass rate in our study was largely due to poor coverage of the anatomical content and partly due to poor GCS. Lectures had the highest overall pass rate which was expected due to in-depth coverage of the anatomy in didactic fashion. Having said that, only 44.7% of lectures actually reached the overall pass mark. This could be due to the fact that individuals/students record tutorials with lack of planning of narration and insufficient coverage of anatomy. Furthermore, some lecturers may not have the knowledge or the drive, and may undervalue YouTube’s educational merit to enhance student learning.

On the anatomical content, most videos fail to convey the heart’s position in the mediastinum and its relation to other viscera. This could be due to the material used not being
sufficient to show these structures and also due to a lack of general awareness of its
importance by the video narrator. Most plastic models do not have adjacent viscera, however
they are mounted on a stand in the way the heart would lie in the body. Only a few uploaders
emphasize this positioning and further on the anatomical relations of the heart with adjacent
structures. Most tend to start with identifying surfaces of the heart or naming external
features. The pericardium’s formations with relation to the transverse and oblique sinuses
were not well covered.

Overall special organization is subliminally learned by the student when dissecting to
find a structure such as a nerve while passing through surrounding tissue (Shaffer, 2004). It is
possible that the limited emphasis on dissection in many modern curricula have made
students less aware of the overall organization. Atria, ventricles, and great vessels were
explained sufficiently in most cases. In our search we found a large number of autotelic
videos focused on the coronary circulation. This seems to be of particular interest to students,
perhaps due to their vital function and clinical relevance in myocardial infarction. However,
these videos did not deal with other structures of the heart and thus were excluded from the
study.

The mean GQS across all the studied videos was below our preset passing standard.
The standard deviation, however, demonstrates that there is a range in video quality. One
reason for this is that there are videos with varying image quality made simply by mobile
phones to professional cameras. Another reason is the range of quality of narration from
clearly spoken with good in-depth coverage of complex formations to simply pointing at
structures and naming them with multiple interruptions through the duration of the video.
Many videos did not state the learning objectives. The ones that did are usually from
institutions or individuals who lecture at an institution. Across all types of material the
majority scored well for the quality of material used in our GQS scheme.
Animations’ having the highest mean GQS shows potential to be a great aid in teaching heart anatomy. This could be due to the ever evolving technology enabling production of accurate clear anatomical animations. New programs permit manipulation of 3D models with ability to express complex textures and controlling the lighting (Shaffer, 2004). In the future, we anticipate more videos created via these programs on YouTube.

The low standard deviation of GQS in animations (0.4) demonstrated the consistency in high quality. Cadavers had the highest standard deviation (2.4) for its GQS which illustrated the range in quality from video mobile phones to professional video making work. The usefulness of cadaveric dissection for learning anatomy should not be underestimated. Institutions owe to prepare and make available good quality cadaveric videos. However, this cannot compare to the experience a student gets when attending a wet lab. Students’ perception about the importance of dissection has not changed with the new innovations in teaching anatomy (Azer and Eizenberg, 2007). Furthermore, 3D virtual reality videos created with OsiriX imaging software (Pixmeo, Geneva, Switzerland), for teaching on arterial supply, have been received positively by students when compared to anatomy textbooks, but results were not the comparable to dissections (Petersson et al., 2009). Utilizing complimentary computerized teaching modules after dissection sessions showed great improvement in student test scores in a cadaver and computer tomographic static images test than the modality alone (Stanford et al., 1994). Similarly, we believe that YouTube heart anatomy videos including cadaver videos are not superior to dissection but can enhance anatomical structural appreciation along with dissections in the lab.

A limitation in the value of the ever-growing number of YouTube heart anatomy videos is the lack of quality control. Unregulated content on YouTube is often inaccurate, misleading or biased (Clifton and Mann, 2011). The challenge for the modern generation is to critically evaluate the resources available to them on YouTube or other similar platforms.
The scoring rubric used in this study can be applied by faculty members on any heart anatomy video on YouTube or other social media database to evaluate its quality. Similar scoring rubrics can be created for other body systems.

Ethical implications exist when students record videos of cadavers in the lab and upload them on YouTube. It is questionable if these students had approval by an authority at their institution to do such recordings. Bond University in Queensland, Australia has a social media policy where photographing and video recording of cadavers are not permitted for posting on the Internet with the exception of research purposes. Millennial students must be cautious to avoid unprofessional behaviors and recognize the expected standards of their profession (DiLullo et al., 2011). The anatomy course as an important symbol of medical education can serve as the cornerstone to introduce elements of professional identity and professionalism (Netterstrøm and Kayser, 2008; Wittich et al., 2013). Copyright breaches can happen when students upload videos of commercial material without permission. YouTube’s policy is to transfer videos only if the uploader owns the copyright or have permission from the copyright holder (YouTube, 2012c). People who breach these copyright laws are at risk of YouTube removing their videos and the copyright holder taking legal action against them. The easy public availability of medical material on the Internet can challenge professional behavior (Farnan et al., 2008).

CONCLUSIONS

The number of heart anatomy videos on YouTube has increased greatly during the last three years. However, only a quarter of the examined videos passed our analysis. Generally, content of the atria, ventricles and the great vessels were well covered in all videos. Position of the heart and its relation to adjacent viscera were poorly covered. Videos using plastic models to learn heart anatomy are more popular. Institution endorsed videos are promising to
be of high educational value on YouTube. Academic teachers covered the anatomical content the best.

It is difficult to identify the high educational value videos due to video descriptions being too similar from video to video and their low popularity. However, the high viewership of videos utilizing simple material such as plastic models and illustrations indicate that viewers preferred them due to ease of interpretation in their self-directed learning. In spite of YouTube’s popularity, searching for the appropriate video may prove challenging and time consuming for students. Therefore, faculty is encouraged to prepare their own videos, verify the available, and provide the students with suggested links. The new era of cloud computing and massive video sharing communities requires additional caution as many videos are uploaded by non-specialists and contain insufficient anatomical content coverage and obscure information.
NOTES ON CONTRIBUTORS

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FIGURE LEGEND

Figure 1. Graphical representation of the number of human heart anatomy YouTube videos uploaded since the launch of YouTube on May 2005 to 31 December 2012.
### TABLES

**Table 1.** Features scored and general data collected of videos analyzed.

<table>
<thead>
<tr>
<th>Anatomical Content Score&lt;sup&gt;a&lt;/sup&gt; (Maximum 7 points)</th>
<th>General Quality Score&lt;sup&gt;a&lt;/sup&gt; (Maximum 13 points)</th>
<th>General Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position of the heart in the mediastinum, relation to: viscera, thymus gland, diaphragm, bones, other structures</td>
<td>Appropriate title</td>
<td>Type of material&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>External morphology: shape, surfaces, landmarks</td>
<td>Appropriate for undergraduate learner</td>
<td>Date uploaded (date/month/year)</td>
</tr>
<tr>
<td>Vascular features great vessels, coronary circulation, venous drainage, ligamentum arteriosum</td>
<td>Topic well covered</td>
<td>Total views</td>
</tr>
<tr>
<td>Atria and its features, openings, apertures, valves, walls, other features</td>
<td>Complex, formations clearly conveyed</td>
<td>Average views/day</td>
</tr>
<tr>
<td>Ventricles and their features walls, valves, chordae tendineae, other features</td>
<td>Learning objectives explained</td>
<td>Opinions “Likes”</td>
</tr>
<tr>
<td>Nerve supply, conducting system</td>
<td>Sound quality</td>
<td>Opinions “Dislikes”</td>
</tr>
<tr>
<td>Physiology of the heart</td>
<td>Use of English/pronunciation</td>
<td>Duration (min/sec)</td>
</tr>
<tr>
<td></td>
<td>Image quality/cinematography</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Name of the author/Institution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comments (positive/negative)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Appropriate category/tags</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No use of Ads/NEL by uploader&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

Total score was calculated as a sum of Anatomical Content Score and General Quality Score; Pass was considered as ≥ 13/20 points and Fail as ≤ 13/20 points, or < 5/7 points in Anatomical Content Score;

<sup>a</sup>One point was awarded per accredited criterion;
<sup>b</sup>Lectures, cadavers, plastic models, plastinated specimens, illustrations, animations;
<sup>c</sup>Appropriate/inappropriate;
<sup>d</sup>YouTube classified ads were excluded;
Ads/NEL, advertisements and non-educational links.
Table 2. Analysis of the videos according to type of material examined and scoring achieved. Viewership and authority is shown as well.

<table>
<thead>
<tr>
<th>TYPE OF MATERIAL</th>
<th>Lecture</th>
<th>Cadaver</th>
<th>Plastic model</th>
<th>Illustration</th>
<th>Animation</th>
<th>Plastinated specimen</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of videos (%)</td>
<td>38 (12.9%)</td>
<td>61 (20.7%)</td>
<td>160 (54.4%)</td>
<td>27 (9.2%)</td>
<td>5 (1.7%)</td>
<td>3 (1%)</td>
<td>294 (100%)</td>
</tr>
<tr>
<td>Mean anatomical content score (±SD)</td>
<td>4.53 (±1.0)</td>
<td>3.97 (±1.7)</td>
<td>3.53 (±1.5)</td>
<td>3.48 (±1.7)</td>
<td>4 (±1.4)</td>
<td>4 (±0.0)</td>
<td>3.75 (±1.5)</td>
</tr>
<tr>
<td>Mean general quality score (±SD)</td>
<td>7.42 (±1.9)</td>
<td>7.23 (±2.4)</td>
<td>7.32 (±1.9)</td>
<td>7.19 (±1.5)</td>
<td>8.8 (±0.4)</td>
<td>8 (±1.7)</td>
<td>7.33 (±2.0)</td>
</tr>
<tr>
<td>Number of videos that passed overall score(^b)</td>
<td>17 (44.7%)</td>
<td>18 (29.5%)</td>
<td>34 (21.2%)</td>
<td>6 (22.2%)</td>
<td>1 (20%)</td>
<td>0 (0%)</td>
<td>76 (25.9%)</td>
</tr>
<tr>
<td>Total views(^a)</td>
<td>73,647 (3.6%)</td>
<td>522,233 (25.8%)</td>
<td>613,640 (30.3%)</td>
<td>551,105 (27.2%)</td>
<td>262,362 (13.0%)</td>
<td>433 (0.02%)</td>
<td>2,023,420 (100%)</td>
</tr>
<tr>
<td>Opinion: Likes(^c)</td>
<td>248</td>
<td>1066</td>
<td>1490</td>
<td>420</td>
<td>415</td>
<td>2</td>
<td>3641</td>
</tr>
<tr>
<td>Opinion: Dislikes(^c)</td>
<td>10</td>
<td>30</td>
<td>38</td>
<td>87</td>
<td>28</td>
<td>0</td>
<td>193</td>
</tr>
<tr>
<td>Ads/NEL included</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>20 (6.8%)</td>
</tr>
<tr>
<td>Institutional authorship</td>
<td>8 (12.7%)</td>
<td>6 (2%)</td>
<td>19 (6.5%)</td>
<td>2 (0.7%)</td>
<td>3 (1%)</td>
<td>1 (0.3%)</td>
<td>39 (13.3%)</td>
</tr>
<tr>
<td>Individual author</td>
<td>30 (10.2%)</td>
<td>55 (18.7%)</td>
<td>141 (48%)</td>
<td>23 (8.5%)</td>
<td>2 (0.7%)</td>
<td>2 (0.7%)</td>
<td>255 (86.7%)</td>
</tr>
</tbody>
</table>

\(^a\)The numbers in parenthesis represent percentages of the values in respect to the total number;

\(^b\)The numbers in brackets correspond to percentages according to the type of material;

\(^c\)Only YouTube account holders are allowed to post their view on opinion function unlocked videos; ±SD, standard deviation; Ads/NEL, advertisements and non-educational links.
### Table 3. Top ten YouTube educational videos related to the anatomy of the heart listed according to total score and views.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title</th>
<th>Teaching material</th>
<th>YouTube link</th>
<th>Duration min:sec</th>
<th>Date Uploaded</th>
<th>Views</th>
<th>Total score 20 max</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>External and internal features of the heart</td>
<td>Plastic model</td>
<td><a href="http://www.youtube.com/watch?v=eFCK7IoV_sQ">http://www.youtube.com/watch?v=eFCK7IoV_sQ</a></td>
<td>12:33</td>
<td>20/9/2011</td>
<td>8,264</td>
<td>18</td>
</tr>
<tr>
<td>2.</td>
<td>Gross anatomy of the heart overview</td>
<td>Lecture</td>
<td><a href="http://www.youtube.com/watch?v=RT2rT_XMYdI">http://www.youtube.com/watch?v=RT2rT_XMYdI</a></td>
<td>50:21</td>
<td>29/1/2012</td>
<td>4,211</td>
<td>18</td>
</tr>
<tr>
<td>3.</td>
<td>Heart (Part 1/2) - BD Chaurasia Anatomy Video</td>
<td>Cadaver</td>
<td><a href="http://www.youtube.com/watch?v=AG6e7MPDe">http://www.youtube.com/watch?v=AG6e7MPDe</a></td>
<td>13:42</td>
<td>5/2/2011</td>
<td>7,115</td>
<td>18</td>
</tr>
<tr>
<td>4.</td>
<td>Heart (Part 2/2) - BD Chaurasia Anatomy Video</td>
<td>Cadaver</td>
<td><a href="http://www.youtube.com/watch?v=uvZ7mp">http://www.youtube.com/watch?v=uvZ7mp</a></td>
<td>10:56</td>
<td>5/2/2011</td>
<td>7,176</td>
<td>18</td>
</tr>
<tr>
<td>5.</td>
<td>Human anatomy dissection 04 (part 1 of 2) Thorax</td>
<td>Plastic model</td>
<td><a href="http://www.youtube.com/watch?v=Mj1mKMXiA">http://www.youtube.com/watch?v=Mj1mKMXiA</a></td>
<td>13:42</td>
<td>7/2/2011</td>
<td>8,685</td>
<td>16</td>
</tr>
<tr>
<td>6.</td>
<td>Heart (Part 1/2) - BD Chaurasia Anatomy Video</td>
<td>Cadaver</td>
<td><a href="http://www.youtube.com/watch?v=K7IoV_sQ">http://www.youtube.com/watch?v=K7IoV_sQ</a></td>
<td>13:42</td>
<td>25/9/2010</td>
<td>332,000</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Heart model II – left atrium</td>
<td>Plastic model</td>
<td><a href="http://www.youtube.com/watch?v=GzvDqU71E">http://www.youtube.com/watch?v=GzvDqU71E</a></td>
<td>2:05</td>
<td>13/10/2008</td>
<td>3,333</td>
<td>16</td>
</tr>
<tr>
<td>17.</td>
<td>Cardiac anatomy</td>
<td>Plastic model</td>
<td><a href="http://www.youtube.com/watch?v=UxuZz">http://www.youtube.com/watch?v=UxuZz</a></td>
<td>11:57</td>
<td>16/5/2012</td>
<td>335</td>
<td>16</td>
</tr>
<tr>
<td>19.</td>
<td>Heart (Atria)</td>
<td>Plastic model</td>
<td><a href="http://www.youtube.com/watch?v=Ckg3h">http://www.youtube.com/watch?v=Ckg3h</a></td>
<td>4:31</td>
<td>8/7/2012</td>
<td>52</td>
<td>16</td>
</tr>
<tr>
<td>22.</td>
<td>Heart (Coronary arteries)</td>
<td>Plastic model</td>
<td><a href="http://www.youtube.com/watch?v=DrK">http://www.youtube.com/watch?v=DrK</a></td>
<td>4:12</td>
<td>8/7/2012</td>
<td>62</td>
<td>16</td>
</tr>
</tbody>
</table>

Videos of the same series are registered as one title;

*Part of video from the *Acland’s DVD Atlas of Human Anatomy* (Acland, 2003) were not uploaded by the author or copyright holder.

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Figure 1. Graphical representation of the number of human heart anatomy YouTube videos uploaded since the launch of YouTube on May 2005 to December 2012. 179x92mm (120 x 120 DPI)