Homepage to distribute the anatomy learning contents including Visible Korean products, comics, and books

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Abstract: The authors have operated the homepage (http://anatomy.co.kr) to provide the learning contents of anatomy. From the homepage, sectioned images, volume models, and surface models—all Visible Korean products—can be downloaded. The realistic images can be interactively manipulated, which will give rise to the interest in anatomy. The various anatomy comics (learning comics, comic strips, plastination comics, etc.) are approachable. Visitors can obtain the regional anatomy book with concise contents, mnemonics, and schematics as well as the simplified dissection manual and the pleasant anatomy essay. Medical students, health allied professional students, and even laypeople are expected to utilize the easy and comforting anatomy contents. It is hoped that other anatomists successively produce and distribute their own informative contents.

Key words: Internet, Anatomy, Learning, Visible Human Projects, Cartoons, Books

Introduction

The corresponding author has made anatomy learning contents since 2000. One trial was the Visible Korean project to produce the serial sectioned images of cadavers [1-4]. After the two-dimensional (2D) sectioned images and outlined images were stacked, the three-dimensional (3D) volume models and surface models were generated continuously [5-11].

The author also drew various comics to explain systemic anatomy and present anatomy mnemonics and humor. The learning effect of the anatomy comics has been reported [12, 13].

In addition, the authors wrote a book on regional anatomy and a dissection manual [14], both of which were for medical students who dissect cadavers.

All these contents are expected to help users learn and enjoy anatomy. In order to contribute more, the authors chose to distribute the contents free of charge through the homepage.

The purpose of this study was to make the students learning anatomy and the people interested in anatomy benefit from the Visible Korean products, comics, and books produced by the authors. For this, the authors determined and reported what kinds of multimedia contents were manufactured and how they were loaded on the homepage.

Materials and Methods

The corresponding author secured the homepage address (http://anatomy.co.kr) in 2003. The address was chosen to symbolize the authors' laboratory that is like "anatomy company in Korea" to produce learning contents. Moreover, the name has advantage to be easy to memorize.

The homepage host computer was a personal computer operating 24 hours a day, 365 days a year located and managed at the authors' medical center. The homepage was de-

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signed very simply in hypertext markup language (HTML) to contain only text menus. The homepage with no illustration appeared like a site map (Fig. 1).

In July 2016, the Flag Counter (Boardhost.com, Inc.) was installed on the homepage to count the visitors from different nations.

Contributors

Among the English contents of the homepage, the contributors—the authors and colleagues—were first introduced. Brief personal information, photos, e-mail addresses, etc. were listed (Table 1, Fig. 1).

Visible Korean products

Scientific articles to introduce the Visible Korean products were uploaded: 35 Science Citation Index (SCI) articles, 14
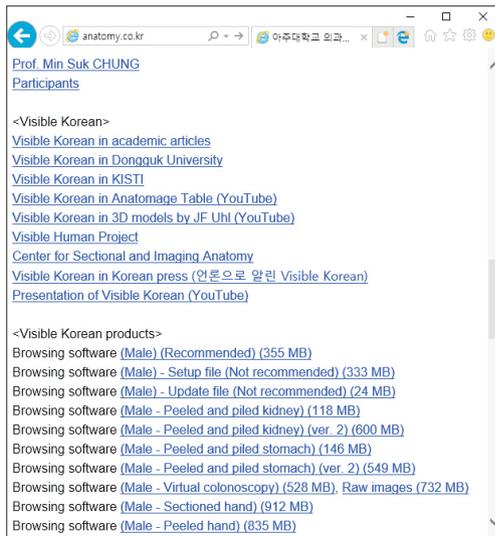

Fig. 1. anatomy.co.kr homepage composed of only simple text menus. The contributors and a part of Visible Korean products are displayed.

Table 1. Categorized anatomy learning contents on the homepage

|	Contents
Contributors	-
Visible Korean products	Articles, Browsing software packages of sectioned images and volume models, PDF files of surface models
Comics	Articles, learning comics (Anna & Tommy), comic strips (Dr. Anatophil), plastination comics (Dr. Plastina), auxiliary homepage (Memory Booster of Basic Anatomy)
Books	Anatomy book (Memory Booster of Regional Anatomy), dissection manual (Almost All Dissection Manual), anatomy essay (Dr. Anatophil's Essay)

Proper names of the contents are in parentheses.
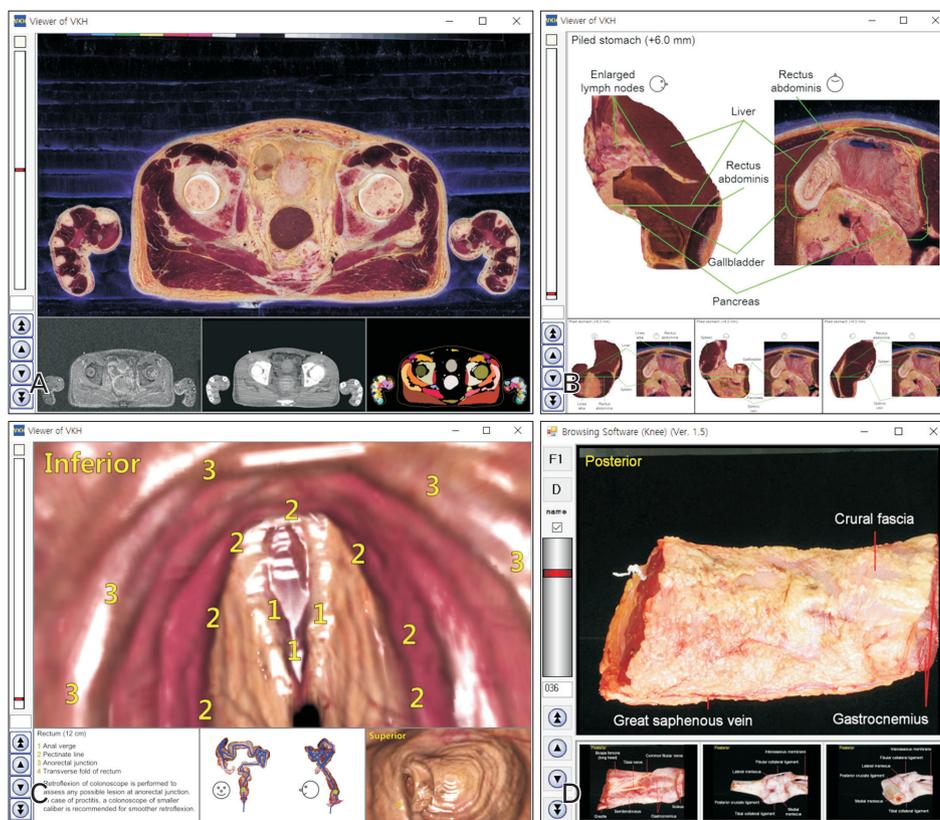
Fig. 2. Browsing software of the sectioned images (A), volume models of stomach (B), colonoscopic views (C), and dissected knees (D).

Science Citation Index Expanded (SCIE) articles, and 8 more English articles (neither SCI nor SCIE) in portable document format (PDF) file.

Seventeen browsing software packages of the sectioned images and volume models were uploaded. After downloading, some software (version 1) needed to be installed prior to use and some did not (version 2) (Fig. 2).

Fourteen PDF files of surface models were uploaded. The PDF files could be readily opened in free Adobe Acrobat Reader software (Adobe Systems Inc., San Jose, CA, USA) (Table 1, Fig. 3) [6].

Comics

Articles about the comics and others were uploaded: four SCIE articles and 10 more English articles.

The various comics on anatomy were put on the homepage. Anatomy learning comics "Anna & Tommy" (16 systems, 853 cuts) were loaded; concurrently, document (DOCX) file of the learning comics were loaded [13]. As well, hundreds of episodes of anatomy comic strips "Dr. Anatophil" were made available [15]. Comics on plastination "Dr. Plastina" (67 cuts) were also put there (Fig. 4) [16, 17].

The auxiliary homepage "Memory Booster of Basic Anatomy" was produced to enable users to learn systemic anatomy easily. The skeletal, muscular, digestive, respiratory, urinary, genital, cardiovascular, and nervous systems were explained with the comics and movies of Visible Korean images and models (Table 1, Fig. 4) [18].

Books

The authors uploaded an electronic book (PDF file) "Memory Booster of Regional Anatomy" consisting of eight chapters (back, upper limb, neck, head, thorax, abdomen, pelvis and perineum, and lower limb). The book contained concise contents, mnemonics, and schematics to promote memorization (Fig. 5).

The "Almost All Dissection Manual" (DOCX file) was uploaded. It could be modified by other anatomy teachers (Fig. 5) [14].

Based on the anatomy comic strips, the anatomy essay "Dr. Anatophil's Essay" (43 chapters) was written and put on the homepage (Table 1, Fig. 5).

Results

The resultant homepage clearly differed from the other homepages in the following aspects.

The homepage in the present study contained both realistic and schematic figures. The Visible Korean raw data with real body color, high resolution, and their derivatives (volume and surface models) provided users with the realistic shapes of body structures (Figs. 2, 3). They were quite different from other popular surface models, which were manually drawn [19]. The schematic illustrations in the comics and books provided users with the kind orientations of the body structures. The auxiliary software included the simplified figures as well as the authentic 2D images and 3D models (Figs. 4, 5).

There were some interactive contents to facilitate positive usage. With the browsing software and PDF files, the manipulation of the 2D images and 3D models was possible. This might yield the interest in anatomy especially among children and adolescents (Figs. 2, 3).

There were some entertaining contents to prevent the users from getting bored. The users, interested in anatomy by the comic strips, might be willing to study anatomy by themselves [15]. For details, they could read anatomy essay along with the comic strips. Further, people who have a look at plastinated specimens could solve their curiosity with the plastination comics (Fig. 4) [17].

The contents could be utilized for other purposes. From the browsing software, the sectioned image and the captured views of volume models could be picked up (Fig. 2) [5] and
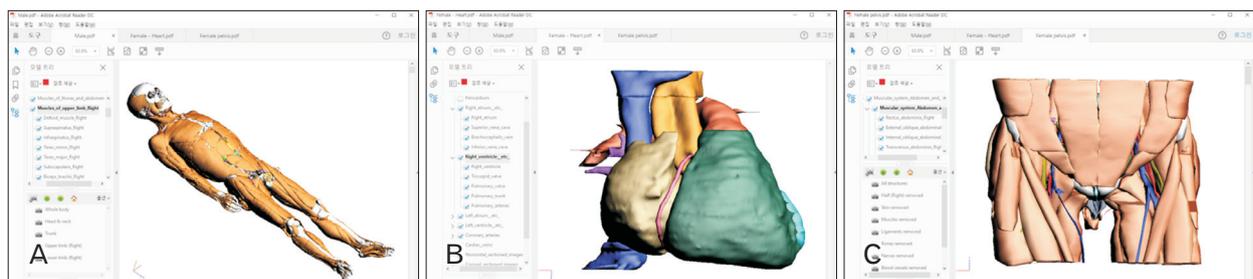

Fig. 3. PDF files of the surface models of male whole body (A), female heart (B), and female pelvis (C).
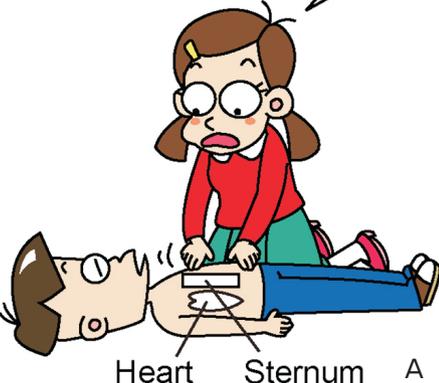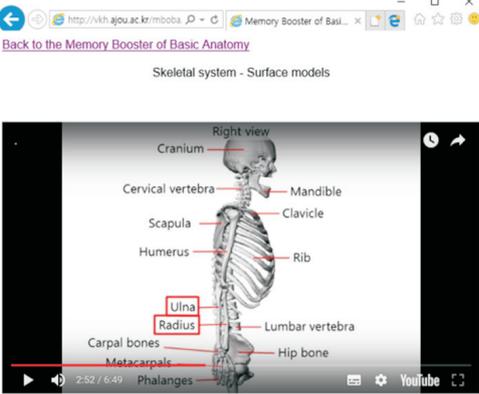
Fig. 4. Anatomy learning comics (A), anatomy comic strips (B), plastination comics (C), and auxiliary homepage of systemic anatomy (D).
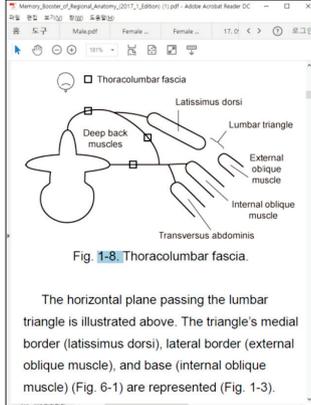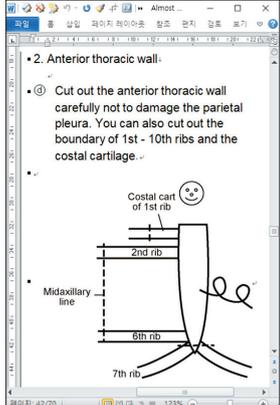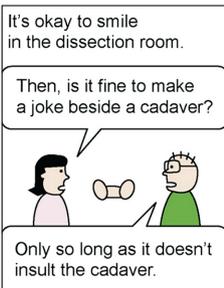

Fig. 5. Regional anatomy textbook (A), dissection manual (B), and anatomy essay (C).
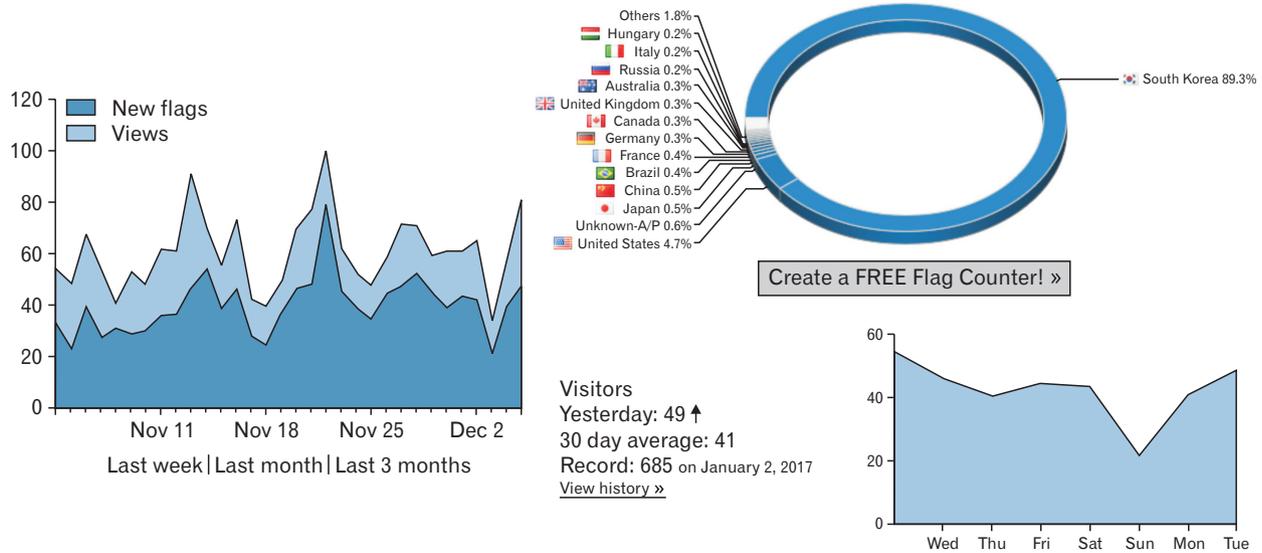
Fig. 6. Flag Counter showing the statistics of the homepage visit at December 6, 2017.

inputted into the lecture slide or examination. From the PDF files, the surface models could be picked up (Fig. 3) [6] and 3D printed for medical practice. The figures and texts in the comics and books could be moved to other learning materials. Only developers who utilize the data for commercial products have to notify the authors in advance.

Another good thing about the presented browsing software was that the sectioned images of volume models could be replaced by the clinical images (e.g., computed tomographs) for a variety of medical pedagogies [20]. The authors have experience substituting the dissected knee photos for those original images (Fig. 2) [21].

In the articles, the authors disclosed the manufacturing methods and learning effects of the anatomy contents. Dozens of articles about the Visible Korean products, anatomy comics, and books have been published, and all reprints of the articles were available on the homepage (Table 1).

The homepage had simple hierarchical menus to facilitate quickly locating desired contents (Fig. 1). On the homepage, the Korean-language menus for the same contents were placed above the English-language menus because the Korean government supported the content production. For the same reason, the project for the sectioned images and outcome products was called Visible Korean.

All contents in the homepage could be seen and obtained without charge or registration. Therefore, anatomy students were able to utilize them on their own computers. With laptop computers or smart phones, the students could see the contents even in the classroom or dissection lab. After the learning tools were downloaded, they could be operated offline with no delays.

Up to December 2017, there were 41 daily visitors on average. Most visitors were from Korea (89%), followed by America (5%) (Fig. 6). It is certain that the anatomy learning contents have been used more than the visit or download numbers showed, because the downloaded files could be copied without technical or legal restriction. Further, all the files could be uploaded and downloaded on the private Internet sites.

Discussion

The authors established this homepage to distribute anatomy learning contents to interested people around the world.

Usage by medical students

The authors recommend that medical students who dissect cadavers read the regional anatomy book. Additionally, in the dissection lab, they can utilize the dissection manual (Fig. 5) [14].

Extra contents for medical students are the various browsing software packages, made of the Visible Korean data. One is to browse the sectioned images and outlined images of the male whole body, male head, and female pelvis for learning the sectional anatomy [20]. In the near future, 2D images of the female whole body will be added on the software [3].

Another is to browse the peeled and piled volume models of the kidney, stomach, hand, etc. for understanding the morphology of the organs [9-11]. The other is to browse the colonoscopic views for learning the actual colonoscopy [8]. A supplement is to browse the dissected knees even though the images are made not from the Visible Korean data but from the dissected cadavers (Fig. 2) [21].

Usage by other students and laypeople

Health allied professional students should first look over the anatomy learning comics (Fig. 4) [13]. After they read the comics, the students can use the PDF files to manipulate hundreds of surface models of the male whole body and others (Fig. 3) [6, 7]. In the future, the surface models of the female whole body will be added [3]. Manipulating the cadaver models can somewhat substitute for actual cadaver dissection which is not easily affordable [22].

In a more convenient manner, students can learn the essential systemic anatomy using the auxiliary homepage "Memory Booster of Basic Anatomy." There, it is very easy to select comics and movies, although the movies do not permit interactive manipulation (Fig. 4) [18], unlike the browsing software and PDF files.

The easy contents (comics, PDF files, auxiliary homepage) were also for laypeople including children. Laypeople's usage is meaningful because understanding anatomy not only satisfies their curiosity but also helps them protect body health. For instance, after people acquire anatomy knowledge, they will better understand their physicians' explanations [23, 24]. The authors have exhibited some of the anatomy comic strips in a science museum to get good response [25].

Homepage policy

This homepage of anatomy contents serves as a digital library for anyone who is interested. The authors will maintain the noncommercial policy to promote popular use by anyone, especially in developing countries. This does not mean that the commercial contents such as books and software are disregarded; it means that both the noncommercial and commercial contents are needed to complement each other [26].

This homepage is under ongoing upgrades in quality and quantity and will be increasingly beneficial to enhancing the anatomy knowledge of various audiences. Examples of upcoming contents are lecture videos as well as other textbooks on systemic anatomy and neuroanatomy. The authors hope that the present report promotes other anatomists to develop their own homepages that provide competing learning tools.

Acknowledgements

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