Original Article

Estimation of Frequencies of Different 'Form's of Illustration in Two Developmental Anatomy Textbooks Commonly Recommended to the Medical Undergraduates of Bangladesh

Md Mesbah Uddin[1], Khondkar Manzare Shamim[2]

[1]Associate Professor, Department of Anatomy, Kumudini Women's Medical College, Mirzapur, Tangail. [2]Professor, Department of Anatomy, Bangabandhu Sheikh Mujib Medical University, (BSMMU), Dhaka

Abstract

Context: Medical education has entered a new era at all levels. Innovations are being in introduced in teaching-learning methods and tools. Developmental Anatomy is an intensely visual subject for many medical students, as they must conceptualise a series of complex developmental events that occur over a period of time. Effective teaching materials are not found in most of the institutions. The illustrations can be used as a handy tool to understand the complex developmental events and mechanisms.

Objectives: To analyse the presentation of illustrations in two Developmental Anatomy textbooks commonly recommended to the medical undergraduates of Bangladesh in order to determine the frequencies of different 'form's of illustration.

Design, place and period of the study: The present study was a descriptive observational study involving quantitative analyses. It was carried out in the Department of Anatomy, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, between January 2008 to December 2008.

Materials and methods: Two most commonly recommended textbooks to the medical undergraduates of Bangladesh were selected for analysing their presentation of illustrations. Six 'form's of illustration (diagram, photograph, photomicrgraph, scanning electron micrograph, diagnostic image and others) based on how they have been created and how they look like were identified. The frequency of each 'form' was also determined.

Results: The mean frequency of a specific 'form' of illustration is the highest for 'diagram' (87.35 ± 7.83)%, and the lowest for 'scanning electron micrograph' (1.32 ± 1.87)%.

Conclusions: Incorporating the findings of the present study with the modern ideas and trends in teaching-learning of Developmental Anatomy and Genetics, suggestions could be formulated on improving the methods of teaching-learning of Developmental Anatomy and Genetics in Bangladesh.

Key words: Illustration, form's of illustration.

Introduction:

An illustration is a picture that depicts or enhances a piece of text. Illustrations are used for the decoration or explanation of a text, or to reinforce concepts and thoughts delivered in written composition. Developmental Anatomy is an intensely visual and complex subject. The understanding of this subject is further hampered by the lack of effective educational materials to teach Developmental Anatomy. Effective teaching materials are not found in most of the institutions.

The illustrations can be used as a handy tool to understand the complex developmental events and mechanisms. Since imagery is a multipurpose strategy, it helps in delivering varying forms of information when combined with other instructional strategies. Illustrations can be presented to the learners to help them develop mental images in order to understand the spatial relationship.[1]

On the other hand, photographs of genetic abnormalities, pedigree charts, and other relevant illustrations may be useful for teaching-learning and assessing Genetics. It may be noted that institutional provision or use of these tools is not very common in our country.

Thus, it is very important to thoughtfully plan the proper use of illustrations in the teaching of Developmental Anatomy and Genetics, in addition to the usual way of teaching the subjects.

Materials and Methods:
The present study was a descriptive observational study involving qualitative analyses. This was carried out to determine the frequencies of different 'form's of illustration (defining each 'form' on the basis of how it has been created and how it looks like).

For the analysis of 'Preface's, two textbooks were selected for the analyses of text and illustrations. These were:
1. Datta A.K. (2006) : Essentials of Human Embryology[2]
2. Sadler T.W. (2007): Langman's Medical Embryology[3]

The basis of selection of these two textbooks was that these are the textbooks of Developmental Anatomy commonly recommended by the teachers of undergraduate medical courses of Bangladesh. They are also the ones, the recent editions of which are more easily available than of other textbooks. The study was carried out in the Department of Anatomy, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, from January, 2008 to December, 2008.

Illustration
Illustration is defined as an act or process of illuminating[4]. Marian Webster's Collegiate Dictionary describes an 'illustration' as a picture or diagram that helps makes something clear or attractive.[5]

For the present study, all forms of picture presented as figures in the Developmental Anatomy textbooks were considered as 'Illustration's. These included different types of diagrams, photographs, photomicrographs, scanning electron micrographs and diagnostic images. This was based on the definitions/meanings provided in dictionaries.

'Form' of illustration
As mentioned above, illustrations may take different forms. For the present study, six different 'form's of illustration were defined on the basis of how they have been created and how they look like. They were as follows:

- Diagram
- Photograph
- Photomicrograph
- Scanning electron micrograph
- Diagnostic image
  - Conventional radiograph
  - MRI scan
  - CT scan
  - Ultrasound image
- Others

Specific operational definitions of different 'forms' of illustration
Each illustration was identified as representing a 'form' according to how it has been created and how it looks like. The following are the operational definition of these 'form's.

1. **Diagram:** A hand drawing or a computer-aided drawing, two-dimensional or three-dimensional, that presents the gross, microscopic or functional features in a realistic, semi-realistic (simplified) or schematic (stylised/distorted/symbolic) or graphical way. Example: Figure 1-2.
2. **Photograph:** A reproduction of structural features in a macroscopic image created by using a photographic camera. Example: Figure 3.
3. **Photomicrograph:** A reproduction of structural features in a light microscope image created by using a photographic camera. Example: Figure 4.
4. **Scanning electron micrograph:** A reproduction of structural features in a three-dimensional surface view under a scanning electron microscope. Example: Figure 5.
5. **Diagnostic image:** A reproduction of:
   - A conventional radiograph Example: Figure 6.
   - An ultrasonogram. Example: Figure 7.
   - An MRI scan. Example: Figure 8.
   - A CT scan. Example: Figure 9.
6. **Others:** Any illustration that does not to be included into the above mentioned 'form's was included under this term. Example: Figure 10.

Methods of estimation of the frequencies of different 'forms' of illustration
For the purpose of the study, the illustrations of the selected textbooks were classified into the several 'forms' on the basis of how they have been created and how they look like (as defined with examples in specific operational definitions).

The illustrations were marked with different symbols according to their forms. Later they were counted following the symbols. Then, the number of each 'form' of illustration was counted and expressed as a percentage of all the illustrations used in presenting all the 'topic's of each selected textbook.

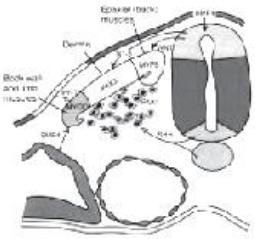

Fig.-1: An example of what 'form' of illustration was identified as a 'diagram' on the basis of how it has been created and how it looks like. This particular two-dimensional semi-realistic drawing shows the expression pattern of genes that regulate somite differentiation. (**Source:** Sadler 2007, p.145).

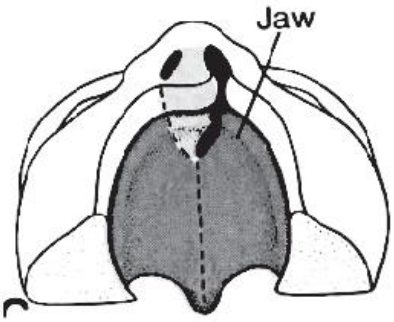

Fig.-2: An example of what 'form' of illustration was identified as a 'diagram' on the basis of how it has been created how it looks like. This particular three-dimensional realistic drawing represents the ventral view of the palate, gum, lip and nose showing unilateral cleft involving the lip and jaw and extending to the incisive foramen. (**Source:** Datta 2006, p.232).

Fig.-3: An example of what 'form' of illustration was identified as a 'photograph' on the basis of how it has been created. This particular illustration represents a photograph showing patient with Angelman syndrome. (**Source:** Sadler 2007, p.20).

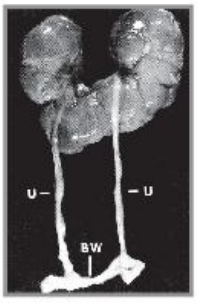

Fig.-4: An example of what 'form' of illustration was identified as a 'photomicrograph' on the basis of how it has been created. This particular illustration is a photomicrographic representation of a horseshoe kidney. (**Source:** Sadler 2007, p.237).

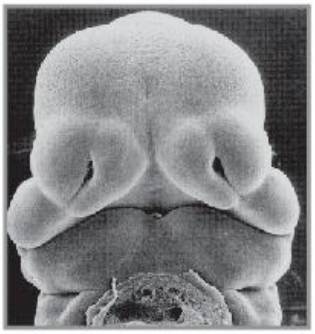

Fig.-5: An example of a specific 'form' of illustration from the textbooks analysed in the present study-'scanning electron micrograph'. This particular illustration represents a three-dimensional frontal view of a 4.5-week embryo showing the frontonasal, maxillary and mandibular prominences. (**Source:** Sadler 2007, p.272).

Fig.-6: An example of a specific 'form' of illustration from the textbooks analysed in the present study-'diagnostic image'. This particular illustration represents a 'conventional radiograph' of a newborn with a large defect in the left side of the diaphragm. (**Source:** Sadler 2007, p.157).

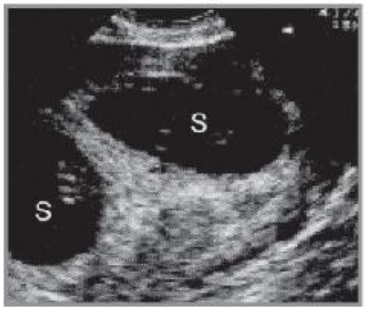

Fig.-7: An example of a specific 'form' of illustration from the textbooks analysed in the present study-'diagnostic image. This particular illustration represents an 'ultrasonogram' showing the presence of two gestational sacs (S). (**Source:** Sadler 2007, p.119).

Fig.-8: An example of a specific 'form' of illustration from the textbooks analysed in the present study-'diagnostic image'. This particular illustration represents an 'MRI scan' of transposition of great vessels (viewed from the left). (**Source:** Datta 2006, p.184).

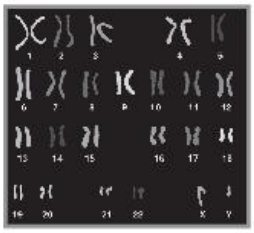

Fig.-9: An example of what 'form' of illustration was identified as a 'others' on the basis of how it has been created. This particular illustration is a chromosome painting of the entire human chromosomes. (**Source:** The image of the identification of human chromosome: Chromosome painting 2006).

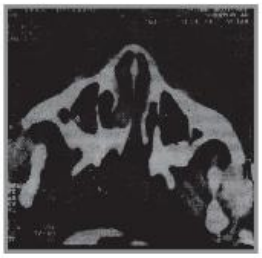

Fig.-10: An example of a specific 'form' of illustration from the textbooks analysed in the present study-'diagnostic image'. This particular illustration represents a 'CT scan' showing the posterior choanal atresia of right side. (**Source:** Datta 2006, p.136)

Results:

Percentage frequencies of different 'form's of illustration

For this variable, each 'form' was defined on the basis of how it has been created and how it looks like. The numbers of illustrations analysed (for their 'forms') in two textbooks were as follows:

a. Datta (2006) : 548 illustrations

b. Sadler (2007) : 946 illustrations

Thus a total number of 1494 illustrations were analysed for their 'form's.

It is observed from Table I and Figure 11 that the most frequent of the illustrations belongs to the form 'diagram' (92.88% in Datta 2006 and 81.82% in Sadler 2007). Photograph (4.74% and 10.89% respectively) has got the next highest value.

Table-I: Percentage frequencies of different 'forms' of illustration presented in two commonly recommended Developmental Anatomy textbooks

Sl. No	Formof illustration*	Percentage frequency in an individual text book± (%)		Mean percentage frequency for the two textbooks ± SD
		Datta n= 548	Sadler n= 946	
1.	Photograph	4.74	10.89	8.23 ± 4.87
2.	Photomicrograph	0.55	3.28	1.60 ± 1.48
3.	Scanning electron micrograph	0.00	2.54	1.32 ± 1.87
4.	Diagram	92.88	81.82	87.35 ± 7.83
5.	Diagnostic Image	1.82	1.37	1.60 ± 0.31
6.	Conventional radiograph	0.55	0.11	0.33 ± 0.31
7.	Ultrasonogram	0.36	1.26	0.82 ± 0.64
8.	MRI scan	0.73	0.00	0.37 ± 0.52
9.	CT scan	0.18	0.00	0.09 ± 0.13
10.	Others	0.00	0.11	0.05 ± 0.08

n: number of illustrations analysed in each Developmental Anatomy textbook.

* Different 'form's of illustration have been defined (according to how they have been produced and how they look like).

* Expressed as a percentage of all the illustrations used in presenting all the 'topic's in a selected textbook.

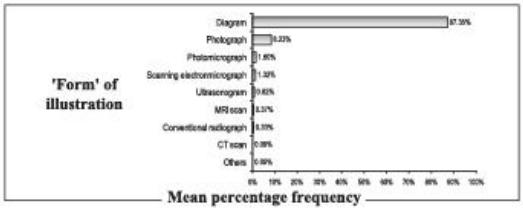

Fig.-11 Mean percentage frequencies of different 'form's of illustration presented in two commonly recommended Developmental Anatomy textbooks (arranged in the descending order of frequency).

Discussions:

The understanding that both Developmental Anatomy and Genetics are visual subjects (the former possibly being more so is essential for proper understanding of the subjects.[6] These two complex subjects must be simplified with suitable illustrations. Considering the recall of information, pictures have a superior effect.[1] Within a traditional medical course, the different forms of images are a very important didactic support of the learning process.[7]

Considering these potentials of illustrations, it is not difficult to assume that a good illustration can help students' understanding of the temporal and spatial correlations of the tissues and organs of the embryo and the fetus. And this may imply that students have to be shown adequate number of illustrations in the classes omitting the unnecessary details of the text and there is be adequate use of illustrations in the examinations as well. This will create self interest in the students' to make proper use of illustrations while studying. Although it is conceivable that much depends on what a course ask for in the examinations, Singh[8] still believes that "the student is interested in illustrations." Illustrations might be the very useful teaching-learning and assessment tools to ensure the development of proper conception on different topics on Developmental Anatomy & Genetics.

It is understandable that many of the concepts, phenomena and information of Genetics are so abstract or so difficult to demonstrate in any practical way that thoughtful textual material has to be used for presenting them. However, Molecular Genetics does not have much structural characteristics like Gross, Developmental and Microscopic Anatomy. These materials can be made more understandable by using schematic diagrams, simplified and stylized. Schematic diagrams of essential information increased learning, while schematic diagrams of non-essential information decreased learning.[9] A number of diagrams presented in Sadler (2007) are three-dimensionals. It also contains scanning electron micrographs (which by definitions are three-dimensional). Larsen[10] states that "good three-dimensional diagrams are obviously central to an embryology text".

Many organs can be studied using scanning electron micrographs of embryos at different ages. These high quality images are more easily interpreted by students and the understanding achieved can more readily be applied to clinical problems.[11]

Photographs of patients are also used in both analysed textbooks. Photographs serve as a "bridge to physical diagnosis." Photographs of rare but important disease conditions can be used for teaching-learning purposes to create interest among the students.[12]

Advances in embryonic imaging, especially ultrasound and MRI scan, have been so rapid in recent decades that medical students should be aware of the different modalities and their capabilities. Teachers can effectively use these imaging technologies in presenting material during formal coursework. This will provide students with clear-cut ideas about many real things. In addition, this will discourage students against depending only on line drawings of the 'notebooks.'

In the examinations, scanned copies of various 'form's of illustration may be used in the OSPE (spotting) as well as in the viva examinations. The questions regarding the illustrations may include identification of parts or other related ones. Other than books, various 'form's of illustrations can be collected from an online source. A Google Advanced Image search putting appropriate key words in the Exact Phrase box can bring plenty of useful images.

Conclusions & recommendations:

The results of the present study would provide some evidence of how the subjects of Developmental Anatomy and Genetics is approached in contemporary Developmental Anatomy books Selection of a list of illustrations may be made through focus group discussions in order to explore and standardise Developmental Anatomy and Genetics teaching/ learning/assessment tools in different medical colleges of the country.

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