

Digital Collage-as a Pedagogical Tool for Effective Learning of Immunological Concepts

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Abstract: Digital collage is an extended version of traditional collage which has gained immense acceptance in the recent days. It is a form of graphic art that uses virtual images from various online sources and juxtaposed together to form one assemblage to convey a specific theme. Immunology, as a course is intricately associated and holds scientific rationale for several aspects of daily life. The course provides immense scope for context-building and story-telling exercises for teaching-learning process. The objective of the pedagogical exercise was to attain a comprehensive understanding of the concept by engaging the students in active-learning through story-building and collage-making. The activity was performed for Immunology course of IV semester undergraduate students of Engineering in Biotechnology. Twelve topics, central to the understanding of the course and their applications were selected for the activity and assigned to each student group. The activity comprised three phases: 1). Drafting of technical sketch related to the topic; 2). Story-building to explain the topic & developing a digital-collage to elucidate the same and 3). Oral presentation of the activity by the group members. The contents of the technical script and stories developed were reviewed for the relevance to the

topic and feasibility for collage-making. A common template was followed to ensure an uniform pattern of collage layout. The activity was followed by rubrics-based assessment and mapping to Graduate attributes, Global competence and Performance Indicators. The activity was instrumental in addressing the graduate attributes related to understanding of domain knowledge, oral and written communications. A formal feedback based on anonymity was collected and the results analyzed. Majority of the respondents opined that the activity was a new experience which helped in deeper understanding of the concept, sensitized their creativity, honed their communication skills and incited a sense of concerted team-work.

Keywords: Digital collage, technical script, story-building.

1. Introduction

'A picture is worth a thousand words'
- Fred R. Barnard, (1927)

The term Collage takes its origin from French, meaning collar – to glue. Collage is a form of an art, which involves the assemblage of different images or any artistic work, thus creating a new whole. The origin of collage can be traced back hundreds of years, but became popular in the early 20th century as an art form of novelty. The term collage was coined by Georges Braque and Pablo Picasso when collage became a distinctive part of modern art. It finds usage

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in architecture, music, films, picture book illustrations etc.

Digital collage, also called as e-collage is an extended version of traditional collage which has gained immense acceptance in the recent days. It is a form of graphic art that uses virtual images from various online sources and juxtaposed together to form one assemblage to convey a specific theme.

Active learning approach has been proved to be more effective mode of learning which helps in internalizing the concepts and effortless retaining of memory recall of the concepts (DeNeve and Heppner, 1997). Several active learning techniques practiced involved, Group role-play (McCarthy and Anderson, 2000; Desai et al, 2016), debates (Elliot, 1993), use of games (Somers and Holt, 1993), problem based learning (Wood, 2003) and project-based learning (Bell, 2010).

Collage when used as a pedagogical tool can be instrumental in discovering the fundamental principles of design, storytelling and meaning-making of the concepts. An approach of active learning mode is more effective especially when the participants are to spend time and toy with the art of making something symbolic or metamorphic and then representing it (Gauntlett D, 2007). Narrative collage has been employed as a tool for narrating the explorations of the domain of imagination (Kostera, 2010). It is extensively used in architecture studies to understand the space-making concepts (Shields, 2014). Multipronged approach of blending free association, story-telling and collage are being practiced as research tools in marketing and management (Koll et al, 2010). Simmons and Daley (2013) advocates the use of collage as an art of thinking to stimulate scholarly work and conceptualizing research questions. While several attempts to teach Immunology with different pedagogical approaches like, virtual teaching using simulation tools, demonstration through kits have been made, the present study focuses on art-based activity through collage and story-telling as pedagogical tools. (Bercot et al, 2010).

Immunology as a course requires, microbiology, cell biology and molecular biology as pre-requisites for good understanding. The research problem that has been attempted to address in the present study using collage as a solution is to understand and remember the concepts for long-term memory . This is

attained by employing story-building activity and pictorial representation.

The objective of the present pedagogical exercise was to attain a comprehensive understanding of the scientific concepts by engaging the students in active-learning through story-building and collage-making. Immunology course was selected for the activity, since it is intricately associated with and holds immense scope for explanation of scientific rationale for several aspects of daily life. The course provides for context-building and story-telling exercises for teaching-learning process. The activity was implemented for IV Semester undergraduate students of engineering in Biotechnology.

2. Methods

A. Participants and Design of the Activity:

The activity was group-based comprising four members in each group with a total of 12 groups. Each group was assigned with a topic.

The topics chosen for the activity were central to the understanding of the course and their applications. They spanned across the chapters of the course so as to cover the course contents. Accordingly following is the table showing the various topics chosen for the study.

Table 1. Topics for Digital Collage Activity

Sl. No.	Title	Significance/rationale for selection
1	Phagocytosis	Non-specific defense
2	Primary and Secondary Immune Response	Types of Immune response
3	Humoral Immunity	Specific immune response
4	Monoclonal Antibodies	Applications & technology of production
5	MHC Restriction	Basis for organ transplantation
6	Complement System	Facilitation of primary immune response
7	Immunological Tolerance	Homeostasis and self- restraint
8	Hypersensitivity	Adversities of immune reactions
9	Autoimmunity	Types and causes
10	Immunodeficiency Diseases	Causes & consequences
11	ELISA	Antigen-antibody reaction
12	Vaccines	Types and Mechanism

B. Process of the activity:

The activity comprised three phases: 1). Drafting of technical sketch related to the topic; 2). Story-building to explain the topic & developing a digital-

collage to elucidate the same and 3). Oral presentation of the activity by the group members.

As part of the first phase, the students had to learn the theory and underlying principle of the topic and draft a detailed technical sketch of the same, so as to have an idea of the collage they were to make.

This was followed by the second phase, which involved a context-building exercise to explain the topic. The story developed were reviewed for the logical flow, feasibility for collage-making and non-deviation from the topic in focus. Due care was exercised so as not to oversimplify and dilute the immunological concept in the process.

Subsequently a digital collage was developed following a common pattern across all the groups to have uniformity. Each collage was designed with a central image having technical flow-chart, surrounded by images supporting the story/context built. Every effort was made to make the images self-explanatory by supplementing with in-built text.

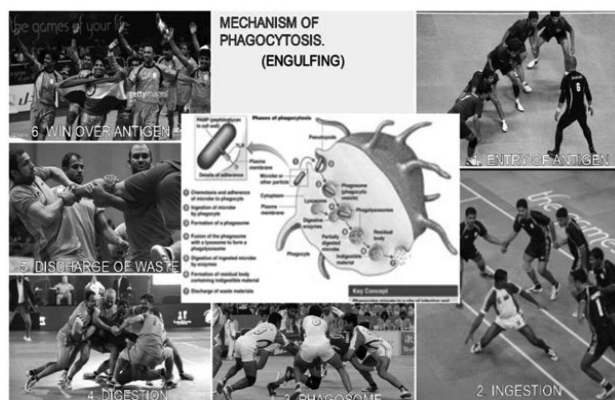


Fig. 1. Collage Illustrating Phagocytosis

The third phase of the activity concluded with oral presentations by each group with other groups and course instructor as audience. The presentation was followed by discussion highlighting the significance of the topic and relevance of the story being built.

C. Illustration of Representative Collage:

A total of 12 collages pertaining to various key concepts of Immunology and spanning across the chapters of the course content were prepared. An indicative collage of the topic 'Phagocytosis' is illustrated in Figure 1.

Phagocytosis is a process through which a cell absorbs a particle, molecule, bacterium, or other type of matter by engulfing it. Phagocytosis refers to the engulfing of larger, solid particles. Often the engulfed particle is another cell, like when a white blood cell, which is a part of the immune system, engulfs a bacterium to destroy it. It involves 5 sequential steps namely 1). Activation 2). Chemotaxis 3). Attachment. 4). Ingestion and 5). Destruction.

As depicted in the collage, a raider (antigen) in Kabaddi game initially enters the zone of opponent team (host cell). The members of the opponent team (host cell defense, macrophage) gradually surround the raider and encircle him from all sides. Once the raider is subdued (antigen neutralized) he is relegated to outside the court zone (released from the cell in the form of puss).

D. Assessment of the activity:

Rubrics-based assessment was practiced for all the three phases of the activity as shown below (Table 2).

Table 2. Rubrics Parameters for Digital Collage Activity

Phase	Rubrics Parameters
1. Drafting of technical sketch	Focus on topic, technical vocabulary, depth
2. Story -building and digital - collage	Story building-Clarity, logical flow, non-deviation from the topic Digital Collage - Quality images, self-explanatory, use of appropriate texts
3. Oral presentations	Fluency, flow of presentation,, slide quality and team coherence

E. Resources:

Open source tools for designing the collage were used. The images were obtained from online repositories and compiled to suit the topic and supplemented with appropriate texts to make them self-explanatory.

3. Results and Feedback

Attainment from the activity:

The activity was instrumental in attaining the various Graduate attributes, Competencies and Performance indicators as shown in Table 3 below.

Table 3. Attainment of Graduate Attributes, Competence and Performance Indicators

Sl. No.	Graduate Attribute	Competence	Performance Indicator
1	Engineering knowledge	Domain knowledge	Molecular biotechnology to solve problems
2	Communication	Listening, speaking & presentation	Oral presentation
3	Communication	Integrate different modes of communication	Use variety of media to convey a message in document or presentation

The activity was able to address all the seven Course Outcomes (CO) (Table No. 4) defined to achieve clear and measurable learning and facilitate proper assessment for the course chosen.

Table 4. Course Outcomes (COs) for Immunology Course

Sl. No.	Course Outcomes
1	Illustrate the concepts of scope, significance and basic concepts of immune system and immune response.
2	Discuss the fundamentals of Humoral immunity, structure and functions of Immunoglobulins, antibody production and hybridoma technology.
3	Interpret the mechanism of Cell-mediated Immunity, Major Histocompatibility Complex and Phagocytosis
4	Explain the functions of Complement system, role of cytokines, concepts of immunotolerance and Hypersensitivity reactions.
5	Apply the concepts of autoimmunity & immunodeficiency and their associated disorders
6	Describe the immunological basis of transplantation and graft rejection, Human Leukocyte Antigen, tissue typing and tumor-specific antigens.
7	Describe the basic concepts and applications of molecular immunology and immunodiagnosis in regard to vaccines and Antigen-Antibody reactions respectively.

A formal anonymous feedback was taken from students through Typeform tool. The questionnaire of Closed-ended structured format with four elements, Strongly agree, Agree, Disagree and Strongly disagree for each question was framed. Twenty four respondents participated in the survey.

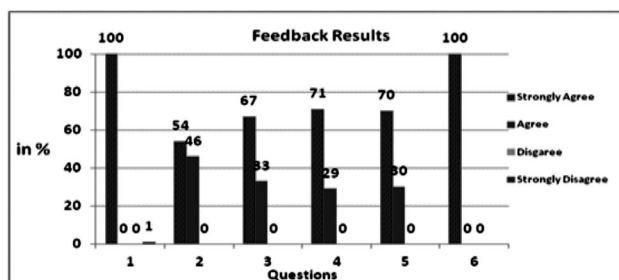
The following table (Table 5) represents the questions asked as part feedback survey.

The results of the feedback survey are shown in Fig 2. All the respondents strongly agreed that the approach was a new method of learning and the tools for making collage were easy to use. No respondents either

Table 5. Questions for Feedback Survey of the Activity

Sl. No.	Questionnaire
1	Was collage-making a new method of learning?.
2	Collage-making activity was instrumental in terms of sensitizing the creative thinking.
3	The activity helped in better understanding of the concept.
4	The oral presentation helped in improving the communication skills.
5	The topics chosen for the activity were clear and spanned across the course content.
6	Usage of software tool for collage-making was easy/difficult

disagreed or strongly disagreed to the questions in the questionnaire.



PS:The numbers on the horizontal X-axis correspond to the questions indicated in Table No 5.

4. Conclusions:

It was inferred from the feedback results that, the activity was useful to students in terms of sensitizing their creativity, provided an opportunity for context-building and able to correlate the immunological concepts and its applications to practical aspects of daily life. Nevertheless, some the activity confronted some challenges like having a logical flow of sequences in the story building, correlation of the story and technical concept and coherence of the images used for presentation.

It was concluded that the approach of Digital collage-making, as a pedagogical tool could enhance the teaching-learning process by engaging the students through active-learning.

Post activity, there exists a future scope for the assessment to be performed by the peer groups. This would make it more objective, competitive and student-centric.

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