Releasing engineers' creativity using media experience

Siu-Kay Pun

***Abstract*—** To maintain a competitive advantage to the large number of engineers produced by economic giants China and India, Singapore needs to produce engineers with an added dimension – engineers with creative minds. There has been constant restructuring of Singapore's education system to produce a workforce that can create knowledge and technology. The stress on creativity and innovation has become a key initiative in educating its young. This paper studies the creative media experience offered to its engineering undergraduates in a media literacy elective course introduced at the Nanyang Technological University. Highlighted are the rationale, approaches and delivery of this course. It discusses the outcomes based on the students' performance and examines whether media experience can benefit engineers' creative minds. It ends on the implications of media literacy on its graduates.

***Keywords*—** Creativity, Engineering education, Media literacy.

I. Introduction

Singapore has done well in its economic development over the past four or so decades, moving from third world to first. Starting with attracting labour-intensive industries in the 1960s, it quickly solved its unemployment problems and by the late 1970s there was in fact a labour-shortage such that it had to shift to attracting higher value-added capital-intensive industries. Today, with globalization and the rapid rise of the economic giants like China and India, it has to move towards a knowledge-based economy and prepare itself to compete with the developed economies in order to stay ahead and to stay relevant.

Being a small city state without any natural resources, Singapore had to depend on its human resource. This is its most important asset and has been central to its phenomenal economic success. As such, it has devoted great attention and has spared no efforts in educating and developing its human resources.

In the early days of its development, the focus of its education system has been primarily on producing the necessary engineering and technical manpower in sufficient numbers to power its industrialization program and to attract the necessary foreign investments. It has been relatively successful in this and its trained manpower has been very competent in receiving and using technology developed elsewhere. In recent years, however, as it moved towards a knowledge-based economy, it is not adequate just to be able to receive and competently apply technology, its engineering manpower will also need to be able to create knowledge and technology, and to be creative in applying these. There is the recognition of the need for its engineering competence to also be creative and to reflect the needs of business and industry. This is also in line with the vision for engineering competence in other developed countries [1, 2].

In order to produce a workforce that has the relevant and competitive edge, its education system has been repositioning and restructuring continually. In recent years, it has moved away from a fixed mould for every child emphasizing academic achievement. New multiple paths have been and are being created to allow each child to grow not only at his/her own pace but to develop his/her talent to the fullest. At the teachers' Day Rally in 2006, Singapore's Prime Minister Lee Hsien Loong pledged that "Every child's talent is valued. We must provide many paths for our students to grow and develop and to build up this whole mountain range of excellence, so that individually they are strong, but as a team we are invincible" [3].

The new technology–driven knowledge economy also puts a high premium on innovation, flexibility, entrepreneurship, creativity and a commitment to lifelong learning. Thus, creativity and entrepreneurship are incorporated into the education system to nurture inventive minds and people who keep looking for a different way of doing things. As Singapore's Education Minister, Tharman Shanmugaratnam, put it, "We know our future has to be in innovation, in every field we engage in whether in media and design, financial services, or precision engineering" [4].

Creative areas like the arts, design and media are now, more than ever before, called to play a more significant role in nurturing creativity and in a broad-based education aimed at developing the "whole person" [5]. Paul Messaris likened that, "…by acquiring visual literacy, people enrich their repertoires of cognitive skills and gain access to powerful new tools of creative thought" [6]. This is also in line with the increasingly visual society we are living in where imagery has become central to our communication, our creation of identity for human, for products and for services [7], and our scientific and technological advancement [6].

No doubt, the enGauge report has incorporated visual literacy skills as one of the essential skills for our future

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knowledge worker. It defines visual literacy as the ability to interpret, use, appreciate, and create images and video using both conventional and 21st century media in ways that advance thinking, decision making, communication, and learning [8].

II. Changes at tertiary level

At the tertiary level, one of the steps needed to meet the demands of a knowledge-based economy is the broadening of the undergraduate curriculum. This was recommended by the International Academic Advisory Panel (IAAP) in 1999. The IAAP is a 12-member international panel of experts advising the Singapore government on how Singapore can build a world-class education system to enable it to cope with the demands of a fast changing, globalized system that require people with multi-disciplinary knowledge skills and creative minds. The recommendation was to move towards a more flexible and diverse education system, one aimed at providing students with greater choice and ownership in their learning. The direction is towards a more broad-based education that nurtures creativity and innovation to help students develop holistically, in and out of the classroom.

The universities responded by offering diverse sets of free electives which their undergraduates can select to supplement modules in their Major and Minor disciplines. As the President of Nanyang Technological University (NTU), Dr Su Guaning, put it, "NTU does not intend to produce just one-dimensional engineers and accountants" [9]. As 65% of the undergraduate population at NTU consists of Engineering students, free electives including visual art and media education help to enrich and broaden the intellectual growth, and the creative and aesthetic development of the students beyond their immediate disciplines. While most of these undergraduates do not have any formal background in art and media training, incorporating visual and media literacy in a broader curriculum enables students to be not only knowledgeable in their specializations but also equipped with the skills of creativity, aesthetic perception and visual communication necessary for productive membership in the new globalized, knowledge economy. As acknowledged founder of Singapore, Minister Mentor Lee Kuan Yew said in 2003, "Americans are not interested in making goods. They see their future in a world where wealth is generated not by making widgets or cars or whatever, but by brain power, by imagination, artistry, art, knowledge, intellectual property" [10].

III. Nurturing Media Literacy at NTU

This paper examines the experience gained from a free elective course entitled "Aesthetic and Creative Techniques in the Moving Images" offered by the School of Art, Design and Media at the Nanyang Technological University. This course attempts to develop media literacy in the students and has been running for twelve semesters since January 2003. It is made available to all NTU undergraduates in a 3-hour lecture-cum-tutorial per week for twelve weeks. The majority of those who have taken this course are engineering students.

A. Rationale, structure and learning approaches

Media literacy, defined generally as "the ability to access, analyze, evaluate and communicate messages in a wide variety of forms" [11], emphasizes the skills of analyzing, evaluating, and creating media and technology messages that make use of language, moving images, music, sound effects, and other techniques [12]. This course is structured to develop the students' analytical thinking and to lay a foundation for visual perception in moving images so as to enable them to become effective visual communicators when using moving images. Among the topics covered are the frame of mind they need to have when watching television, motion pictures and TV commercials; how they can recognize illusion and reality; how they can make sense of cinematic images; how they can recognize, respond to, interpret and analyze moving images and their intended messages; and how they can develop their aesthetic sense.

Students are firstly introduced to the nature of television medium to understand the difference between images that are created on the screen and the reality of our world. This is to provide them with the proper frame of mind when seeing moving images on the screen. The video on the Rodney King incident was used for illustration and analysis as to how the video was made to mean what various people, in various contexts, decided it should mean. It also brings across the point that the power of television comes from the power that visual messages have in manipulating human emotions [13].

Once students have the proper frame of mind, they are introduced to the various cinematic techniques used by well known classical and contemporary directors. This is to prepare students with the language of moving images in order for them to comprehend the art of cinema and the illusion created by the directors to manipulate audience attention, expectation and emotion. Examples of works by these directors would be projected on the screen. Using discussion style, students are brought to recognize and understand how directors can use, for example, close up shots to review details or heighten the drama; telephoto lens to give a foreshortening effect that does not exist in reality; wide angle lens to provide better perspective so that a punch with a fist close towards the camera appears to knock someone down; composition of the cast to suggest roles they play at that particular moment; a subject seen at low angle can imply an overpowering and authoritative figure as opposed to one seen at eye level or at high angle; fast camera movement can quicken the tempo and excite the audience; lighting can create mood, be it sunny, joyful, upbeat or dark eerie suspense; music and sound effects can also be used to create mood, guide the audience emotions and actively shape how we perceive and interpret the image. In our digital age, the roles of visual effects and computer graphic imagery play in the art of cinema. While all these cinematic techniques may seem to be separate entities, they are later brought to the students in a composite whole in the

technique using the art of editing [14].

In the second level of cognition in the course, the students start to experience the director's manipulation of cinematic space and time. Here students experience a new dimension, namely the fourth dimension, on the screen as they learn how directors seek to control the audience's attention and anticipation by contracting and expanding screen time or creating a rhythm by patterning screen time. Similarly, students can also recognize how directors can draw their audience in and lead them along by various means of constructing cinematic space, for example, using a wide establish shot before close up shots to reveal the details as opposed to revealing the details of the action in isolation before establishing their connection. Directors can also place two or more events together in parallel editing to create another dimension and meaning to the storyline. This experience of cinematic space through sight and sound in the fourth dimension provides a new way of seeing and perceiving moving images for the students and serves as a foundation in cognitive learning, in comprehension and understanding that can later progress to interpreting the meaning of the images and the message intended.

Students at this stage are formed into small groups of three to four and, as a group, watch, brainstorm and analyze short films shown on the screen. They then present their analyses to the whole class for further comments and discussion. Students are also given opportunity as individuals to respond to a film shown in class by writing his/her analysis. This enables them to further reconstruct and organize personal knowledge and understanding.

During these exercises, students are encouraged to view the selected film as many times as they need, to relax, enjoy and immerse totally especially while watching the first three times. This is to give room for spontaneous feelings to come forth and to experience the aesthetic composition of the moving images. Repeated viewings of the same short film also provoke new ways of seeing…"every single time they saw these films they saw something different…they understood that the same object can represent different things" [15]. This provides the platform for interpretation and for the understanding of the message intended. Comments on their written analyses are given by the lecturer to further guide them in their creative experience.

Students are also given the opportunity to apply what they have learnt by creating a storyboard based on a given scenario. During class, they form themselves into small groups of three to four. Each group would then brainstorm to conceptualize creative and novel ideas using the cinematic techniques learnt to construct the storyboard for film production. In this team environment, students learn to explore creative, novel ideas, challenge one another's minds, learn from another's talent and finally present their storyboard to the whole class for further comments and discussion. Figure 1 illustrates the learning model employed.

IV. Learning Outcomes

A. Written analyses based on a film shown in class

Based on the experience of the past twelve semesters, a large number of the students performed well, showing that even engineering students, with their technology bias, are able to understand and make good use of the moving images for effective communication. Based on the performance of the students in their written analyses, they can be grouped broadly into three categories.

The first category consists of analyses that are well written and communicated. Most of the cinematic techniques employed by the director were identified. Their interpretations

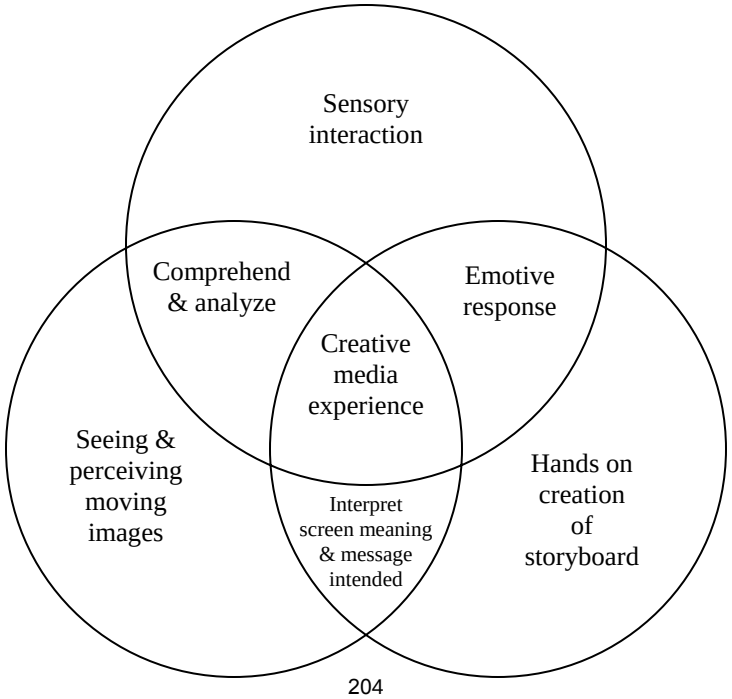

Fig. 1. Learning Model for Media Literacy.

of screen images and sound were perceptive and very thoughtful with new ideas that often surprised even the lecturer. They responded with their senses and expressed their feelings to what they saw. They were able to grasp the intended message by the director. On the average, 28% of the students fall under this category.

The second category consists of analyses with ideas well communicated. For this group, a good number of the cinematic techniques employed by the director were identified. Their interpretations were sound and appropriate. However, they tended to be more descriptive with only some analytical inputs. Students responded with their senses and were able to grasp the intended message by the director. 53% of the students fall under this category.

Students in the third category tended to mislabel the cinematic techniques used and provided very descriptive interpretation without any analysis. A few also misjudged the message intended. 19% fall under this category.

B. Creation of storyboard in small groups

When it comes to creation of the storyboard, again based on the experience of the past twelve semesters, 66% of the students put in much effort in brainstorming to come up with creative and novel ideas. With the given scenario, they added in surprising plots, twists and turns, and sad or humorous endings. They also attempted creative cinematic techniques to attract and hold the audience's attention and to give suspense. These students also had fun and enjoyed working together.

The rest, comprising 34% of the students, presented their storyboards without the elements that can draw the audience in, excite the audience, draw their feelings, and make them feel tense, or give them a surprise. The cinematic techniques this group of students employed tended to be the standard type without much evidence of creativity.

C. Creation of storyboard by individual during examination

During a two-hour examination, students were tasked with two questions, each comprising 50% of the total marks. The first question was to create a storyboard based on a given scenario using the professional format learnt in class. Students were judged on the cinematic techniques they employed, whether these techniques were used suitably and whether they exercised their creative minds by injecting unexpected twists and turns to the storyline. Students were required to justify their choice of cinematic techniques used. The other question was based on their understanding and comprehension of subjects learnt in class.

Based on the data collected from the examination papers conducted in the past twelve semesters, an average of 65% of the students were able to employ appropriate cinematic techniques that held viewers' attention and led to very good development of the storyline, usually with very few technical mistakes. While the rest of the 35% were able to apply the cinematic techniques to achieve good results, they were found to make occasional technical mistakes, for example, unnecessary jump cuts or unclear development of the storyline. 38% of the storyboards created included surprising plots, twists and turns while 50% of the storyboards showed some attempts made at including these although the storylines fail to excite the readers. 12% followed the given scenario without any attempt made to inject any creative elements into it. 15 % were unable to complete creating the storyboard given the time frame allotted for the examination.

V. Conclusion and Implications

It can be concluded that engineering students, with their technology-biased background, can be nurtured to be more creative by exposing them to creative media experience as indicated in this study. Though nearly all of these students have no background in either visual or media literacy before they took this course, the majority of them learnt to respond with their senses and were able to perceive and comprehend the visual messages after taking just one elective course. 66% were able to generate interesting and novel ideas for the storyboards when working in a group. When working individually and given a fixed time frame in the examination, presumably under pressure, 65% of them were able to create good development of the storyboards while 38% even included surprising plots, twists and turns. They were able to acquire the ability to rapidly produce ideas, one of the traits common in people of high creative ability according to Guilford [16].

According to the survey of students' feedback conducted at the end of each semester, the majority rated this elective course very favorably. They enjoyed watching the films shown in class and most fed back that they have gained much insight in perceiving moving images and would be more analytical in interpreting the director's intended message. Most felt that the cinematic techniques learnt would help them in their future careers and they are confident that they will be more creative and effective in using moving images to communicate. Some would like to take additional electives in media literacy including video production.

Moving images increasingly play a more dominant and active role in our economy, in our communication, marketing, entertainment, scientific and technological pursuit. With rapid globalization, to stay ahead of the pack, engineering graduates will not only need to be equipped with the traditional technical and engineering skills but they will also need to have minds that are creative and innovative. Today's workers who are multidisciplinary and effective visual communicators will have a competitive edge over others. Media literacy will play a bigger role in educating our young to be creative and competent as they embark in their future careers.

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