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Exploring the Attitudes of Students Using an Edutainment Graphic Novel as a Supplement to Learning in the Classroom

Abstract

Educators have successfully used various forms of entertainment media to inform the public about a wide range of subjects. Some of these methods have been implemented as learning tools for use in an academic setting. This study explores the attitudes of a student population using print education-entertainment as a supplement to classroom learning. In this participatory study, biology students reviewed a custom cell biology graphic novel (comic book) before studying the subject in an enrolled course, and provided feedback on how they felt about using it as a complementary learning aid in a Q-Methodology survey.

The cell biology graphic novel was designed and written by the primary investigator using similar structure and informational content found in multiple high-school and college-level textbooks. Q-sample statements were then developed by the primary investigator. These statements were sorted (Q-sort) by participants according to which statements they agreed or disagreed with most. The results of this Q-Method study have outlined five different attitude profiles within the tested population, each indicating which aspects of this education-entertainment were most important to the students while learning basic cell biology.

Introduction

Overview and purpose.

The concept of educational entertainment is certainly not new. In fact, this constructive medium can be traced back to early Greece, where Aristotle

discussed the capability of the dramatic arts to teach moral lessons (Piotrow, 1994). Since then, 'edutainment' techniques have been developed and employed to effectively inform families, communities and patients through various mediums of entertainment. Print works, electronic interactive applications (Sward, Richardson, Kendrick, & Maloney, 2008), television programming, music, and even performance art, such as improvisational theater (Newcomb & Riddlesperger, 2007), have been utilized to present health messages stealthily, as if merely to entertain. In fact, Mexican producer Miguel Sabido has even developed a novel soap opera delving into sexual health, AIDS prevention, and family planning (Piotrow, 1994). These progressive methods of 'edutaining' have been proven as pervasive, attractive, emotion-invoking, persuasive [and in some cases] profitable approaches to informing the public (Piotrow, 1994).

It seems we have learned one thing over the years, and that is entertainment media has the power to attract people to activities that result in both rewarding and memorable experiences. These engaging events are revisited at leisure to provide equally gratifying results for individuals and larger groups. To its detriment, however, such media is often criticized by scholars, parents and the public, who regard these "addictions" as distractions from traditionally constructive or educational activities. For example, an article from LiveScience.com suggests that video games hinder learning for young boys (Rettner, 2010). The key to shifting individuals away from the addiction and to the education is to combine the entertainment with learning.

In recent years, the conception of 'edutainment,' or media designed specifically to both entertain and educate, has broadened the scope of traditional education. This format, though still debatable as a substitute to traditional teaching methods, may prove effective as supplemental material or informal introductions to classroom topics; for example, a student who watches a prime time medical drama on the risks of sun exposure may recall the characters, scenarios, and perhaps even technical jargon in a classroom discussion on melanoma weeks later. In effect, passive exposure to information-enriched entertainment may prove beneficial as a method of making connections, recalling information, enhancing memory, and stimulating interest in academic subjects.

The effects of supplemental/casual edutainment are yet to be determined, but qualitative studies can pinpoint student engagement in the subject matter; thus, drawing conclusions about the benefits on learning. These results may ultimately broaden our understanding of student epistemology. But before any of this can be done, it is important to understand our audience so that we can effectively target the broadest possible range of students.

In this study, a graphic novel on cell biology was designed by the primary investigator and presented to students prior to their unit on cell biology. After the unit exam, a Q-methodology study was conducted in order to define the specific attitudes towards using the graphic novel as a supplement to learning.

Significance of the study.

Studies on modern entertainment-education are relatively few and far

Keywords: edutainment, Q-methodology, biology, learning, education, epistemology

between, yet the genre appears prevalent in both our educational systems and culture. In such instances as medical drama and television programming, research on mainstream entertainment and its entertainment-education initiatives has offered new insights on how to evaluate and improve future media for educational purposes. In one study, the impact of breast cancer-based storylines (from popular series' *ER* and *Grey's Anatomy*) on primetime audiences was explored by assessing their attitudes, knowledge, and behaviors after exposure to both programs (Hether, Huang, Beck, Murphy, Valente, 2008). It was found that individual program exposure offered moderate impact on breast cancer awareness, while combined display of both stories was most effective at changing positive impact outcomes. These results provided insight on how to improve the impact of future entertainment goals in education and health.

In other forms of entertainment-education, studies have provided a basis for discussion and further research. Short film has been proven effective at educating Nigerian communities on HIV-related risks (Lapinski & Nwulu, 2008). Radio drama has had positive behavior-changing effects on Botswana residents when it comes to HIV safety and stigma (Pappas-DeLuca et al., 2008). Even educational card games (Odenweller, Hsu, & DiCarlo, 1998) and video games (Duque, Fung, Mallet, Posel, & Fleiszer, 2008) have been successful at promoting learning and engaging students in medical topics. All of these examples have provided health educators with new models of effective teaching that appeal to contemporary audiences.

In this particular study, supplemental education-entertainment print media has been introduced in a college level cell biology course for the first time, taking the primary step to creating effective edutainment: understanding the audience. Using Q-Methodology, we are able to understand the strengths and weaknesses of this edutainment graphic novel as described by the end users (aka. students). By looking at factors such as information recall and learning

engagement, educators can use the information provided to potentially develop a more engaging, rather than passive, curriculum for students.

Narrative, entertainment, and learning.

Narratives have been particularly effective at conveying information through popular media. Of the documented cases, many of these fall under the category of televised 'medical dramas,' in which health information is communicated to the audience through story, dialogue, and plot. Studies conducted by Mohan J. Dutta (2007) at Purdue University have demonstrated that "...individuals who learn something about disease and its prevention from television soap operas and prime time programming are more likely to be health-oriented than individuals who do not learn something about disease and its prevention from television soap operas and prime time programming." In a similar study, Latino populations in the United States were more likely to pursue breast cancer screenings after exposure to *telenovelas* about the subject (Wilkin et al., 2007). Through narratives, the motivating power of entertainment media can constructively encourage subject retention of information on selected topics.

Similar motivating effects have been observed in print edutainment media as well. When applying educational narrative to print, edutainment media may take on the form of full length novels, as with the works of best-selling author Michael Crichton, or illustrated children's books, such as the award-winning *Magic School Bus* series from Scholastic Inc. In one study by Putnam & Yanagisako (1985), "...a 16-page, 4-color comic book was developed as part of a multimedia public education campaign designed to improve skin cancer knowledge and prevention/detection behavior." Over 90% of readers indicated that the comic book was easy to read, understand, and was also interesting. Once distributed, data were collected, revealing a 29.5-44.3% increase in sun-exposure prevention behavior.

Few, if any, studies have been conducted to define the attitudes of a student body using supplemental/casual print edutainment in parallel to classroom learning. If and when these studies are done, their results may shed light on how to develop powerful new learning tools. These innovative, new, supplemental entertainment-education materials can then effectively prime future students for learning in a more traditional environment.

Methodology

Materials: 'Edutainment' graphic novel on cell biology.

Todd & Bhu Conquer Cell Biology is an original, highly stylized and plot-driven graphic novel on basic cell biology written and illustrated by the primary investigator. Like a traditional comic book, framed images are used to describe story progression and action while text bubbles are used to contain dialogue. The narrative, which follows two students desperately trying to escape a giant cell in order to attend their final exam, is designed to cover as much information as possible while maintaining an engaging, fast-paced plot.

Important information on cellular organelles and cellular functions was initially acquired from high school and college-level biology textbooks, such as *The World of the Cell* (6th Ed.) by Becker, Kleinsmith, and Hardin (2006), and *Biology* (6th Ed.) by Campbell and Reese (2002). These sources provided structure and guidelines for the most fundamental information on cell biology. Character development, plot progression, dialogue scripting, and concept storyboarding were then applied using the core educational information as the framework for entertainment content. Completed drafts were reviewed, and a final version of the novel was digitally painted and prepared in *Adobe Photoshop*. A virtual interactive comic book was then developed using a demo *Adobe Flash* application from *FlashPageFlip.com* in order for students to easily access the material. The interactive demo allows the user to turn the pages of the comic book virtually, simulating realistic magazine dynamics.

Materials: Q-Sample, condition of instruction & answer sheet.

Because the study involved the viewpoints and opinions of the participants, Q-methodology was the most effective method of obtaining data. Q-Methodology is a combination of qualitative and quantitative statistical techniques utilized to extract commonly shared opinions regarding a specific topic of inquiry. It is an appropriate tool for measuring small sample sizes to extract the most common opinions shared by a targeted population. The qualitative methods of the Q-Methodology allow for factor analysis of the most commonly formulated opinions identified after the data are collected (Valenta & Wigger, 1997).

To begin, the primary investigator developed a list of twenty-three (23) subjective statements (Q-Sample) that expressed the opinions to be extracted of the participating subjects (see Appendix). These statements both indirectly and directly explored the following questions:

- Did you have prior knowledge of cellular organelles before reading the graphic novel?
- Did you learn new concepts/ideas/information from the graphic novel?
- Was the graphic novel enjoyable? Entertaining? Humorous?
- Were you able to recognize organelles from events in the novel while in lecture?
- Did you find the novel helpful in understanding concepts?
- Did you recall information/events from the graphic novel during your unit assessment? During your studies prior to your assessment?
- Would you read the graphic novel again now that you have knowledge on the subject? Would you find it more enjoyable?
- Would you say you were more interested in learning cell biology after reading the novel?
- What was the novel most/least successful at accomplishing?

In addition, the survey participants were given detailed instructions, using

My views on the cell biology graphic novel

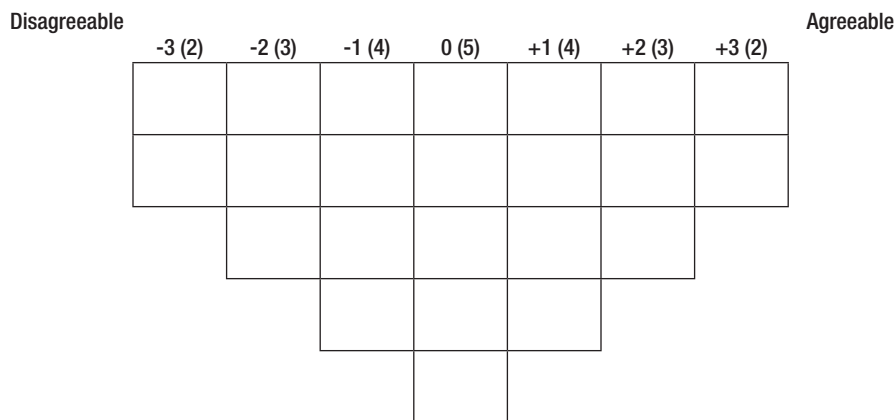


Figure 1: Sorting grid answer sheet

a ‘Condition of Instruction,’ on how to proceed with the sorting method of Q-Methodology. The Condition of Instruction is a brief description of the research topic (theme) articulated in the form of a question that the subjects are to use as a reference point while sorting the Q-Set statements. The expressed goals of the research and the topic itself was also described. A Q-methodology answer sheet was developed in accordance with standard design procedures (Figure 1).

Methods of inquiry.

Communication and collaboration with the University of Illinois at Chicago’s biology department and its faculty provided access to testable subjects. Forty-nine students were recruited for the Q-methodology survey and graphic novel review. Consent forms were given to volunteers to fill out and return to the primary investigator within 24 hours. All participants in the study were 18 years or older and enrolled in a biology course teaching the basics of cell biology.

Students participating in the graphic novel review and Q-Methodology survey obtained access to an electronic copy of the custom graphic novel. This occurred one week before the onset of their unit on basic cell biology. Subjects were then instructed to review the graphic novel during the week prior to their academic unit, and return to it at their leisure until the end of the study.

After the conclusion of the course section on basic cell biology, students were given the 23 Q-Set statements and an answer sheet. With these, they proceeded to perform a Q-Sort. Keeping the Condition of Instruction in mind, the subjects were asked to configure the sorted statements and place the ranked statements on a blank answer sheet. The Q-Sort (ranked statements) represents the one-hundred percent (100%) subjective responses reflecting the participants’ opinions.

There were 23 statements to sort. The participants were asked to place the sorted statements in order from “Most Agreeable” to “Most Disagreeable” in the grid-designed answer sheet (Figure 1). For example, each participant’s two most agreeable statements (identified by the assigned numbers on the Q sample list) were placed in the two boxes at the far right of their grid and each participant’s two most disagreeable statements would be placed in the two boxes at the far left of their grid. A duration of 15-20 minutes was sufficient for the completion of this activity.

Population/Sampling methods.

The population of participants consisted of 49 individuals between the ages of 18 and 21 who were enrolled in a biology course covering basic cell biology at the University of Illinois at Chicago. There were 12 male participants and 37 female participants. These students were not compensated for participation, and

the study remained solely on a 100% voluntary basis. Eligibility criteria required participants to be English-speaking. Faculty at the partner institution identified a population of eligible students, and recruitment occurred prior to a scheduled biology class.

Methods of analysis and interpretation of data.

The Q-sort responses indicate how the students felt about the graphic novel and how it may have helped in their learning and review experiences. All raw data analysis has been completed using a Q-methodology program, PQMethod

software, PQM 2.11, available via: <http://www.lrz-muenchen.de/~schmolck/qmethod/downpqx.htm>.

Statements and raw sort data were input into the PQMethod software using STATES and QENTER program prompts respectively. Values are given to the seven sort data columns of the grid (Figure 1). The value range ascends from -3 (most disagreeable statements) to +3 (most agreeable statements) with 0 being neutral. Once all 49 sorts were entered into the PQMethod program, a Principal Components analysis was performed. This analysis effectively takes the raw data file created by QENTER, a compilation of all student responses, and computes and outputs a correlation matrix into another file. This correlation matrix describes relationships between all pairs of data in the set. In addition, an un-rotated factor loadings file was also created (Schmolck, 2003).

By rotating the factor loadings with the QVARIMAX, the primary investigator performed a conventional factor analysis, creating multiple rotation loadings for comparisons. These factor-analyzed statements revealed a limited number of definitive corresponding patterns from the collection of entered Q sorts. These correlations are indicative of similar viewpoints, which will describe each group's attitude towards using the graphic novel as a learning aid.

The program add-on *PQROT* automatically flags values to associate with specific factors. Then the QANALYZE prompt is initiated to provide the primary investigator with a complete statistical output of the collected Q sorts. With these data, the primary investigator was able to infer conclusions based on the patterns of thought behind each factor group.

Results

The 49 voluntary participants (over the age of 18) represent the majority of students enrolled in the course. Analysis of the Q-sorts resulted in a five factor solution (i.e. the factor array), that is, five distinctly different attitude profiles defined by the respondents' perceptions. The following noted statements not

Table 1: Factor Q-sort values for each statement

No.	Statement	No.	Factor Arrays				
			I	II	III	IV	V
1	I learned new concepts from the graphic novel.	1	1	-2	2	3	0
2	I found the graphic novel entertaining.	2	3	-1	2	-2	3
3	I found the graphic novel humorous.	3	1	-2	-1	-3	1
4	I found the graphic novel enjoyable.	4	2	0	1	-1	2
5	The graphic novel made me aware of new concepts.	5	1	0	0	2	-1
6	I remembered events from the comic book while in lecture.	6	-1	-1	1	3	1
7	I recalled events from the novel during my unit test.	7	-2	0	0	1	0
8	I remembered events from the novel while studying.	8	-2	0	0	1	-1
9	I would read the novel again since I have studied cell biology.	9	-3	-3	-3	0	-1
10	The graphic novel helped me visualize cellular organelles.	10	-1	1	1	2	1
11	The graphic novel helped me understand cellular organelle functions.	11	-1	0	2	2	0
12	I would find the comic more enjoyable now that I have studied cell biology.	12	0	-1	-1	-3	2
13	After reading the novel, I became interested in learning about cells.	13	-3	-3	-2	-2	0
14	Before reading the novel, I was interested in learning about cells.	14	-2	-1	-3	-1	-2
15	Entertainment media like the graphic novel makes learning more enjoyable.	15	2	3	-1	1	3
16	I would like to use entertainment media like this graphic novel in my school classes.	16	3	3	-2	0	2
17	I enjoy entertainment that applies non-fiction science topics.	17	2	-2	-2	-1	-2
18	The graphic novel was organized.	18	0	1	3	0	0
19	The graphic novel was informative.	19	0	2	3	1	-1
20	The art style of the graphic novel was appealing.	20	1	1	1	0	-2
21	I would use the graphic novel as a reference on cellular organelles.	21	-1	1	0	-1	-3
22	I would recommend this novel to classmates and friends.	22	0	2	-1	-2	1
23	I became more familiar with cell biology topics after reading the novel.	23	0	2	0	0	-3

Standard Deviation = 1.719

Variance = 2.957

only characterize each group, but also define the individual within that group. Statements with a salient +3 or -3 rating define the most important opinions of each attitude profile (Table 1).

Students loading on the first factor (I) found the graphic novel entertaining (statement 2, with a highly salient +3 rating) and would like to use entertainment media like this graphic novel in their school classes (statement 16). They would not, however, read the novel again after taking cell biology (statement 9, with a highly negative importance, -3 rank) or were not any more interested in cell biology after reading the novel (statement 13). These responses indicate a desire to use entertaining edutainment in school, without taking up an interest in the topic or significantly learning from

the novel. Other significant statements include +2 rankings for statements 17 (“I enjoy entertainment that applies non-fiction science topics.”), 4 (“I found the graphic novel enjoyable.”) and 15 (“Entertainment media like the graphic novel makes learning more enjoyable.”) as well as significant -2 rank for statements 14 (“Before reading the novel, I was interested in learning about cells.”) and 7 (“I recalled events from the novel during my unit test.”). Factor I was labeled the “diversion seeking” group (Table 2).

Participants loading on the second factor (II) felt that entertainment media like the graphic novel makes learning more enjoyable and would like to use such media in their courses (statements 4 and 16). However, as with factor I, these

students felt that they were not interested in learning cell biology after reading the novel nor would they read it again after taking the course (statements 13 and 9). Other statements include significant +2 rankings for statements 23 (“I became more familiar with cell biology topics after reading the novel.”), 19 (“The graphic novel was informative.”) and 22 (“I would recommend this novel to classmates and friends.”) as well as significant -2 rankings for statements 1 (“I learned new concepts from the graphic novel.”), 3 (“I found the graphic novel humorous.”) and 17 (“I enjoy entertainment that applies to non-fiction science topics.”). Because their responses seem to indicate positive feelings towards entertainment-education, Factor II was labeled the “pro-edutainment” group (Table 3).

Those Q sort respondents that loaded on the third factor (III) found the graphic novel both informative and organized (statements 18 and 19) but were never interested in learning cells before reading the novel (statement 14). They also indicated that they would rather not read the novel again now that they understand cell biology (statement 9). Significant +2 rankings are given to statements 11 (“The graphic novel helped me understand cellular organelle functions.”) and 2 (“I found the graphic novel entertaining.”) while -2 rankings are given to statements 17 (“I enjoy entertainment that applies non-fiction science topics.”) and 13 (“After reading the novel, I became interested in learning about cells.”). Because this group doesn’t hold a passion for the subject matter and tends to focus on the structure of the novel, Factor III is dubbed the “strictly business” group (Table 4 on the next page).

The fourth factor (IV) loaders remembered events from the comic book while in lecture and learned new concepts from the graphic novel (statements 6 and 1). They also reported that they did not find the novel to be humorous and would not find it any more enjoyable now that they have studied cell biology (statements 3 and 12). Factor IV was named the ‘information recall’ group. Other statements that define this group are indicated by +2

Table 2 – Factor I Profile: The ‘Diversion Seeking’ Group

Grid Position	Number	Statement
+3	2	I found the graphic novel entertaining.
+3	16	I would like to use entertainment media like this graphic novel in my school classes.
0	12	I would find the comic book more enjoyable now that I have studied cell biology.
0	18	The graphic novel was organized.
0	19	The graphic novel was informative.
0	22	I would recommend this novel to classmates and friends.
0	23	I became more familiar with cell biology topics after reading the novel.
-3	13	After reading the novel, I became interested in learning about cells.
-3	9	I would read the novel again since I have studied cell biology.

Table 3 – Factor II Profile: The ‘Pro-Edutainment’ Group

Grid Position	Number	Statement
+3	15	Entertainment media like the graphic novel makes learning more enjoyable.
+3	16	I would like to use entertainment media like this graphic novel in my school classes.
0	4	I found the graphic novel enjoyable.
0	5	The graphic novel made me aware of new concepts.
0	7	I recalled events from the novel during my unit test.
0	8	I remembered events from the novel while studying.
0	11	The graphic novel helped me understand cellular organelle functions.
-3	9	I would read the novel again since I have studied cell biology.
-3	13	After reading the novel, I became interested in learning about cells.

rankings for statements 5 (“The graphic novel made me aware of new concepts.”) and 10 (“The graphic novel helped me visualize cellular organelles.”), as well

as significant -2 rankings for statements 13 (“After reading the novel, I became interested in learning about cells.”) and 2 (“I found the graphic novel

entertaining.”). Refer to Table 5 for the Factor IV profile.

Finally, students loading on the fifth factor (V) found the graphic novel to be entertaining (statement 2) and felt that entertainment media like the graphic novel made learning more enjoyable (statement 15). However, they did not feel that the graphic novel should be used as a reference on cellular organelles (statement 21) nor did they become more familiar with cell biology topics after reading the novel (statement 23). A ranking of +2 for statements 12 (“I would find the comic book more enjoyable now that I have studied cell biology.”) and 16 (“I would like to use entertainment media like the graphic novel in my school classes.”) was found, as well as a significant -2 ranking for statements 14 (“Before reading the novel, I was interested in learning about cells.”) and 17 (“I enjoy entertainment that applies non-fiction science topics.”) indicating that these statements are also very important to (aka. define) this factor. Based on these responses, Factor V was labeled the ‘entertained’ group (Table 6).

Discussion

This Q-methodological study revealed five distinct attitudes towards the graphic novel and learning among students enrolled in a cell biology course: (I) diversion-seeking, (II) pro-edutainment, (III) strictly business, (IV) information recall, and (V) entertained. The primary differences and similarities between these five attitude profiles towards edutainment and learning will be discussed. In addition, the characteristics of the edutainment that appealed to these groups as well as the potential edutainment had for these specific groups will be examined. Because this is a Q method, the ratio or number of students that fall under each category is not provided, only their viewpoints will be explained.

‘Diversion-seekers’ are individuals that enjoy being entertained and prefer activity over tedium. They would rather use edutainment materials in class over traditional teaching methods, but do not linger on topics for long. New, engaging

Table 4 – Factor III Profile: The ‘Strictly Business’ Group

Grid Position	Number	Statement
+3	18	I found the graphic novel organized.
+3	19	I found the graphic novel informative.
0	5	The graphic novel made me aware of new concepts.
0	7	I recalled events from the novel during my unit test.
0	8	I remembered events from the novel while studying.
0	21	I would use the graphic novel as a reference on cellular organelles.
0	23	I became more familiar with cell biology topics after reading the novel.
-3	9	I would read the novel again since I have studied cell biology.
-3	14	Before reading the novel, I was interested in learning about cells.

Table 5 – Factor IV Profile: The ‘Information Recall’ Group

Grid Position	Number	Statement
+3	6	I remembered events from the comic book while in lecture.
+3	1	I learned new concepts from the graphic novel.
0	9	I would read the novel again since I have studied cell biology.
0	18	The graphic novel was organized.
0	20	The art style of the graphic novel was appealing.
0	23	I became more familiar with cell biology topics after reading the novel.
0	16	I would like to use entertainment media like this graphic novel in my school classes.
-3	12	I would find the comic book more enjoyable now that I have studied cell biology.
-3	3	I found the graphic novel humorous.

Table 6 – Factor V Profile: The ‘Entertained’ Group

Grid Position	Number	Statement
+3	2	I found the graphic novel entertaining.
+3	15	Entertainment media like the graphic novel makes learning more enjoyable.
0	1	I learned new concepts from the graphic novel.
0	7	I recalled events from the novel during my unit test.
0	11	The graphic novel helped me understand cellular organelle functions.
0	13	After reading the novel, I became interested in learning about cells.
0	18	The graphic novel was organized.
-3	21	I would use the graphic novel as a reference on cellular organelles.
-3	23	I became more familiar with cell biology topics after reading the novel.

media must be constantly introduced in order to keep them amused. Neutral responses from this group suggest that the graphic novel was somewhat informative, as they were indifferent about becoming more familiar with cell biology after reading the novel. Edutainment for this group is like any other form of entertainment, and if it is introduced into a curriculum it may be effective as a teaching method, as long as it isn't overused.

The 'pro-edutainment' group is excited about the prospects of education-entertainment. Not only is it enjoyable to them, but they strongly agree that it should be used in school. This demographic is one of the most responsive to edutainment and seems to be enthusiastic about its application. In fact, one respondent that fell in this category was so receptive that they commented on their survey saying, "I think [the graphic novel] was awesome and there wasn't enough room to agree with all the statements!" Neutral responses suggest that the novel helped somewhat with recalling information during their exam and studying. In addition, it helped somewhat at informing them about cellular organelles and new concepts in biology. Like their diversion-seeking counterparts however, 'pro-edutainers' are driven to constantly search for new material and will not re-read material or become interested in a topic overnight.

Of a different mindset, the 'strictly business' group are more interested in the technical aspects of this particular edutainment piece. They are neutral about its ability to help recall information and educate. Instead, individuals in this factor are more interested in how informative the novel could be as well as its organization. These people were not thrilled with revisiting the novel after their exam or even learning cell biology in the first place. Though they found the novel to be moderately enjoyable, edutainment on cell biology may not appeal to individuals with this viewpoint.

The 'information recall' factor holds true promise in the field of edutainment development. These individuals feel

strongly about the graphic novel's ability to aid them in recalling information and teaching them new concepts. In addition, the graphic novel aided these individuals in visualizing and understanding cellular organelles and their functions (statements 10 and 11, both with a +2 rating). As the most responsive group to this particular edutainment, this group also gave neutral responses for organization, art style appeal, and their thoughts on reading the novel again after their exam. They didn't, however, find the graphic novel humorous or feel that they would get any more enjoyment out of the novel after studying the topic. This leads the primary investigator to believe that the particular aesthetic and writing of this novel may not be completely suitable for this group.

Finally, Factor V is defined as the 'Entertained' group, since the majority of the statements these individuals agreed with pertained to how enjoyable or entertaining the novel was to them. They agree that edutainment can make learning more fun, and enjoy the notion of just being entertained. Unlike diversion-seekers, these individuals do not feel as strongly about not reading the novel again or not cultivating an interest in cells after reading the novel. In fact, these responses were border-line or neutral. However, they don't feel that this edutainment should be used as reference or for short-term learning goals.

Of the five groups mentioned, it is suggested that broad-spectrum, entertainment-heavy edutainment be designed specifically for individuals in all Factors excluding Factor III (aka. the 'strictly business' group). By emphasizing engagement and entertainment aspects, Factor I and Factor V groups ('diversion seeking' and 'entertained' groups respectively) will be more responsive towards using edutainment in the classroom. To appeal to Factor I (a.k.a. the 'diversion seeking' group) and II (a.k.a. the 'pro-edutainment' group), fresh, episode or series-based edutainment can appease the constant search for new material. Information-heavy entertainment-education material can also be specifically tailored for Factors II (a.k.a. the

'pro-edutainment' group) and IV (a.k.a. the 'information recall' group) as they tend to benefit from this area. Research pertaining to popular art styles, scenarios and humor should also be researched in order to appeal to a specific demographic (as mentioned with the 'information recall' group).

These conclusions can benefit both educators and developers of edutainment media. In the classroom, understanding how different students will react to using edutainment is essential to successful learning methods with these materials. Future studies on this subject may also describe how a teaching curriculum can further benefit, or even be built around, edutainment media. In fact, a future study defining the percentage of students within each factor may refine and prioritize these strategies even further. With this information, edutainment developers can understand how to create successful media targeting specific groups of students. These strategies will maximize both the educational and entertainment values to each specific factor, resulting in the most effective product.

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- Appendix – Condition of instruction and the list of 23 Q sample statements**
- Condition of instruction: Which of the following statements would you rank as "Most Agreeable" to "Most Disagreeable" when describing your experience with the graphic novel?
1. I learned new concepts from the graphic novel.
 2. I found the graphic novel entertaining.
 3. I found the graphic novel humorous.
 4. I found the graphic novel enjoyable.
 5. The graphic novel made me aware of new concepts.
 6. I remembered events from the comic book while in lecture.
 7. I recalled events from the novel during my unit test.
 8. I remembered events from the novel while studying.
 9. I would read the novel again since I have studied cell biology.
 10. The graphic novel helped me visualize cellular organelles.
 11. The graphic novel helped me understand cellular organelle functions.
 12. I would find the comic book more enjoyable now that I have studied cell biology.
 13. After reading the novel, I became interested in learning about cells.
 14. Before reading the novel, I was interested in learning about cells.
 15. Entertainment media like the graphic novel makes learning more enjoyable.
 16. I would like to use entertainment media like this graphic novel in my school classes.
 17. I enjoy entertainment that applies non-fiction science topics.
 18. The graphic novel was organized.
 19. The graphic novel was informative.
 20. The art style of the graphic novel was appealing.
 21. I would use the graphic novel as a reference on cellular organelles.
 22. I would recommend this novel to classmates and friends.
 23. I became more familiar with cell biology topics after reading the novel.