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**BOBCATSSS 2010 @ Parma, Italy**

*Dates: Monday 25th, Tuesday 26th, Wednesday 27th January, 2010*

**Bridging the digital divide:  
libraries providing access for all?**

**Connecting the public with science:  
comic books and libraries**

Arsev Umur Aydinoglu  
University of Tennessee

Suzie Allard, Ph.D.  
University of Tennessee

## Introduction

Scientific and technological advancements have made the world a more complex place to live (Castells, 1996; Friedman, 2008; Nicolescu, 2002) and are considered important to a nation's economic health as well as to the quality of life for citizens (American Competitiveness Initiative, 2006). In everyday life citizens are confronted by a plethora of science issues ranging from nanotechnology (e.g. Anderson, 2010; Barras, 2009; Brindell, 2009; Fletcher, 2009; The power, 2009) to genetically modified food (Batista & Oliveira 2009; Fennell, 2009; Smith, 2007)) to climate change (e.g. Steyn 2010; Walsh & Ramzy, 2009; What lies beneath, 2009). This suggests that formal education provided by schools needs to adapt quickly to the rapidly growing complexity in the environment, however, schools are often limited by lack of funding and specific curriculum requirements. Librarians already facilitate the scientific process by being active partners in the full information life cycle for audiences including scientists and citizens. However, reaching young people poses a special challenge and the positive lessons learned from graphic novels (Crawford, 2004; Downey, 2009; Heaney, 2007) suggest that libraries can supply another media that facilitates young people's interest in science information through another media that is also very attractive -- comic books. To support the idea that comic books are a valid media to collect and provide access to, this study explores how comic books readers are reacting to comic books in relationship to information about science, technology and scientists with particular attention on how comic books spur information seeking.

The high level of interest in comic books is reflected in the marketplace. According to John J. Miller (2007), in 2007 over 85 million comic books<sup>1</sup> were sold in the United States by Diamond Comic Distributors. This translates into a market share of almost \$430 million USD. However, this number only represents one distributor in the U.S. and does not include overseas sales and sales by other distributors through convenience stores, newsstands, and mass-market bookstores. In fact, total market size is estimated between \$660-700 million USD (Shapiro, 2009) representing growth from around \$300 million USD only a decade ago. However, the market is much bigger in the Asia. Manga, mostly known as Japanese black-white comics, market is estimated around \$6 billion USD. In summary, comic book (or mangas) sector is a huge and have considerable impact people's lives not only economically but also culturally.

## **The existing literature**

To set the background for this study, three areas of literature were reviewed: comic books, popularization of science and technology, and entertainment-education strategy.

### **a. A Brief History of Comic Book Studies**

For this paper a comic book (or comics in short) is defined as a magazine of a number of drawings in order (sequential) and text (though not necessarily all the time) used together to tell a story. Generally it consists of 24 to 32 pages. Graphic novel is a number of comic books that are combined together to tell a coherent story. The first study about comic books by Fredric Wertham (1954) argues that violence, crime, drug use and other adult behaviors in comic books were encouraging young people to engage in crime. Today many of his arguments seem antiquated, but at the time his views were thought-provoking. He suggested that comic books were promoting homosexuality, based on his

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<sup>1</sup> Top 300 comic books only.

analysis of the close relationship between Batman and his sidekick Robin and on his analysis that Wonder Woman was strong and independent; therefore, she had to be lesbian. In the context of the times, and because Wertham was a respected psychiatrist working with troubled youth, his ideas were quite influential (Nybert, 1998). Parents were alarmed and comic book sales dropped drastically.

Since that time many studies have been done on comic books, some on their relevance to art and aesthetics (e.g. Harvey, 1996; Carrier, 2001), some on their relation to culture (Wright, 2003), gender (Lavin, 1998; Noh, 2008), and violence (e.g. Kirsh, 2002a & 2002b; cite), and some on their uses in education such as language (e.g. Cho & et. al, 2005; Ranker, 2007), art (Berkowitz & Packer, 2001), and business ethics (Gerde & Spencer, 2008), and political science (Thomas, 1983).

There are several prominent peer-reviewed journals on comic books including **ImageText** published by the University of Florida, **European Comic Art** published by Liverpool University, **Deutsche Comicforschung**, **Mechademia** published by the University of Minnesota and **Studies in Graphic Narratives** published by Felici Editore Srl. Studies related to comic books have also been published in journals that have a more general focus on communication. For instance, Journal of Popular Culture has been a medium that published many studies about gender, race, military, sex, violence, drug use representation in comic books; effects of comic books on children and young people; comics and culture; superheroes – modern mythology; history of comics; politics and propaganda in comic books and cartoons; students and comics; and justice in comic books (Rhode, 1996).

A recent exemplar of comic books and science is Rifas' (2007) examination of the effects of comic books on people's perception of nuclear power plants. He notes that in 1960s, the when comic books were being financed by energy companies, there was

support for nuclear power plants. However in the 1970s independent comic books (also known as underground comics) emerged which began taking a position against nuclear power plants and at this time citizens began to follow the environmentalist movement<sup>2</sup> which also did not support nuclear power.

Rifas' study was exceptional. There have been only a few studies exploring science and comic books, and none focusing on what readers think about science, technology and scientists. This study was undertaken to begin exploring that gap.

### **b. Popularization of science and technology**

Popularization of technology has always been important. Since the Medieval period, books were disseminated among the members of guilds on masonry, gunpowder, papermaking and block printing (Vickery, 2000, p.36). The interest in such publications is never lost, though their scope has increased enormously –especially in this digital age. On the other hand, popularization of science, excluding medicine, was only a minimal issue until the World War 2. Medicine is excluded from this statement since interest in popularizing basic medical information was a high priority prior to WW2 because the price to be paid for a lack of knowledge is so high. For instance, Barry (2004) notes the efforts in 1919 to create public awareness campaigns to fight the Spanish Flu, which eventually killed 5% of the world population.

Beyond medicine it took another great threat to focus public attention on science. Gregory and Miller (1998, p.36) note that the atomic bomb began focusing public attention on science. Initial interest highlighted Einstein and Oppenheimer but interest peaked when Russia launched the first satellite, Sputnik, in 1957 which caused panic

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<sup>2</sup> It is also been argued by some by some scholars that the increase in scientific literacy triggered the environmentalist movement as people started to interpret the things that had been done by scientist and industry.

among U.S. citizens, and which created a national dialog about science. As Gregory and Miller (1998, p. 40) note:

“President Eisenhower responded to journalists’ questions about U.S. science with the remark, ‘Well, let’s get this straight. I’m not a scientist’; and scientists leaped into the public arena armed to the teeth with the ideas for putting the United States back in its rightful place at the top of the scientific heap.”

Also in 1957, the American Association for the Advancement of Science was established and since then, many programs have been implemented to reduce scientific illiteracy from broadcasting documentaries (e.g. programming that may be seen on networks such as Discovery Channel or BBC) to publications for laymen (Stephen Hawking’s *A Brief History of Time* or Desmond Morris’ *Naked Ape*), to basic science education in schools. Several decades later, in the 1990s, a new type of science fiction novel gained popularity. These novels provide extensive amount scientific facts with scientific citations; although, they are fiction. This genre is called ‘ficta’ and the prominent author in this genre is Michael Crichton (Briar, 2006).

The use of comic books to popularize science had started with promoting reading. From the beginning of 19<sup>th</sup> century, comic books had been used to promote reading and language learning (Dorris, Curtis & Rampal, 1995). Later, the net had got wider and many articles were written on the use of comic books and cartoons in the classroom for disciplines such as history, political science, and other social sciences; to stimulate discussions, to illustrate lectures, and to teach social science reporting (Thomas, 1983). In order to promote reading and have many children in their libraries, librarians also started to show interest in comic books and some policies were created to serve these goals (Gorman, 2003).

Finally, in the last two decade comics had been used to explain complex scientific facts. Here some studies are provided to demonstrate how comic books and cartoon strips

could be used for this purpose. First, Cheesman (2006), a professor of biology, argues that comic strips can be used as a pedagogical tool for understanding science concepts, getting students' attention, introducing a new topic and stimulating critical thinking. Second, Christensen (2007, p.227), a researcher at Energy and Environmental Research Center, recommends the use of graphic novels to stimulate critical conversations in social science classes such as conflicts, wars and holocaust by explaining the power of comics very efficiently: "The visual component of graphic novels supports text comprehension, making the stories accessible to readers at all levels." The third study by Noh (2008) investigates how science, technology, and women are represented in Korean sci-fi girls' mangas by a textual analysis on four texts of Korean girls' comics. Finally, according to Curriculum Review (2002) Kakalios, a physics professor at the University of Minnesota, "has become a minor celebrity for using super-heroic examples to get students excited about the freshman physics course." Kakalios did not make his students directly engage in comics but he used examples from them, such as Flash and X-Men, in order to explain basic physical concepts such as velocity, vibration or Doppler shift.

### **c. Entertainment-education strategy**

Singhal and Rogers (2003) define entertainment-education as "the process of purposely designing and implementing a media message to both entertain and educate, in order to increase audience members' knowledge about an issue, create favorable attitudes, shift local norm, and change the overt behavior of individuals and communities" (Singhal & Rogers, 2003, p.288). This strategy does not endorse the traditional dichotomy found in mass media content – that mass programs should be either entertaining or educating. (Singhal & Rogers, 2002). The strategy was introduced in broadcasting through a Mexican soap opera, *Simplemente Maria*, in which the main

character promoted young girls to enroll to adult literacy and sewing classes. These programs earned high ratings, involved audience members emotionally, and spurred interpersonal conversations among the audience (Singhal & Rogers, p.292). Because of the narrative approach, pleasurable activity and appeal to the emotions, this approach proved its usefulness and later used in promoting health messages many times all over the world.

International organizations have used the entertainment-education strategy in order to reach young audiences. For instance, World Bank has started a manga (Japanese style comic book) series of eight books in three languages (English, Chinese and Indonesian) to be distributed free of charge to a target audience of children between 12 to 18 years old in developing countries to promote Millennium Development Goals, which are eight goals set by donor institutions to overcome underdevelopment. While telling an exciting story, the comics provide information on poverty, HIV/AIDS, global warming, child soldiers, corruption and so on (World Bank, 2005, 2006, 2007, 2008). Following that example, the United Nations has started to work together with Marvel Comics to use “Spider-man and the Incredible Hulk to create a comic book showing the international body working with superheroes to solve bloody conflicts” (Brewster, 2007).

## **The Research Question**

Comic book heroes and villains often have histories that tie them directly to science. Most of the superheroes are a result of an accident or wrong doing during an experiment in the laboratory (if they are not intentionally being mutated there). For instance; Spiderman was bitten by a radioactive spider; Hulk was exposed to Gamma rays, whereas Fantastic Four to cosmic rays in a space shuttle; Flash inhaled chemicals in a laboratory hit by a lightning, and all of the X-Men are genetically mutated (Gresh &

Weinberger, 2002). Their archenemies are also a result of science: Dr. Octopus, Green Goblin, Lizard, Dr. Doom (Gresh & Weinberger, 2005). Both superheroes and super-evils use weapons, vehicles and accessories that are created by high technology. Here are a few examples: Iron-man's armor, Batman's car 'batmobile', Scarecrow's poisonous fear gas, Hawkeye's special arrows and Green Goblin's glider (Gresh & Weinberger, 2002 and 2005).

This suggests that science and technology are a main focus of comics. Therefore, examining comics helps us better understand popularization of science, comic books should be examined. This is especially important since many people start reading comics at an early age and the first impression people have of science is very likely to influence their construction of reality. Therefore, this study explores the question "what does science, technology and scientist mean to a comic book reader?"

Some researchers have studied how Hollywood movies influence audience attitudes towards scientists (Terzian & Grunzke, 2007) but there has not been a similar study conducted with comic book readers. This study will hopefully fill the gap in the literature.

## **About the Study**

The research question for this study is approached through the constructivist paradigm since this paradigm deals with 'meaning'. Meaning is very important as Blumer (1969, p.2) puts it: "... human beings act toward things on the basis of the meanings that the things have for them. This study explores the meaning of science, technology and scientist. Therefore, participants' mindset is important and only the constructivist tradition lets participants express their thoughts and emotions freely. As Glaser and Strauss (1967) point out, the paradigms that employ quantitative methodologies, imply positivism and post-positivism, and do not listen what data tells them. They are designed

to verify or falsify existing theories. Guba (1990) agrees with this statement arguing that because positivism and post-positivism believe there is one Truth, these paradigms' views are restricted only to look for that Truth. Even though post-positivism accepts people have different realities; and thus, modifies their understanding of objectivity, in the final analysis they look for Truth. On the other hand, as Guba names it as 'the theory ladenness of facts', "the facts that are collected must be *independent* of the propositional (theoretical) statements" (1990, p.25). In his ground breaking book, *The Structure of Scientific Revolutions*, Thomas S. Kuhn (1962) also addresses how collecting data according to a paradigm let disregard facts, which is named 'anomaly' in that context. It is obvious that science cannot advance if it disregards facts.

Guba points out the flaws of positivism and they can be applied to this study as well. For example, the researcher cannot interview every comic book reader in Knoxville, the researcher is aware of that he is not free of values during his study, and there will be an interaction with the participants to a certain degree; although, he will manufacture distance (1990, p.25-6). Therefore, only constructivist paradigm suits this kind of study.

Guba notes that constructivism is relativist in terms of ontology which means "realities exist in the form of multiple mental constructions" (1990, p.27). This study intends to learn more about how people construct the image of science, technology and scientist based on the comic books to which they are exposed. There are as many constructs as there are participants because each participant has a different interpretation of the world. There is no right or wrong; consequently, the only position the researcher can take is being a relativist.

As for epistemology of constructivism, "if realities exist only in respondent's minds, subjective interaction seems to be the only way to access them" says Guba (1990, p.26). In fact, in quantitative methodologies subjective interaction is employed as well

because, for example in surveys, the participant is asked how he or she sees the world from the window of the researcher. It is a clear subjective interaction indeed (though positivist researchers do not accept).

Methodologically, Guba states that as the aim is identifying constructs as many as possible, hermeneutic and dialectic process should be used, so that while the former “consists in depicting individual constructions as accurately as possible, the latter “consists of comparing and contrasting these existing individual constructions” (1990, p.26). Qualitative techniques, such as long interview give the opportunity to do so and this study is going to generate data with it.

In conclusion, by using the constructivist paradigm, the researcher takes relativist position in terms of ontology and subjectivist in terms of epistemology.

## **Methodology**

Participants: The participants of this study were selected from heavy comic book readers around Knoxville, Tennessee. The Knoxville metropolitan area has nearly 700,000 residents and is the third largest city in the state. It is home to the main campus of the state university, and to many businesses and services. A heavy reader is someone who reads more than 7 books per year (Stutman & Cassady, 1983, p.13) . Based on this, for this study we define a heavy comic book reader as one who has read at least 7 graphic novels which translates into approximately 42 comic books<sup>3</sup>. Since there are countless genres in comic books, in order to increase the possibility of science and technology exposure, readers of science and technology related mangas, such as mechas (giant robot mangas), and superhero comics were interviewed. In superhero comics characters and their equipment are mostly developed through science and technology.

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<sup>3</sup> Generally a graphic novel consists of six issues of a comic book.

The participants were contacted through a local comic book store. All of them were males between the ages of 18 to 29 years old. Their professions are as follows: a senior high school student, a craftsman's apprentice, a PhD student, and a business owner. No monetary incentive was provided to the participants; their participation was purely voluntary. Participants were given a statement of the research purpose, they read and signed the informed consent form and all of sessions were audio recorded. The interviews took place at the local comic book shop store and a coffee shop.

Data Collection: Data were generated by interviewing the participants. McCracken's *Long Interview* method was used as it "can take us into the mental world of individual, to glimpse the categories and logic by which he or she sees the world" (1998, p.9). This "sharply focused, rapid, highly intensive" (p.7) method allowed the researcher to have a better understanding of how the participants saw science and technology, the limits of science and technology, and the relationship with the reality.

According to the constructivist paradigm, people are active meaning makers; there are multiple realities and they only exist "in the context of a mental framework (construct) for thinking about it" (Guba, 1990, p.25) Therefore, the long interview is the appropriate data generation method as it allows the researcher to understand the mental framework of the participant through free conversation. The researcher used a discussion guide (a set of questions to be asked to reveal the mental construct of the interviewee) in order to let the participants explain and depict their individual constructs –hermeneutic approach. Each participant was asked the same questions; however, the order of questions was different each time because of the different development of the interviews with each one of them. Encouragement and relevance are crucial in interviews; for this purpose, the subsequent question emerged from the last reply of the interviewee whenever possible, which resulted in asking questions in different order. This is also appropriate to constructivist theory because it sees inquirer and inquired together and "findings are

literally the creation of the process of the interaction between the two” (Guba, 1990, p.27).

### **Interview Questions**

What is the frequency of your reading?

What is your favorite genre? Why?

Who are your favorite heroes & villains? Why?

What do you think about the scientists in comic books?

What do you think about the use of science in comic books?

What is the role of technology in comics?

What’s your opinion about the explanations in the comics that tell how something works?

When you read something, do you go & check it?

Does the knowledge provided in the comic enforce what you know or contradict with it?

Do you think they are real/possible/exaggerated?

Any ideas on how should science be depicted in comic books?

What do you think about scientific literacy and comics?

### **Table 1 – Discussion Guide**

To answer the question of how many interviews are enough, the redundancy criterion was applied, which means that interviews were conducted until a pattern in their responses was observed (McCracken, 1998, p.37). Age, status, education and occupation contrast was considered in the selection of participants so that distance between the researcher and participant could be manufactured. The contrast helped to eliminate biases by distributing them among different features of the participants.

The analysis of data began immediately as the interviews began. The epoche concept is important at this phase and the interviewer eliminated or at least gained clarity

about, preconceptions (Patton, 2002, p.407) and manufactured distance (McCracken, 1998, p.22), to help assure that the data was as free of bias as possible. Since every word said and action taken by the researcher during the interview could have an effect on the response, the researcher minimized these effects and encouraged the participant to express his or her mental construct. This was ensured by the subsequent questions and the floating responses which were emerged from the immediate analysis of data. McCracken's five staged analysis was used to analyze the data. These stages are observation, expanded observation, observation, theme, and interview theses (p.42-6). The researchers did not fit the data to a previous theory for verification but identified results coming from the data and facts as Glaser and Strauss argue (1967). This avoided understanding the phenomenon according to the researcher's paradigm and instead focused on understanding the mental framework of the participants.

For data to be credible they must exhibit "symptoms of truth", which are exact, economic, mutually consistent, externally consistent, unified, powerful and fertile (McCracken, 1998, p.50). Unless these conditions present, it means that the study does not have the appropriate standards. These standards establish credibility and in order to obtain them Patton recommends:

1. "rigorous techniques and methods for gathering high-quality data that is carefully analyzed, with attention to issues of validity, reliability, and triangulation;
2. the credibility of the researcher, which is dependent on training, experience, track record, status and presentation of self; and
3. philosophical belief in the phenomenological paradigm..." (2002, p.461).

For this study, in order to obtain high quality and carefully analyzed data, the interview was prepared and conducted with special care referring to the methods whose success were proven before such as long interview. The interviews were audio recorded

and verbatim transcribed. In reporting the results the reader may assess validity directly from quotes which are provided as much as frequently as possible.

Since this study is an exploratory one, the 'open-topic write-up' approach is employed in respect with herding and landing objectives which "allow rich and abundant data to speak to the reader" (quoting as much as possible) and "provide a clear and vivid sense of the ethnographic particulars while also showing the general formal properties and theoretical significance of these data" (make the necessary connections with previous studies, if possible) (McCracken, 1998, p.58). It is important to use the passages of respondents' words and descriptors because they provide a basis for accepting, rejecting, or modifying the conclusions to the reader. Moreover, they are needed in assessing the validity of the study.

## **Findings**

Analytic induction produced three categories related to the reader and comic book relationship: characters liked, scientific knowledge and triggering effect, feasibility and reality.

### **Characters liked**

Superhero comics' readers expressed similar taste for their likes. While Spiderman, Batman, Ironman and X-Men are the most popular superheroes among these readers, Magneto and Dr. Doom are the most popular villains. Some of these super characters do not possess superpowers. Ironman and Dr. Doom use a metallic armor, Batman uses leather armor; and all of these armors are high tech products, some of them beyond today's technology. The powers of the rest are imaginary such as walking on walls, producing spider-webs, controlling metal objects, telepathy, and telekinesis. Even though the powers and equipments they possess are imaginary and non-feasible (to a

certain degree), interviewees stated that they like them because they are “real” and they feel connected to the characters.

“And so with the superhero books, what you got? You got characters in one way or other the good ones they connect on some level with the reader. Spiderman, everybody is at that point sometime. Everybody knows what it is like not be able to do, out of luck. Everyone knows what’s like to be discriminated. That’s what X-Men is for. It’s something that connect on various levels to somebody. And you can feel it. You can understand why, when the characters are well done, you can understand why they work as well as they do.”

This participant refers to Spiderman’s real identity, Peter Parker. When he was a student, Peter Parker was unpopular among students: a geek with glasses, a slim body, and he was often bullied by other students. Even after gaining his superpowers, his personal life has been a mess always. Actually, that is the reason behind the Spiderman comics’ success. Everybody found something related to themselves in Peter Parker and influenced by him in one or other way.

The struggles and limitations that superheroes face (especially in their daily life) are common characteristics of heroes in Marvel Comics. The other big comic company, DC Comics, has heroes that are unattainable, invincible and free from daily problems such as Superman and Wonder Woman which made the participants unable to connect with them.

“Why Marvel? That’s a priority quite a few people take. Because DC characters are iconic and the only ones I listed before (Batman and Flash) are the ones that enough human nature attached to them, that they are not from another planet trying to interact with this planet. They are real people having to overcome limitations or things that they’ve been put into against their will or powers that they’ve been given that they have to understand that in order to relate exist and continue doing what they need to in this world to get by as well as use their power for a positive nature.”

The exception is Batman for DC Comic heroes. He does not have any super powers and his life is full of tragic events, and his name came up many times among the

most loved superheroes during the interviews such as “I really like Batman too” or “Anything from Batman.”

People prefer to feel connected to the characters. One of our participants was a trained scientist. When he was asked about the evil genius scientist stereotype in comics, he reacted immediately and expressed his dislike about the idea of evil or nutty scientist stereotype in comics. He cannot feel connected to the scientists depicted in comics because he know what scientists are like in real life:

I don't like the idea of the evil scientist or the nutty professor in that matter. It does seem like that they make it sound a little bit more lightly to go insane or something. If it wasn't such a common theme, it wouldn't be bad I guess. A professor flips out once in a while –it happens in real life but it seems to me a pretty reoccurring theme in comics.

### **Scientific knowledge and triggering effect**

Comic books exposed readers to some scientific facts while they were reading. Different from entertainment-education models, these comic books have neither theory-based message designs nor supportive multimedia campaigns; however, they are pretty influential. One participant, who attends high school, said that he became aware of nanotechnology from comic books.

“... actually Grant Morrison did a story a couple of years ago where they use where the Sentinels turned into nanoids, then flow through mutants bloods to keep them in control. And when you sit back and think about it and –had a friend in University of St. Louis studying biomechanical engineering, studying how you can do this stuff in people, how you can put nanoids in someone. Then you look at a different standpoint it is a little bit scary because if you can get something like that into somebody's blood or whatever it's insane. And it's something actually happening now. ... I learnt nanotechnology from comic books.”

Another participant, who is only a high school graduate, gave an example related to subatomic particles that he learnt from mangas.

“Some other pieces of equipment they used so called positron rifle which basically fires a beam of positrons to the target which reacts on the subatomic level resulting in explosion. ... They say that this space based weapon would

be very effective. The problem of firing it into earth is because of air molecules.”

Readers noted how comic books exposed them to complex issues of biology and physics. Below are two examples about physics:

“Flash taught me physics. Because in order to judge how you gonna hit somebody, how far he goes back, how much you speed he is gonna pick up the velocity, acceleration, travelling. They taught me a lot. They taught me physics, they taught me vocabulary.”

“The idea in physics that there is more than just one world, there are multiple worlds, when you are in different world, you made different choices. Because I read *Crisis on Infinite Earths*, all that kind of stuff, I can get the idea. It makes sense to me. It’s not completely random. It’s not that farfetched. Because I got a mental image of what I know about it.”

We learned that readers found that comic books provided direct information about scientific facts through story-telling and extras at the back page. In addition, comic books served as an indirect source through triggering individual information-seeking and stimulating discussions among readers. When they were asked if they did further research<sup>4</sup> on the things they saw in comic books they replied that they did.

“Absolutely! Because it’s the science stuff or literary references they make, if something that I don’t know, I wanna learn more about it.”

“Oh, yeah! Absolutely! That’s the purpose of reading. In my opinion, in general, in could be a comic book, it could be a regular book, it could be a textbook, it’s to expound on a subject that you know nothing about or enjoy or want to know more about that.”

Sometimes this further research is not about learning something new but for checking or confirming the existing knowledge.

“Yeah, it does and that’s about as deep as it goes. I have never been spurn to see serious research from it. But, yeah, google or Wikipedia or something. Because I wonder, for some things I realize that they are not outright also but exaggerations. It makes me wonder how much of it exaggeration here, what’s actually feasible.”

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<sup>4</sup> Research here does not mean a scientific research; it is just looking into Google or Wikipedia or going to a library.

The other indirect information source is the discussions among readers. As they feel that they are emotionally attached to the characters or even the places that stories take place (Marvel Universe, Gotham City, Metropolis, post-apocalyptic world and etc.), they quickly involve in long discussions on the characters, plots, equipments, vehicles and even ‘what if’s’<sup>5</sup>. These long discussions also serve to a better understanding of scientific facts.

“I hear this many times as a comic book shop owner like being a bartender. You get to hear everybody. Always tell you about ‘I have this idea why a lightsaber should work.’ And then they start breaking it down. They tell you about taking Carbon and things, putting in a microwave, getting that blue arc and then saying ‘Now, we need something to contain the energy and have it slow like the lightsaber does as well as to absorb the energy that is released and turn it around and use the energy.’ You look at them and say ‘Get a girlfriend’.”

### **Feasibility and reality**

The readers believe that some events, equipment or powers in the comics are farfetched, odd and exaggerated; whereas they also believe that many things are feasible. All of the participants expressed this dual view about feasibility. It is unclear how they do the judgment for farfetched or exaggerated things. While they are discussing the issue, they demonstrate high knowledge of science such as lightsaber, jet propulsion, X-Jet, nanotechnology. The inspiration to scientists mentioned as well.

“Who would have thought that you would be able to download movies or use a compact disc or the communicators on Startrek are now cellphones.”

“I think that can change the world moves because kid opens a book, Spiderman and sees something, sonar. And decides ‘I like that, I’m gonna learn more about that’. So then goes to library, open a book, reads about sonar systems, the way it is used, communicate with whales. Next thing you know, you got somebody who can learn to communicate with another animal.”

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<sup>5</sup> What if basically means what would happen if it did not happen that or this way. It has become so common that later comic book companies published many ‘what if’ series exploring these alternative stories such as ‘Conan in New York’ or ‘Marvel 1602’.

The participants also expressed interest in explanations in the story line or at the end of the story. Participants were asked which is more preferable ‘explanation of scientific facts’ or ‘action’, and most participants expressed a preference for having more explanations. Only the participant who is a scientist said that he is not satisfied with the explanations because they are wrong sometimes.

## **Discussion**

The purpose of this study was to explore how comic book readers build meaning about science, technology and scientists from comic books which could help ascertain if comic books have a place in library collections for science entertainment-education. The findings support the idea that science and technology mean a lot to comic readers; and therefore, an entertainment-education strategy could be employed to increase scientific literacy among comic book readers. This suggests that it is worthwhile to include comic books in library collections.

Comic books have similarities with the soap operas that used entertainment-education strategy. They both have their audience or readers emotionally attached. Young women who are in Maria’s shoes were behind the success of *Simplemente Maria* soap opera as they established empathy between the character and themselves; whereas, young comic book readers established a similar relationship with the daily life of superheroes such as Spiderman. It could be assumed that successful comic books already have that connection between the main character and the consumer, otherwise they would not be successful, so a requirement for entertainment-education strategy has already been achieved.

According to Singhal & Rogers (1998), narrative story telling is one the reasons that these soap operas are successful. They are neither didactic nor preachy but by story-telling, they convey the designed messages to the audiences. The narrative power of

comic books was realized quickly and since the end of 1960s, they have been called graphic novels to express that they have the complexity of a novel (which means narrative power) and visual power of graphics. Therefore, another requirement for entertainment-education strategy already exists in comics.

Pleasurable activity was another reason that entertainment-education soap operas are so influential. When people have pleasure, they tend to do that activity more. The more exposure and repetition of the message will strengthen its influence. Reading comic books is fun which was explained many times during the interviews. Moreover, comic book fans read the comics more than once. Increasing the exposure to messages so efficiently, comic books demonstrate that they have another requirement for entertainment-education strategy.

Singhal & Rogers (1998) also mention how soap operas spurred interpersonal communications among the audience. Discussing an issue with many people over and over again will both increase the exposure and provide expansions in understanding. Comic book readers like to discuss everything in comic books, such as personality and powers of superheroes and villains, plots and feasibility of them, equipments, gadgets, vehicles either face to face or through online. Therefore, this feature of comic books could also increase the power of entertainment-education strategies.

In conclusion, comic books have all the features that an entertainment-education strategy could be implemented. Involvement, pleasure, visually supported narration, and a community of its own makes one of the perfect mediums for this strategy. Moreover, comics also trigger information-seeking, which is an important asset in learning as the more interested in the topic the better they learn. Educating through comic books has already been in progress in developing countries through international organizations like the U.N. and the World Bank and there is no reason that it could be used to increase

scientific literacy in the U.S., where more than half of the whole comic books consumed, and in other areas of the world, particularly among young readers.

### **Bibliography**

- American Competitiveness Initiative. (2006). President's letter. Retrieved November 18, 2009, from <http://www.whitehouse.gov/stateoftheunion/2006/aci/print/index.html>
- Anderson, T. (2010). Wild cards: Three to watch. *Kiplinger's Personal Finance*, 64(1), 22.
- Barras, C. (2009). Artificial cartilage could outperform the real thing. *New Scientist*, 201(2702), 18.
- Barry, J.M. (2004) *The great influenza: The epic story of the deadliest plague in history*. New York: Penguin Books.
- Batista, R. & Oliveira, M.M. (2009). Facts and fiction of genetically engineered food. *Trends in Biotechnology*, 27(5), 277-286.
- Berkowitz, J. & Packer, T. (2001). Heroes in the classroom: comic books in art education. *Art Education*, 54, 12-8.
- Blumer, H. (1969). *Symbolic interactionism: Perspective and method*. California: University of California Press.
- Brewster, D. (2007, December 26). UN joins forces with Marvel Comics. *Financial Times on the Web*. Retrieved on February 12, 2008, from <http://www.ft.com/cms/s/0/a9d5f5ee-b3ff-11dc-a6df-0000779fd2ac.html>
- Brier, S. (2006). Ficta: remixing generalized symbolic media in the new scientific model. *Public Understanding of Science*, 15, 153-174.
- Brindell, J.R. (2009). Nanotechnology and the dilemmas facing business and government. *Florida Bar Journal*, 83(7), 73-77.
- Carrier, D. (2001). *The aesthetics of comics*. Pennsylvania: Pennsylvania State University Press.

- Castells, M. (2009). *The rise of the network society: The information age: economy, society and culture, volume I*. 2<sup>nd</sup> ed. (with a new preface) Malden, MA: Wiley-Blackwell.
- Cheesman, K. (2006). Using comics in the science classroom: A pedagogical tool. *Journal of College Science Teaching*, 35, 48-51.
- Cho, G., Choi, H., & Krashen, S. (2005). Hooked on comic book reading: How comic books made an impossible situation less difficult. *Knowledge Quest*, 33, 35-8.
- Christensen, L.L. (2007). Graphic global conflict: Graphic novels in the high school social studies classroom. *The Social Studies*, 97, 227-230.
- Crawford, P. (2004). Graphic novels for elementary school libraries. *Knowledge Quest*, 32(3), 35-37.
- Curriculum Review (2002). Add pow! to your physics class with comic-book lessons: An interview with James Kakalios. *Curriculum Review*, 43, 14-5.
- Dorrel, L.D., Curtis, D.B. & Rampal, K.R. (1995). Book-worms without books? Students reading comic books in the school house. *Journal of Popular Culture*, 27, 223-234.
- Downey, E.M. (2009). Graphic novels in curriculum and instruction collections. *Reference & Users Services Quarterly*, 49(2), 181-188.
- Fennell, D. (2009). Marketing science: The corporate faces of genetic engineering. *Journal of Communication Inquiry*, 33(1), 5-26.
- Fletcher, S. (2009). Master of the small. *Popular Science*, 275(5), 58.
- Friedman, T.L. (2008). *Hot, flat, and crowded: why we need a green revolution, and how it can renew America*. New York: Farrar, Straus and Giroux.
- Gerde, V.W. & Foster, R.S. (2008). X-Men ethics: Using comic books to teach business ethics. *Journal of Business Ethics*, 77, 245-258.
- Glasser, B.G. & Strauss, A.,L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine Publications

- Gorman, M. (2003). *Getting graphic: Using graphic novels to promote literacy with preteens and teens*. Ohio: Linworth Publishing, Inc.
- Gregory, J. & Miller, S. (1998). *Science in public: Communication, culture, and credibility*. Massachusetts: Basic Books
- Gresh, L. & Weinberg, R. (2002). *The science of superheroes*. New Jersey: John Wiley & Sons, Inc.
- Gresh, L. & Weinberg, R. (2005). *The science of supervillains*. New Jersey: John Wiley & Sons, Inc.
- Guba, E.G. (Ed.). (1990). *The paradigm dialog*. California: Sage Publications.
- Harvey, (1996). *The art of the comic book: An aesthetic history (Studies in popular culture)*. Mississippi: The University Press of Mississippi.
- Heaney, M.J. (2007). Graphic novels: a sure bet for your library. *Collection Building*, 26(3), 72-76.
- Kirsh, S.J. & Olczak, P.V. (2002a). Violent comic books and judgments of relational aggression. *Violence and Victims*, 17, 373-80.
- Kirsh, S.J. & Olczak, P.V. (2002b). The effects of extremely violent comic books on social information processing. *Journal of Interpersonal Violence*, 17, 1160-78.
- Kuhn, T.S. (1962). *The Structure of Scientific Revolutions* (3rd ed.). Chicago: The University of Chicago Press.
- Lavin, M.R. (1998). Women in comic books. *Serials Review*, 24, 93-100.
- McCracken, G. (1998). *The long interview*. California: Sage Publications.
- Miller, J.J. (2008, January 24). 2007 Final Comics Sales & December Sales Reports. Message posted to *The Comics Chronicles*, retrieved on February 12, 2008, from <http://www.comichron.com/>
- Nicolescu, B. (2002) *Manifesto of transdisciplinarity*. Albany, NY: SUNY.

- Noh, S. Science, Technology, and Women Represented in Korean Sci-Fi Girls' Comics  
*Paper presented at the annual meeting of the International Communication Association, Sheraton New York, New York City, NY Online.* Retrieved 2008-02-10 from [http://www.allacademic.com/meta/p14511\\_index.html](http://www.allacademic.com/meta/p14511_index.html)
- Nyberg, A.K. (1998). *Seal of approval: The history of the comics code*. Jackson: University Press of Mississippi.
- Patton, M.Q. (2002). *Qualitative research and evaluation methods*. California: Sage Publications.
- Ranker, J. (2007). Using comic books as read-alouds: Insights on reading instruction from an English as a second language classroom. *The Reading Teacher, 61*, 296-305.
- Rhode, M. (1996). *A Bibliography of Comics Articles in the Journal of Popular Culture*. Retrieved on February 9, 2008, from [http://www.english.ufl.edu/comics/scholars/jpc\\_index.html](http://www.english.ufl.edu/comics/scholars/jpc_index.html)
- Rifas, L. (2007). Cartooning and nuclear power: From industry advertising to activist uprising and beyond. *Political Science and Politics, 40*, 255-260.
- Shapiro, M. (2009). The wonderful world of comic books. Retrieved on January 7, 2009 from [http://iscribepro.com/index.php?option=com\\_content&view=article&id=92:the-wonderful-world-of-comic-books&catid=3:articles&Itemid=41](http://iscribepro.com/index.php?option=com_content&view=article&id=92:the-wonderful-world-of-comic-books&catid=3:articles&Itemid=41)
- Singhal, A. & Rogers, E.M. (2002). A Theoretical agenda for entertainment-education. *Communication Theory, 14*, p.117-35.
- Singhal, A. & Rogers, E.M. (2003). *Combating AIDS: Communication strategies in action*. California: Sage Publications.
- Smith, J.M. (2007). Genetically engineered foods may cause rising food allergies. *Total Health, 29*(4), 40-42.
- Steyn, M. (2010). Why climate change is hot hot hot. *Maclean's, 123*(1), 100-101.

- Stutman, R. & Cassady, D. (1983). Heavy readers not always better writers, study shows. *Journalism Educator*, 38, 11-14.
- Terzian, S.G. & Grunzke, A.L. (2007). Scrambled eggheads: ambivalent representations of scientist in six Hollywood film comedies from 1961 to 1965. *Public Understanding of Science*, 16, 407-419.
- The power of being made very small. (2009) *Economist*, 392(8638), 75-76
- Thomas, J.L. (Ed.) (1983). *Cartoons and comics in the classroom*. Colorado: Libraries Unlimited, Inc.
- Vickery, B.C. (2000). *Scientific communication in history*. Maryland: Scarecrow Press.
- Walsh, B. & Ramzy, A. (2009). A river ran through it. *Time*, 174(23), 56-63.
- Wertham, F. (1954). *Seduction of the innocent*. New York: Rinehart.
- What lies beneath. (2009). *Economist*, 393(8660), 87-88.
- World Bank (2005). *1 World Manga: Passage 1: Poverty – A ray of light*. Washington DC: Viz Media.
- World Bank (2005). *1 World Manga: Passage 2: HIV/AIDS – First love*. Washington DC: Viz Media.
- World Bank (2006). *1 World Manga: Passage 3: Global warming – The lagoon of the vanishing fish*. Washington DC: Viz Media.
- World Bank (2006). *1 World Manga: Passage 4: Child soldiers – Of boys and men*. Washington DC: Viz Media.
- World Bank (2006). *1 World Manga: Passage 5: Girls education*. Washington DC: Viz Media.
- World Bank (2007). *1 World Manga: Passage 1: Corruption – Broken trust*. Washington DC: Viz Media.
- Wright, B.W. (2003). *Comic book nation: The transformation of youth culture in America*. Maryland: The Johns Hopkins University Press.