The Pedagogical Alliance of Science and Science Fiction: Preparing the Way for Scientists of the Future

Janice Bogstad (Ph.D.), Professor, Head of Technical Services
McIntyre Library, and
Faculty for English, Graduate, Honors and Women's Studies Programs
U of Wisconsin-Eau Claire

Mi Qi, physics teacher
SCI-FI PHYSICS
Secondary School, People's University in Beijing.

Tian Song, Associate Professor of Philosophy of Science
Beijing Normal University
Science Fiction as Thought Experiment
Prof. Yan Wu (Ph.D.)
Director of Research Center for Science Fiction and Creative Education
Faculty of Education, Beijing Normal University

1.Science Fiction: Preparing the Way for Scientists of the Future

By Dr. Janice M. Bogstad, Professor, Head of Technical Services, McIntyre Library, and faculty English, Graduate, Honors and Women's Studies, U of Wisconsin-Eau Claire
(bogstajm@uwec.edu)

Ask an astronaut, engineer or scientist and it's likely they will tell you that they first got interested in science through SF and many still read SF. Popular television shows as early as the 1960s, and as recent as the present, confirm this relationship. *Start Trek*, first aired on American television from 1967-1969 influenced many future scientists. And *The Big Bang Theory*, an extremely popular contemporary show portrays post-doctoral physicists with major interests in science fiction, computer gaming and comic books. In fact, some NASA scientists celebrated the successful Mars missions recently by meeting the actors on the set of *The Big Bang Theory*. Additionally, a number of science fiction writers in the U.S. and Britain, at least, are themselves either scientists or work closely with the scientific community. And finally, writers of popular science in the United States such as Michio Kaku also address the science in science fiction as part of their popularizing efforts.

The expectation of a connection between reading or viewing science fiction was acknowledged in the 1990s with the special exhibit at the National Air and Space Museum in Washington, D.C., an exhibit of artifacts from the first *Star Trek* television series. *Star Trek* was instrumental in educating the public about the space program in the United States and keeping citizens interested. I was asked to speak at a presentation associated with the Air and Space Museum exhibit on a panel that addressed such issues as race and gender foregrounded in the television series and how *Star Trek* started to break down barriers of race and gender in the space program. Today NASA employs men and women of many ethnic and racial backgrounds who work both as astronauts and as members of the many scientific teams.

But the intersection between STEM studies and science fiction is even more pervasive.

Science fiction serves several functions in relation to STEM studies. As noted above, it can pave the way for, and explain the need for, scientific inquiry. Also, many young people who read science fiction go on to study sciences, technology, engineering or medicine and the biological sciences, motivated by their contact with this forward looking literary genre. And many continue to read it and emulate characters in the written and media stories throughout their careers. Additionally, the genre helps to keep up the interest of the general public in the sciences and to understand what the sciences offer to their overall quality of life. And science fiction also models the scientific method, our model for interacting with the world, and also the universe.

In fact, anyone familiar with the currently popular Big Bang Theory television series currently, encounters characters who are already successful practical and theoretical scientists. These young men and women exemplify the longstanding interest in science fiction as they refer to the media and written works that are part of their background and current entertainment, *Babylon Five, Planet of the Apes*, computer games, *The Time Machine*, and also comic books.

Many science fiction writers are also scientists – the most famous historical figure is Isaac Asimov who wrote hundreds of works of popular science along with his science fiction. Arthur C. Clarke who made his living writing extremely popular SF also supported Dolphin research. Kim Stanley Robinson leads modern SF writers in his incorporation of the science of climate change into his fiction such as the 'Science in the Capital' series and *Antarctica.'* Lesser known, but still popular writers such as Joan Slonczewski and Catherine Asaro are also scientists and teach science or engineering at universities.

I could go on to describe the many ways in which science fiction and STEM studies intersected historically as well as in the present, and will be more specific in the pages below, as I detail authors versed in climate sciences, biology, engineering, physics, mathematics and astronomy. This is not an attempt to assert either direct connections or direct influence but to outline intersections that suggest an early interest in science fiction which is more accessible to the developing mind can stimulate a developing interest in some form of scientific study in later life by demonstrating the importance of science in daily life.

Below I will detail the fictional works and the STEM topics they reference, but first I also wanted to mention how my interested in this topic was sparked by an article in a local journal, "ON WISCONSIN" which discussed women from my own University of Wisconsin-Madison who now work in our space program. (On Wisconsin Magazine Spring 2012 http://onwisconsin.uwalumni.com/features/shared-space/).

Here two women, Eversley and Lenuis described *The Right Stuff* (a book made into a film) and the *Star Trek* television series, as well as the films, as childhood influences that lead to their NASA careers. As reported in *On Wisconsin*: "Lenius grew up watching *Star Trek* with her dad and sitting on the back porch of her home in Omro, Wisconsin, searching the night sky for constellations pictured in her astronomy guide."

Many intersections between scientific inquiry and science fiction literature have helped to create a popular grounding, supporting the educational efforts that prepare our young people for careers in the sciences. While most of my examples will be taken from Western science fiction, many works of which are available in Chinese translation, there are also Chinese SF writers whose work contributes to the effort to make science careers both attractive to and accessible to students in the middle grades and high schools.

Examples which will be used in my presentation to start the discussion include:

Jules Verne and H.G. Wells, science and early science fiction

Isaac Asimov-writer of many works explaining science to all age groups, from young children to adults.

Kim Stanley Robinson-science and global climate change

Joan Slonczewski-Biology professor at Kenyon College and SF writer

Arthur C. Clarke-2001 Space Odyssey

Alistair Reynolds-and complex created environments

Television shows and series such as Star Trek, Babylon 5, Deep Space Nine

Selected Bibliography

Bly, Robert W. *The Science in Science Fiction: 83 SF Predictions that Became Scientific Reality.* BenBella Books, 2004

Cavelos, Jeanne. *The Science of Star Wars: An Astrophysicist's Independent Examination of Space Travel, Aliens, Planets and Robots as Portrayed in the Star Wars Films and Books*. St. Martin's Press, 2000.

Cavanaugh, Terence. *Teach Science With Science Fiction Films*. Linworth, 2004.

Daspit, Toby. *Popular Culture and Critical Pedagogy: Reading, Constructing, and Connecting*. Routledge, 2000.

Dubeck, Lerol. *Fantastic Voyages: Learning Science Through Science Fiction Films.* 2nd ed. Springer, 2003.

Glassy, Marc C. *The Biology of Science Fiction Cinema*. McFarland, 2005.

Gunn, James. *The Science of Science Fiction Writing*. Scarecrow Press, 2000.

Kaku, Michio. *Hyperspace: A Scientific Odyssey Through Parallel Universes, Time Warps, and the 10th Dimension*. Anchor, 1995.

-----.*Physics of the Future: How Science Will Shape Human Destiny and Our Daily Lives by the Year 2100*. Anchor, Reprint Ed. 2012.

-----. *Physics of the Impossible: A Scientific Exploration into the world of Phasers, Force Fields, Teleportation, and Time Travel*. Anchor, Reprint Ed. 2009.

Kirby, David A. *Lab Coats in Hollywood: Science, Scientists, and Cinema*. MIT Press, 2011.

Kakalios, James. *Amazing Story of Quantum Mechanics: A Math Free Exploration of the Science That Made Our World*. Gotham, Report Edition, 2011.

_____.*The Physics of Superhereos.* Gotham, 2nd edition, 2009.

Kraus, Lawrence M. *The Physics of Star Trek*, revised. Basic Books, 2007

Perkowtiz, Sidney. *Hollywood science: Movies, Science, and the end of the World.* Columbia Univ. Press, 2010.

Raham, Richard. *Teaching Science Fact with Science Fiction*. Libraries Unlimited, 2004.

Youngquist, Paul. *Cyberfiction: After the Future.* Palgrave Macmillan, 2010.

I. Mi Qi,
Physics Teacher,
High School Affiliated with Renmin University, Beijing, China

"Report on the Sci-fi Physics Course at the High School Affiliated with Renmin University, Beijing"

In the high school affiliated to Renmin University, 3 physics teachers have offered a Sci-fi Physics course during the last 4 years. It is a free-choice course for all the high school students. Each semester, around 40 students select our course. Our objectives for the course are, firstly, trying to encourage students to analyze and interpret the physics principles from sci-fi movie clips; secondly, develop students' critical thinking skills; thirdly, let students concerned about the relationship of science, technology and society enhance their awareness of sustainable development; lastly, we also wish to inspire students' abilities to be imaginative by welcoming their own creative work by creating physics sci-fi stories. During the class meeting period, we try to organize for our lesson broadly different sci-fi themes which relate to physics, superheroes, space travel, robotics, disaster and so on. During the class instruction period, we show movie clips, then provide leading discussions, then let students began their homework to further analyze the presentation of science in the films. In the future, we will launch same courses at the inter-school level which can be offered to four other schools in Beijing. After four semesters of teaching practice, we have observed that Sci-fi Physics is a very good curriculum choice for STEM education. The successful results are mostly in the following aspects: First of all, it enhanced the students' interest in learning physics. Secondly, the course enhanced the students' concern about physics phenomena in everyday life. Thirdly, it can also develop the students' abilities to cooperate on projects and to present their ideas. My discussion will primarily focus around our practices in the sci-fi physics class.

II. Song Tian, Associate Professor
Beijing Normal University

"Science and Science Fiction Movies"

Science Fiction is a kind of thought experiment about society, especially about the relationship between human life and science/ technology. With the advent of a special piece of technology, or a special physical condition of the world, or a special natural change what will happen to human society? SF writers proposed these sorts of questions, and then answer them using theory, logic, and imagination.

A conclusion reached at the basic theoretical level of the philosophy of science is that experiments are not neutral. SF thought experiments are based on the writers' basic understanding of science, technology, the meaning of human life, the aims of social structure, and the essence of civilization. SF writers' understandings, to some extent, are the reflection of social ideology. On the other hand, SF often provides some extraordinary worldviews and concepts; on the other hand, those reflections are part of a social ideology.

In the western SF tradition, most of the early writers, from Mary Shelly onwards, did not trust that science would improve human life. They expressed their skepticism in their SF works. Anti-scientism has been in the mainstream of Western SF up to the present. But in China, most early writers accepted scientism ideology and they tried to show how much improvement future science and technology would provide in human life in general. Only a few writers expressed their doubts

in their works.

Many things have changed in both the sciences and culture since 2000, and this is even truer for the 20th century. Many SF writers in China are reflecting a worldwide resurgence of anti-scientism and as educators we should be committed to countering a problematic social trend.

III. Yan Wu, Professor, Beijing Normal University

"Science Education and Science Fiction Teacher"

It is a long-established concept in China that the value of science fiction lies in the spreading of scientific knowledge. Lu Xun (1903) pointed out that while scientific reading kept boring the readers, only science fiction could arouse their interest. Therefore, science fiction carries the task of imparting science to the public in a comfortable environment. Gu Junzheng (1940) proved in his own collection of short stories, *Under the Arctic*, that science fiction could teach people scientific facts, such as the operation of radio antennae, hypnosis psychology, principles of electromagnetics, and oxidation-reduction reactions. He also criticized the western custom of "not taking seriously the imparting scientific knowledge in the scientific fiction represented by H.G. Wells". Zheng Wenguang (1958) imposed an idea that science fiction must be based on science, but it was not necessary for the fiction to pursue accurate scientific proof. Imagination was critical for science fiction, and with this writers shall inspire and develop people's interests in science, calling for actions necessary to conquer nature and improve the level of scientific knowledge in both scientists and the greater public. Therefore, Wenguang put a great amount of astronomic knowledge in his works. Tong Enzheng (1979) said that the main purpose of science literature including science fiction was to develop a "scientific view" of the world and life. Though his later writings had a solid scientific foundation, he attached considerable significance to the description of the scientific method. Wu Yan (1991) held the idea that science fiction served as an important tool for children's education, functioning as a motivation of studying science, a stimulus for the development of children's intuition and imagination, and encouraging the capacity to solve problems and adapt to a scientifically-based society. Yang Shicheng (2006) said that through the reading of science fiction, readers, especially young people, could develop their own imagination, which exerted a subtle and divergent influence on their learning and usage of science, appreciation of science, and discovery of philosophies of life, improvement of morality and of quality-of-life. Pan Xinhe (2007) put forth an idea that science fiction must be used in science education in order to employ people's perceptive experiences and maintain their childlike imaginative abilities. In addition, there were some negative comments on the scientific mistakes in Chinese or Western fiction. For example, Cai Jingfeng (1981) pointed out that scientific expression in science fiction must be accurate and not violate scientific principles. Shi Gong (1982) and Zhao Shizhou (1982) agreed that some works in which scientists were denounced as insane people would exert ill influence on readers.

In terms of specific situations concerning the teaching of science, Ye Lihua (2004) believed that science fiction and science fiction films had a practical function in science, literature, individuals and society. Well-written science fiction works serve as catalyst of scientific development. Additionally, science fiction could combine the teaching of scientific knowledge and the pleasure of reading. Wu Yan (2009) put forth an idea that science fiction novels/short stories/films were significant in science education. First of all, science fiction was appealing and easily acceptable to students as good advance organizers. Secondly, not only did science fiction possess scientific descriptions, it also revealed a different understanding of science, as well as the complex relations between different subjects and between science and society. Science fiction assists in the construction of students' knowledge frames from the perspective of psychology of

constructionism. Thirdly, the writing of science fictions is a sort of scientific activity in a virtual environment created by the writer; it represents a real society of a group of scientists, thus making itself closer to reality by shifting abstract scientific knowledge into a flowing social process. Fourthly, through the reading of intricate stories, readers are able to develop their imagery thinking through the method of "learning by doing". Fifthly, due to the fact that most science fiction is based on future knowledge structures rather than the existing system, science fiction enables students to look into future from a more open-ended perspective.

Despite the positive ideas being put forth that one can readily apply science fiction to science education, there are relatively few examples where it is practiced in real teaching, most of them taking place in the most recent 30 years, and in universities. Science fiction teaching in primary and middle schools are mostly combined with Chinese language teaching. Science is seriously studied by students for the purpose of writing good fiction. School-based, separately-opened, science fiction courses ask students to analyze works on different subjects in order to increase their understanding of the scientific system as well as the influence of science on society.

The application of science fiction novels/short stories/films to science education has long been discussed in China, and we have achieved some agreement on this. However, there are still few who apply this method in their teaching practices and even in those cases, they are plagued with the lack of materials and guidance. Therefore, universities should work with primary, secondary and vocational schools to start developing and teaching courses to better improve the wide application of science fiction and science fiction films to science education.

Selected Bibliography

Cai, J. (1981). Writing more good science fiction for children-and criticize some existing stories. In H. Yi (Ed.), On Science Fiction (pp. 84-91). Beijing: Popular Science Press.

Chen, S. (2006). Writing science fiction in language and literature class-research and practice. The Inservice Education and Training of School Teachers, 4, 48-50.

Gu, J. (1940). Preface of under the arctic. In J. Gu (Ed.), Under the Arctic. Shanghai: Culture and Life Press.

Lu, X. (1903). Preface of from the earth to the moon. In J. Verne (Ed.), From the Earth to the Moon (pp. i-ii). Tokyo: Culture and Life Press.

Pan, X. (2007). There any value of existence of education without imagination? (First part). Fujian Forum (Social Science Edition), 2, 8-12.

Peng, J. (2008). Science fiction and the development of children's creativity. Modern Chinese Language and Literature, 8, 156-158.

Tong, E. (1979). On my view of science literature. People's Literature, 6, 110.

Wu, Y. (2009). "The Relationship Between Science Education and Science Fiction-History, Values, Problems and Future Research." Paper presented at the Second Academic Conference of Science Communication, Dalian.

Wu, Y. (1991). "Functions of Children's Science Fiction." In Y. Wu (Ed.), *Teaching and Research Materials of Science Fiction* (pp. 44-49). Beijing: College of Education Administration of Beijing Normal University Press.

Yang, S. (2006, Aug.t 31). "Where are the Advantages of Chinese Science Fiction?" *Science Times*, p. 3.

Ye, L. (2004). "Preface of Studies on Science Fiction." In L. Ye (Ed.), *Studies on Science Fiction* (pp. I-V). Xinzhu: National Communication and Transportation University Press.

Zhao, S. (1982, April 10). “Hangs the sheep's head, buys the dog meat.” *China Youth Daily*, p. 4.

Zheng, W. (1958). “Often Ahead of Science Discovery-Talking About Science Fiction.” In P. S. Press (Ed.), *How to Write Popular Science Works* (pp. 158-162). Beijing: Popular Science Press.