Science Fiction as Inspiration for K-12 Education: An Ideas Unlimited Study

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Abstract

K-12 Education for Space Settlement: How might science fiction inspire changes to K-12 schools for humanity's multi-planet future? The purpose of this paper is to provide an answer to this research question as guidance for educators and education policy makers. In keeping with KSI's institutional focus on the Philosophy of Space, the researcher first conducted a review of relevant scholarly literature before implementing an original qualitative study of expert opinion to see what trends might emerge from the two approaches. Participant responses to the target prompt revealed several themes consistent with the review of literature. The panel of experts also recognized the dystopian nature of much of the genre, but most of their responses were more inspirational in nature and could be organized into the broad themes of *constructivist learning*, *problem-based learning*, *technical skills*, *soft skills*, and an *optimistic vision* of the future. This consensus with the literature suggests that these themes may be valuable as actionable recommendations for educators and policy makers.

Keywords: Education, Space Philosophy, Science Fiction, Qualitative, Ideas Unlimited, Constructivism, Problem-Based Learning, Soft Skills, Optimism.

Introduction

This paper is in response to Elsey and Omarova,[1] who articulated an invitation for scholars at Kepler Space Institute (KSI) to explore the genre of science fiction for worthy examples of imagined future education systems. The purpose is to provide guidance to educators and education policy makers in creating K-12 schools that prepare students better for humanity's impending multi-planet future. In keeping with KSI's institutional focus on the Philosophy of Space, the researcher first conducted a review of relevant scholarly literature before implementing an original qualitative study of expert opinion to see what trends might emerge from the two approaches. In the end, both the existing literature and the new results of the study highlighted similar themes that can be offered as guidance for practicing educators and leaders, as well as illuminating opportunities for further research by space philosophers and other academics.

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[1] Barry Elsey and Amina Omarova, "An Imagined Order: Connecting Ideas about Quality Education to Human Communities Living in Outer Space," *Journal of Space Philosophy* 8, no. 2 (2019): 11-23.

Literature Review

This literature review was conducted to explore previous publications in the fields of space philosophy and learning theory that had already addressed the interaction of science fiction and education. The review was thus limited in scope, and did not directly revisit primary sources, such as short stories, novels, or films. Even so, several useful themes emerged from the literature. Though most science fictional depictions of schools, learning institutions, and education systems tend to be dystopian (in keeping with common settings ripe for adventure and heroism amid dramatic stakes), there were also signs of more visionary extrapolations of the sort that typify the genre at its best—and often most prescient. Various philosophers and theorists of this type are identified.

Turin[2] identified a long history of dystopian visions of learning in science fiction, from Jules Verne's dark versions of a future Paris in 1883 to modern tales like the *Matrix* films. Elsey and Omarova[3] summarized concerns about a dystopian future for space settlements in the open question of how much the norms of social order might intrude on personal freedom in the name of survival needs; they were clearly concerned about threats to personal autonomy—and the potential that the military-industrial complex would dominate civil society (and education systems) in early space settlements.[4] Though they too concluded that much of science fiction depicted dystopian social orders, they also noted that other stories projected a vision of the future more supportive of human dignity, personal freedom, and self-actualization.[5] Unfortunately, as Todd[6] insinuated, 21st-century schools already have a dystopian dimension in expecting students to repress their natural curiosity in favor of minimizing disruption and an ultimate dependency on adults. Simpson and Gibbons[7] also noted the pressure that digital mediation is already imposing on students when they are learning through a screen, an issue that has surely been exacerbated during the COVID-19 pandemic since 2020. That said, Levinson and Jandrić[8] appreciated the ability of science fiction to help readers to consider their own current problems from a new hypothetical perspective, and to learn valuable lessons—even when

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[2] Ornat Turin, "How Is the Futuristic School Imagined in Science Fiction Movies and Literature?," *History of Education and Children's Literature* 13, no. 1 (2017): 673-97.

[3] Elsey and Omarova, "An Imagined Order."

[4] Barry Elsey and Amina Omarova, "Space Education: Earth Bound Ideas or Something Else?," unpublished manuscript.

[5] Barry Elsey and Amina Omarova, "Space Education for Human Communities Living on Mars," *Journal of Space Philosophy* 9, no. 1 (2020): 21-41.

[6] Joseph Todd, "A Utopian Mirror: Reflections from the Future of Childhood and Education in Aldous Huxley's Brave New World and Island," in *Childhood, Science Fiction, and Pedagogy: Children Ex Machina*, ed. David W. Kupferman and Andrew Gibbons, 135-54. Singapore: Springer Nature, 2019.

[7] Philip W. Simpson and Andrew Gibbons, "Filling the Mind: Cortical Knowledge Uploads, Didactic Downloads and the Problem of Learning in the Future," in *Childhood, Science Fiction, and Pedagogy*, 155-69.

[8] Paul Levinson and Petar Jandrić, "Children and Pedagogy between Science and Fiction," in *Childhood, Science Fiction, and Pedagogy*, 211-26.

the fictional setting is dystopian. Todd[9] ultimately chose to focus on the promise of more utopian alternatives in some science fiction. For instance, he was particularly interested in students' sense of sovereignty in their relationships with adults (which might be considered student agency as opposed to dependency), and in the posthuman futures offered by Aldous Huxley (for example), which depicted a model for engaging children with their community, with nature, and with self-reflection.

This approach of looking for more optimistic depictions of learning environments led to more positive recurring themes in the literature, including a focus on constructivist learning typified by student engagement, context-embedded learning, inquiry-driven experiences, collaborative or socially negotiated learning, and opportunities for reflection or metacognition.[10] In contrast to the educational dystopias that Turin[11] identified, where students are not involved as active participants and partners in learning, Simpson and Gibbons identified an explicitly constructivist theme in some depictions, where a "constructivist reality transforms classrooms from places of teaching to places of learning in which the teacher and the classroom [may] disappear."[12] Andrews identified similar themes in stories like Vinge's *Rainbow's End*, Butler's *Parable* series, and Stephenson's *The Diamond Age*, in which "students engage in peer-led, project-based learning both in and out of class, driven by international competition and awareness that their experience will soon lead to adult work in a globalized world,"[13] and he, of course, pointed out the degree of student agency in Card's *Ender's Game*. Levinson and Jandrić also identified recurring themes of student agency and "child freedom,"[14] which Turin[15] saw as well, in Le Guin's *Dispossessed*, while Foster[16] explored stories in which the unique epistemologies of children were valuable in the face of habitually conformist adult thinking, such as in the Netflix series *Stranger Things*. In short, many science fiction authors have "faith in children's innate drive to learn and to become participants in adult worlds."[17] In addition, Todd[18] focused on the importance of reflection in stories like Brave New World … and also lamented the lack of reflection already seen in today's schools.

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[9] Todd, "Utopian Mirror."

[10] Mark Douglas Wagner, "Massively Multiplayer Online Role-Playing Games as Constructivist Learning Environments in K-12 Education: A Delphi Study" (doctoral dissertation, Walden University, 2008).

[11] Turin, "How Is the Futuristic School Imagined," 687, 691.

[12] Simpson and Gibbons, "Filling the Mind," 163.

[13] Gillian Andrews, "To Boldly Go Where No Learner Has Gone Before: Independent Inquiry, Educational Technology, and Society in Science Fiction." *E-Learning and Digital Media* 12, no. 3-4 (2015): 349.

[14] Levinson and Jandrić, "Children and Pedagogy," 215.

[15] Turin, "How Is the Futuristic School Imagined," 687, 691.

[16] Adam Foster, "Heretic Gnosis: Education, Children, and the Problem of Knowing Otherwise," in *Childhood, Science Fiction, and Pedagogy*, 171-87.

[17] Andrews, "To Boldly Go," 358.

[18] Todd, "Utopian Mirror."

In keeping with the more constructivist visions for learning found in science fiction, the accompanying teaching methods tended to focus on mentorship (as opposed to didactic instruction), on providing experiential learning opportunities, and on nature-embedded learning. Turin concluded that "when there are positive references to teaching [in science fiction], they are often associated with the image and the role of the teacher as a mentor,"[19] citing characters such as Yoda, Morpheus, and Mazer Rackham as exemplars; also, in *The Dispossessed*, for example, "studying is pursued in mutual interest groups … [while] teachers move from one place to another, offering their expertise, each time to a different group."[20] Andrews[21] identified similar themes of coaching as mentorship in works like *Rainbow's End*. In some stories such as *The Diamond Age* and others, mentorship is provided by an AI, as pointed out by Simpson and Gibbons.[22] In still other stories, like Varley's *Beatnik Bayou*, education "transcends the limits of the classroom and [is] carried out on the move in a natural environment, in the encounter of daily events."[23] A typically embedded teaching approach in constructivist education is problem-based learning, which appears in many science fiction stories, including Rainbow's End, where students engage with peers in the "context of complex, compelling, real-world projects."[24] A pragmatic take on information literacy[25] and on technical skills, such as the computer programming, space construction, lunar mining, cold fusion, and laser communication that Asimov predicted,[26] is also a hallmark of constructivist teaching in science fiction.

Technical skills such as these are a particularly common recurring theme in science fictional depictions of future learning experiences, often with a focus on survival, science, technology, engineering, and math (STEM) skills, hard science, or advanced educational technologies. As Elsey and Omarova noted, the "continuous awareness of the imperative for survival"[27] will likely impact any education system in early space settlements. Naturally, this need would lead science fiction authors to predict learning institutions focused on STEM skills[28] and to explore what role new technologies might play in education. Consider the desk tablets or battle room in *Ender's Game* for instance. The computer or artificial intelligence (AI) in the role of teacher is also a common theme in science fiction; Simpson and Gibbons[29] identified this trend as inevitable and transformational, and the primer in

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[19] Turin, "How Is the Futuristic School Imagined," 687, 691.

[20] Turin, "How Is the Futuristic School Imagined," 687, 691.

[21] Andrews, "To Boldly Go."

[22] Simpson and Gibbons, "Filling the Mind."

[23] Turin, "How Is the Futuristic School Imagined," 693.

[24] Andrews, "To Boldly Go," 349.

[25] Simpson and Gibbons, "Filling the Mind."

[26] Turin, "How Is the Futuristic School Imagined," 693.

[27] Elsey and Omarova, "An Imagined Order," 21.

[28] Elsey and Omarova, "Space Education for Human Communities."

[29] Simpson and Gibbons, "Filling the Mind."

The Diamond Age is a particularly good fictional example.[30] The convergence of education technologies with the human body via some form of brain-computer interface is also commonplace in science fiction, from the hypnosis in 1899's *The Sleeper Awakes* to more modern entries like William Gibson's *Johnny Mnemonic* or the *Matrix* films.[31]

If students are expected to master (or take for granted) advanced technologies in the future, they are often also expected to develop competence in a variety of soft skills. Many stories showcase the need for student creativity. As early as Asimov's 1957 story *Profession*, an argument was made suggesting the easy acquisition of knowledge via brain downloads would be insufficient to support "creativity or the advancement of knowledge."[32] Similarly, Simpson and Gibbons[33] identified a deeper educational philosophy that asks not just if or how a new technology might be implemented in schools, but whether it should be. Elsey and Omarova[34] considered classic (Greek) philosophy an important foundation for liberal society, social fairness, and citizenship—and especially for facing the unknown in space. Todd[35] was also explicitly interested in educational philosophy, from a very stoic-like resilience … to the use of psychedelics to understand the world better. It follows that educators might prepare students to apply a similar degree of philosophical thinking and open mindedness in the future. Furthermore, Levinson and Jandrić[36] saw this sort of philosophical pursuit as addressing the same kind of questions that religion does, and they agreed with Todd[37] in highlighting stories suggesting that a more spiritual connection with nature may be important for human health. As such, it may be reasonable to also prepare students for an active transrational spiritual life in addition to providing more rational philosophical foundations during their education.

This call for students to be well rounded in creativity, philosophy, and spirituality is in keeping with the more aspirational visions for a better future found in science fiction. From early speculative stories like *Gulliver's Travels* to more recent stories like *Star Trek*, the genre has offered innovative ideas about how learning might create a better world.[38] For example, in *Beatnik Bayou*, John Varley illustrated a world in which "the paramount goal of education … is aspiration for empathy and altruism, which transform the individual into a moral entity capable of choosing right from wrong."[39] Elsey and Omarova[40]

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[30] Andrews, "To Boldly Go," 349.

[31] Turin, "How Is the Futuristic School Imagined," 693; Andrews, "To Boldly Go," 349.

[32] Andrews, "To Boldly Go," 349.

[33] Simpson and Gibbons, "Filling the Mind."

[34] Elsey and Omarova, "An Imagined Order"; Elsey and Omarova, "Space Education: Earth Bound Ideas."

[35] Todd, "Utopian Mirror."

[36] Levinson and Jandrić, "Children and Pedagogy."

[37] Todd, "Utopian Mirror."

[38] Turin, "How Is the Futuristic School Imagined."

[39] Turin, "How Is the Futuristic School Imagined," 692, 694.

[40] Elsey and Omarova, "Space Education for Human Communities."

identified a similar theme of more utopian science fiction that describes learning systems focused on human dignity, personal freedom, self-actualization, civil society, and the passing on of these values. Todd[41] also explored ways science fiction reimagined education in terms of gender roles, adult relationships, disciplinary power, and both human and posthuman ideals, including encounters with the other. Sometimes these education systems are subversive, such as the primer in *The Diamond Age*, which was commissioned to provide the engagement missing from traditional schools.[42] In addition, Todd[43] found hope even in dystopian fiction—because readers' reactions can still lead to positive cultural transformations. Andrews[44] valued the way that science fiction can prompt educators to articulate pedagogical goals and consider how they relate to potential future technologies and visions for future society.

In any case, Turin[45] neatly summarized the more optimistic depiction of education in science fiction in very constructivist terms:

> The more pleasant aspects of futuristic learning involve choice: choice between right and wrong and choices of interests and topics. The learning process will be independent, motivated by fascination, a desire to experiment and the will to extend wisdom. It will occur in the encouraging environment of age peer groups. The mentor's character as a charismatic role model will be of greater importance, promoting insights and maximizing cognitive and physical skills…. Alternative impressions view the purpose of education in humanistic terms, aimed at socialising a moral and kind person and making use of advanced technologies to broaden the flexibility of choice and independence of the individual.

Method

In the wake of the literature review, this qualitative study involved a grounded theory approach using the Ideas Unlimited method to engage a panel of experts and make their tacit knowledge explicit for real-world implementation, and for further research. The researcher operated from a social constructivist paradigm, a common foundation for education research, which rests on the belief that the human mind is constantly engaged in developing subjective meanings from the environment in which it lives, and that meaning making is a process of social negotiation via dialogs or conversations between individuals.[46]

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[41] Todd, "Utopian Mirror."

[42] Andrews, "To Boldly Go."

[43] Todd, "Utopian Mirror."

[44] Andrews, "To Boldly Go."

[45] Turin, "How Is the Futuristic School Imagined," 692, 694.

[46] John W. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Method Approaches* (Thousand Oaks, CA: Sage, 2003).

School design is a complex, long-term undertaking involving many human elements that limit the effectiveness of quantitative analysis, making a qualitative approach more appropriate, especially when concerning an emerging future context such as space settlement. Trochim[47] defined qualitative research as a process involving any measures where the data are not recorded in numerical form, and he included short written responses on surveys among his examples of qualitative data. These measures are especially appropriate in a social constructivist context because qualitative researchers are interested in the meanings that people construct and how they make sense of the world and their experiences in it.[48] The role of the researcher in qualitative research is thus to gather, analyze, and interpret data—a process that requires careful observation, tolerance for ambiguity, confidence in intuition, and clarity in communication.[49]

Because no K-12 schools exist that focus on preparing students for humanity's multi-planet future, a grounded theory approach is an effective choice for generating new ideas. According to Leedy and Ormrod, "the major purpose of a grounded theory approach is to begin with the data and use them to develop a theory."[50] In this case, the study works from the expert opinions of the participants to derive an abstract theory meant to guide policy makers.[51]

In particular, the Ideas Unlimited method is well proven for planning purposes, improving performance, and generating new ideas. According to Downing et al., "Ideas Unlimited collects and organizes ideas from people to solve strategy, policy, planning, program, process, task, or procedural problems."[52] Traditionally, ideas are collected on small slips of paper, thus the original name of C. C. Crawford's "Crawford Slip Method" before Dr. Bob Krone coined the name "Ideas Unlimited."[53] For this 2020 study, an online Google form was used to collect submissions asynchronously from geographically dispersed participants into a collaborative web-based Google Spreadsheet shared between the researcher and his academic advisors. Participants responded to a single prompt, known as a "target" in the Ideas Unlimited method, that was designed to focus their mind on their relevant experience.[54] Their responses were then copied from the

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[47] William M. Trochim and James P. Donnelly, *Research Methods Knowledge Base* (Mason, OH: Atomic Dog/Cengage Learning, 2008).

[48] Sharan B. Merriam and Elizabeth J. Tisdell, *Qualitative Research: A Guide to Design and Implementation* (Hoboken, NJ: John Wiley & Sons, 2015).

[49] Creswell, *Research Design*; Merriam and Tisdell, *Qualitative Research*.

[50] Paul D. Leedy, Jeanne Ellis Ormrod, and Laura Ruth Johnson, *Practical Research: Planning and Design* (Harlow, UK: Pearson, 2021), 140

[51] Creswell, *Research Design*.

[52] Lawrence G. Downing, Ben A. Maguad, and Robert M. Krone, *Values Analysis for Moral Leadership*. (London: Bookboon, 2016): 30

[53] Bob Krone and Selena Gregory-Krone, *Ideas Unlimited: Capturing Global Brainpower* (Wilmington, DE: Stratton Press, 2019).

[54] Krone and Gregory-Krone, *Ideas Unlimited*.

spreadsheet into Zotero qualitative research software for a process of tagging, keyword classification, and data reduction, with a focus on making recommendations for performance improvements.[55] An outline of the results was created using the online outliner Workflowy, and this paper is the final outcome of the study. The researcher was personally responsible for all aspects of implementing the Ideas Unlimited process. He composed the target (and associated instructions, though these were adapted from a target sheet created by Dr. Bob Krone at KSI), recruited all participants, analyzed all data, and interpreted all findings.

Thirteen participants were included in the study, each an expert in K-12 education, science fiction, or both. All participants are credited as co-authors of this paper. Their names, titles, and professional affiliations also appear in Appendix A. The following is the target each of them responded to:

> K-12 Education for Space Settlement: How might science fiction inspire changes to K-12 schools for humanity's multi-planet future?

Results

The participants' responses to this target prompt revealed several themes consistent with the review of literature. The panel of experts also recognized the dystopian nature of much of the genre, but most of their responses were more inspirational in nature and could be organized into now familiar themes of constructivist learning, problem-based learning, technical skills, soft skills, and an optimistic vision of the future. This consensus with the literature suggests that these themes may be valuable as actionable recommendations for educators and policy makers.

Many elements of constructivist learning environments were evident among the responses, including student agency, inquiry-driven learning, opportunities for collaboration, a focus on reflection, and teaching as mentorship. Participants questioned how education might look when the goal is not preparing students for industry, and how students might then chart their own educational journeys. There was an emphasis on student inquiry and on encouraging curiosity early and consistently throughout the school experience. Despite this call for individualism, there was also a call for a collective approach to expanding human presence in the solar system and beyond; based on participants' experiences with science fiction, they saw working together as essential to survival in space and facing the unknown. As such, several envisioned student projects as group efforts, with diverse (perhaps even multi-planet) teams of students, each contributing their own strengths. Others noted that science fiction as a subject in school is valuable as an opportunity for self-reflection, as well as reflection on the best and worst of humanity … and how we might face future challenges. In alignment with the existing literature of space philosophy and education theory related to science fiction, the study

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[55] Downing et al., *Values Analysis*.

participants also saw the role of the teacher changing; in a student-centered learning environment, the teacher serves more as a mentor, in context and as needed – and even technology such as interactive software or AI can play a similar mentorship role.

In this environment, open-ended problem-based learning was seen as a valuable model illustrated by some science fiction. Outcomes might include projects or portfolios and be focused on sci-fi themes like solving climate change, surviving with limited resources, or role-playing new organisms … while drawing from a variety of disciplines in generating solutions. The elements of design thinking were explicit and common in participant conceptions of future problem- or project-based learning: understanding a problem (and the people it effects), ideating potential solutions, testing prototypes, and iterating to improve—or pivoting to a new idea. One participant declared, "science fiction is the ultimate design genre! … Creators of science fiction have been imagining and exploring solutions to these problems for decades." Furthermore, engaging with science fiction stories liberates readers (or viewers) from the constraints of their current realities so they can expand their capacity for imagination and risk-taking as they solve problems. In one case, problem solving was framed in the context of students undertaking an "adventure" themselves, as a group naturally.

Pragmatically, adventuring, design thinking, and problem-solving in general will require students to be competent in a variety of technical skills, especially in the sorts of futures imagined in science fiction stories. Survival in hostile environments is often an issue projected and portrayed in science fiction, and participants saw the importance of students developing the STEM skills necessary to survive and thrive. Considering the multi-planet element of the target prompt, participants also imagined that students would have to master the technical skills necessary for distance education. And with science fiction stories in mind, they projected several other educational technologies, including augmented reality and virtual reality (AR/VR) or "holodeck," computers on multiple surfaces (such as desks or walls), AI, and actual spacecraft. All would require significant competence in technical skills from future students.

As in the literature review, the study also revealed that student success (and humanity's success) would rest on more difficult-to-teach soft skills, such as the arts and social and emotional learning. Though some emphasized "the science, not the fiction," other participants pointed out that STEAM skills (including the arts) will also be important to human happiness in future space habitats. Similarly, strong interpersonal skills will be necessary for "pods" of people working and learning together in close quarters for long periods; teachers' experiences with the Coronavirus in 2020 explicitly influenced this line of thinking. Open-mindedness and acceptance would also be important in any encounter with alien life, a staple of science fiction stories and an eventuality for which students of humanity's multi-planet future should be prepared, even if the aliens wind up being post-human descendants of Earth life as well. Participants also called for social-emotional learning to be integrated across core subjects like reading, writing, mathematics, history,

and science, such that even learning technical skills should include practicing "softer" disciplines.

This focus on soft skills is in keeping with the participants' shared vision for a better future. As Dr. Katrina Adkins pointed out, "science fiction is a genre that relies on imagination, science, technology, and futuristic possibilities" and though much of it portrays a dystopian setting, the educators and philosophers involved in the study chose to focus on more optimistic visions. Many of the participants reported personally finding inspiration in particular stories themselves. They saw the genre as full of hope, and as valuable for K-12 learning communities to explore, with potential benefits such as normalizing risk, failure, and commitment to problem solving in schools. It was further suggested that educators should "reverse engineer" the best learning environments science fiction has to offer and persist even in the face of fear (of dystopian futures, failure, or otherwise). They also saw hope for using technology to improve the environment and provide future generations with a "healthier Earth full of nature's best diversity," as school principal Emmy Leleu enthused. They projected a cultural evolution that would eradicate poverty and digital divides (or cultural divides) in education. And based on the inspiration of posthuman science fiction reading lists, they imagined a future of staggering diversity and unrelenting acceptance of differences (among humans and the alien). Ultimately, this is a powerful vision of the world that might be possible if students are well prepared to shape humanity's multi-planet future, rather than being passive victims of a dystopian inevitability.

Conclusion

The review of literature and the results of the original Ideas Unlimited survey conducted for this study revealed similar themes, which can now be offered both as recommendations for practitioners in education and as additional invitations for academics to conduct further research adding to this field of knowledge in space philosophy and education theory. The following recommendations can be extrapolated from the themes revealed in the study above:

1. Constructivist learning environments: Schools should be organized to provide student-centered learning environments that are motivating and engaging, with primarily context-embedded, inquiry-driven, and collaborative learning experiences. Opportunities for reflection should be an integral part of the process, and educators should operate more like mentors or coaches than traditionally didactic teachers.
2. Problem-based learning: Schools should challenge students with problem-based learning experiences, incorporating information literacy skills, the design thinking process, and the application of multiple academic disciplines.

3. Technical skills: Schools should encourage student mastery of a wide variety of STEM skills, including coding, making, and competency with advanced education technologies such as AR, VR, and AI.
4. Soft skills: Schools should also include ample opportunities to develop difficult-to-teach soft skills, including creativity, the arts, philosophy, spiritual pursuits, and social emotional skills for both interpersonal relationships and self knowledge.
5. Inspiring vision: Schools should encourage students to tackle difficult problems and persevere in their pursuit of solutions by espousing an optimistic view of what is possible in humanity's multi-planet future, a vision typified by diversity, equity, inclusion, environmental stewardship, humanist values, and post-human possibilities.

These recommendations may be valuable in early-stage strategic planning, but both the review of literature and the original research conducted for this study were limited in scope. Perhaps the greatest value may be in the revelation of additional questions for further research prior to later stage implementation. For instance, academics may wish to explore the primary source material with a much more in-depth original review of science fiction stories that include meaningful characterizations of schools, learning institutions, or other education systems. Academic reviews of such fictional accounts are few, but the source may be rich with inspiration – and warnings. Researchers may also wish to pursue the following lines of inquiry:

1. In what ways might specific imagined learning environments (such as *Star Trek*'s Starfleet Academy, for example) inspire the design of real-world schools?
2. What are the most useful examples of problem-based learning in science fiction, and how might they inform practitioners' planning for student learning experiences?
3. Based on science fictional representations, what technical skills might be most important to today's K-12 students in their future?
4. What sort of soft skills do K-12 students need to develop to fulfill our best hopes for moral and ethical leadership in humanity's multi-planet future?
5. How might schools instill in students a sense of optimism for the future and an aspiration to shape it? What role might science fiction play in this cultural transmission?

It is the researcher's hope that this contribution to the literature of space philosophy will inspire meaningful learning experiences in contemporary K-12 classrooms and

support an ongoing tradition of research into the role science fiction might play in shaping future real-world education for the better.

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About the Author: Originally a high-school English teacher, Dr. Mark Wagner also served as an educational technology coordinator at the school, district, and county levels. For fourteen years he then served as CEO of EdTechTeam, a California Benefit Corporation that provides professional development to fifty thousand teachers a year. As co-founder of ARES Learning, Dr. Wagner now unites his early love of space exploration (he originally studied Astronautical Engineering as an undergrad) with his career in education technology.

Mark Wagner has a PhD in Educational Technology and a master's degree in cross-cultural education. He is the author of *More Now: A Message from The Future for The Educators of Today* (2018). Dr. Wagner is currently engaged in original research for graduate certificates in Space Education and Space Philosophy at the Kepler Space Institute, with expected completion in Summer 2021.

Outside work, Mark loves playing hockey, practicing martial arts, and obsessing over his '62 beetle, which now runs on an electric motor and Tesla batteries. He is a certified health coach and biohacking enthusiast, who also enjoys songwriting, spending time in nature, and exploring the world with his friends and family.

Editors' Notes: Dr. Mark Wagner is a scholar and researcher for the Kepler Space Institute. It is well established thar Science Fiction has repeatedly played an important role in future science, technology, and human factors achievements. This article contributes to the knowledge for Space youth education. It also provides questions for future research in that arena. ***Bob Krone and Gordon Arthur.***