Playing with the Future:
Envisioning Education for the 22nd Century

David D. Thornburg, PhD
Norma Thornburg, MA
Thornburg Center for Space Exploration
dthornburg@aol.com
www.tcse-k12.org

The year was 1999 and, to read the papers of that period, the world we knew was on the brink of collapse. The culprit was something called the "millennium bug," a software error that was expected to appear as the calendar rolled over to the year 2000. Because some legacy software only used two digits to represent the year, software calendars were (presumably) going to roll from 1999 to 1900, not 2000. This possible error was creating fear that elevators would stop working, and that airplanes were going to fall out of the air. Survivalists were stocking up on food, gold and human powered tools because the global electrical grid was going to collapse, along with all banks. We can look at this today and laugh, but it is hard to overestimate the fear that some had of our world dissolving into chaos.

This bred concern for Y2K (year 2000) compliance – insuring that bookkeeping and other records used updated software to guarantee that, on January 1, 2000, all would be normal, and we would not awaken to see horse-drawn carriages in the streets. Our Center even received documents from clients requiring us to show that we were Y2K compliant before they would do business with us.

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At that time, several people were thinking about *real* Y2K compliance in education: were schools truly preparing students for life in the 21st century? Some of the thoughts at that level of compliance turned into books, including the ASCD book, *The New Basics*[1]. The argument was that, with the birth of a new century, we had the opportunity to examine education, and to transform our practice to ensure that students were prepared for a future unlike the past known to most teachers, parents, and community members. We talked about new skills for a new age and quoted data showing that the students of the time were largely unprepared for the world into which they were graduating. Furthermore, we even suggested shifts to new pedagogical models, many of which were not so new, and proposed updating the curriculum around "21st century skills." The goal was simple: foster the changes needed to transform schools in support of all learners.

Instead, the United States got the "No Child Left Behind" laws that not only reinforced the flawed and antique curriculum of the past, but raised the stakes by insuring that progress toward these flawed goals were measured to the nth degree.

Instead of moving forward, we moved backward. The transformations we've seen in schools so far in this "new" century have been small, incremental, and woefully inadequate. For example, some schools have moved from blackboards to interactive whiteboards on which computer-projected information is shared. As used in most classrooms, this has become the proverbial case of old wine in new bottles. The teacher-centered delivery-style methods of the past remain unchanged. The fact that it is now cheaper to provide real laptop computers to every child than it is to buy a bag full of textbooks should guarantee that every classroom uses 1:1 computing, yet the actual student-computer ratio is still well over 3:1[2]. In other words, not only have we not brought our schools into the 21st century, we are paying a premium to maintain an outdated model of education that fails to meet the needs of any child in school today.

The "perfect storm" of change left education virtually untouched. Organizations like the Partnership for 21st Century Skills[3] continue to advance the cause, but the reality is that we are already almost a decade into this century and our grandparents would still recognize most of our classrooms. In our view, the problem is not that the identification of the skills is flawed – it is rather an implementation issue. Years ago, Caroline Schoeder suggested that some people change because they see the light, and others change because they feel the heat[4]. In fact, neither approach has worked – so far.

Now, to be fair, if the future was simply going to be an extrapolation of the past, an incremental approach to change might be appropriate. This, however, is not the case. For

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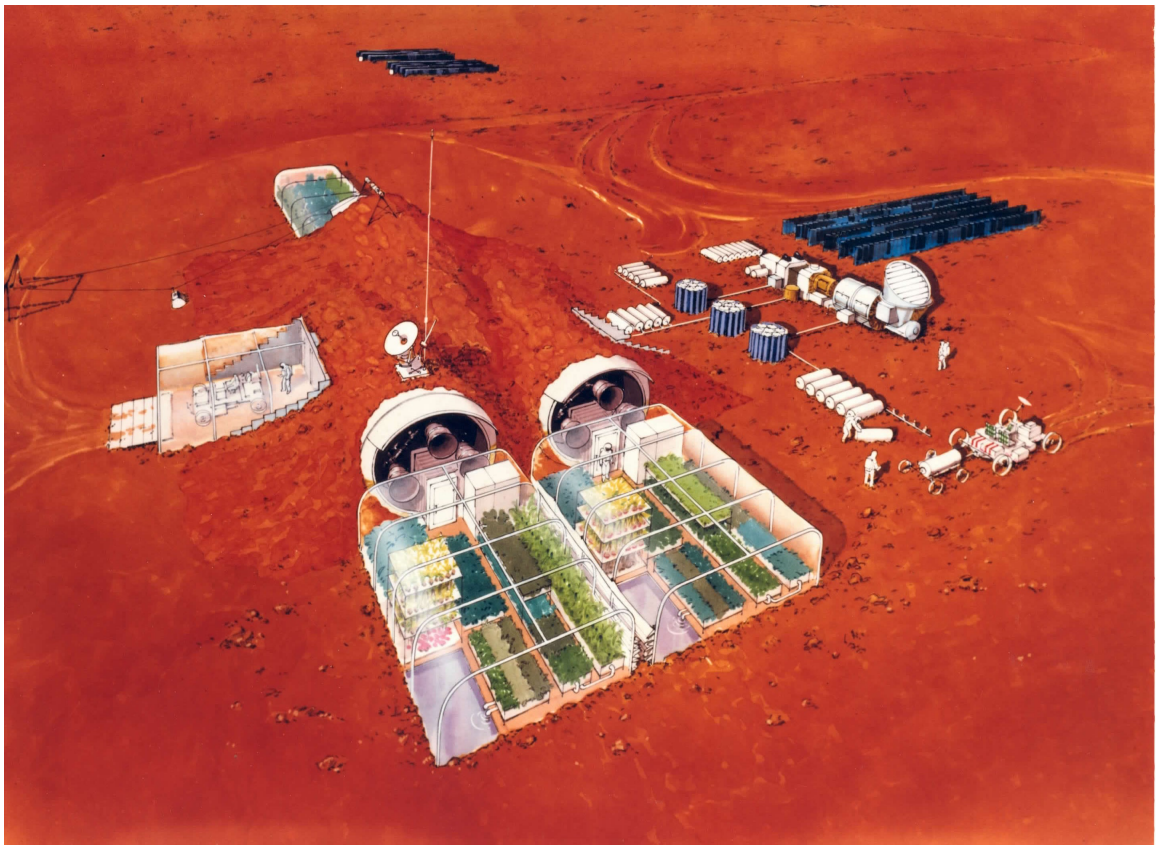
example, look at the following picture:



What you are looking at is an artist's rendition of a habitat for Mars. Now this picture wasn't created for a science fiction film or book – this picture comes from NASA. Why does NASA care? Because the current plan is to have a colony on Mars started by 2031 – a mere twenty-two years from now. And where, exactly, are those humans who will be starting this colony? Many of them are in our classrooms today. This isn't fiction; this is reality. In other words, ours is the last generation in history for which Earth will be the only home for humans.

Did you pay attention to that sentence? *For the first time in history, some humans will choose to leave the Earth and reside on another planet – and this may happen in a little over twenty years from now.* This is bigger news than the colonization of the New World at the start of the 16th century. At least then, people were going to areas that already had indigenous inhabitants who were also human. But even then, the explorations were so life-altering that we still teach about them today.

So here we are poised at the cusp of a revolution whose magnitude can scarcely be described.

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Borrowing from Star Trek, we will boldly go where no one has gone before.

Against this very real backdrop, look at your school or classroom. Does your curriculum and pedagogical practice reflect the kinds of knowledge and skills your students will need to live in our Solar System? (We can no longer just refer to our "world!") We are hard pressed to find any aspect of the curriculum from history to calculus that shouldn't be impacted by this new perspective.

And what about the students themselves? Are they eager to live in this new era?

Of course they are – it is their destiny. Consider the kids in the following picture:

These college kids are exploring science in a classroom where the Earth's gravitational force is not felt for periods of up to a minute or so – a condition referred to as zero-G. They have all gone to the Johnson Space Center with experiments of their own design that require microgravity. After pre-flight training, they are placed in a special airplane (lovingly known as the Vomit Comet) where they experience zero-G alternated with upward forces of twice the force of gravity (as they get ready for the next zero-G cycle) – and this process is repeated about 30 times.

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The look on their faces speaks volumes – they are enjoying their work in this specialized environment, and they are proud to be among a select group of kids who get to do experiments in this "lab!" Now, if one of these kids were to land and come to sit in your school, how would she react? Is your learning environment as engaging as what she had just experienced?

Now you don't have to go to extremes to create compelling learning environments – it is not necessary to have the class experience zero-G. But it is very important that schooling is seen as engaging – an experience for which time seems to evaporate – where students are so pumped with enthusiasm, they can't wait to develop their skills! For example, look at these first-graders who were doing engineering experiments and needed some more information from a teacher:

Some teachers have always had the capacity to elicit this response in their students. Today we need to have rich learning experiences for all our students.

So, how do we get serious about fostering systemic change in education? We have ample

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proof that an incremental approach in which the future is seen as an extrapolation of the past is doomed to failure. This leaves us with a different alternative:

Let's design the present from the future!

Yes, you read that right – we are proposing that the way to truly transform education starts with the future, which we then use to look back to the present, asking ourselves, "What must we do today so our future vision of education comes true?"

So how, exactly, do we go about doing this. Well, let's pick a time in the future for our focus. Since we are already in the 21st century, it seems logical to look at the next one in the list: the 22nd century! This puts us out far enough in the future we can let our imaginations run free, unencumbered by the kinds of constraints we perceive to be holding us locked in a system based on the past. Another nice consequence for choosing the 22nd century is that none of us knows, with clarity, what may or may not happen, thus freeing us to dream big!

If you are a science fiction fan, or spend a lot of time reading books and magazines devoted to futures thinking, you might already have a list of amazing things that might happen a hundred years from now. If not, don't despair. There are great free resources that can spark your thinking as close as your networked computer. For example, the Singularity Hub[5] has amazing resources that grow every week. While not looking (generally) at a distant horizon, the free videos from the TED conferences[6] are amazing. Another great document[7], based on forecasts from experts, looks forward 150 years with a primary focus on technology.

During this visioning phase, you needn't concern yourself with a pure education focus. Look at all aspects of life – habitat, food, health, jobs, exploration, and (of course) learning.

To get you started, look at the items in the following table and write down the year you think these things will come true (hint, a few of them already have!)

Breakthrough	**Year**
Food as designer medicine	
Autopilot vehicles	
Time travel	
Teleportation	

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First bacterium assembled from scratch	
Computer enhanced dreaming	
More robots than people in developed countries	
Global voting	
Faster than light travel	
Thought recognition as an input method	
Exoskeleton provides people with superhuman strength	

You might want to expand this list on your own – and let your imagination flow. For example, many people think that it is impossible for anything to travel faster than the speed of light. Actually, it is impossible to accelerate any particle to faster than light (hyperluminous) speed, but this does not mean that hyperluminous velocities are impossible, nor that the particles that travel at these speeds can't be harnessed – only that the particles we know about won't do the job.

Once you are immersed in the spirit of this exercise, it is time to turn your attention to education. I'll prime the pump by starting with a couple of examples. You should not feel limited by what I write – come up with ideas for these topics on your own.

Let's start with a core academic subject: mathematics.

Century	20	21	22
Mathematics	Numeracy to calculus and other topics addressed in the 17th to 19th century	Numeracy to calculus and other topics addressed in the 17th to 19th century	Hyperfusive galactic correlation theory developed in the 22nd century

Notice that for the 20th and 21st century curriculum we made the entries the same. The point is that not only has the math curriculum (in terms of math concepts taught) remained virtually unchanged for the past 100 years or more, we have failed to incorporate any 20th century math into our K-12 classrooms even though we are in the 21st century. If nothing else, these two columns point to an aspect of our curriculum that deserves a lot of attention!

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For the 22nd century, I made up a completely fictitious branch of mathematics. This is the fun part – you can just make things up! The real point we want to make by doing this is that the 22nd century curriculum for students includes mathematical ideas discovered in that century, whatever they might be.

So, armed with this simple table, and using the future to pull the present, you might decide to transform your math curriculum in a way that all students are provided with an introduction to important mathematical ideas from the century in which they are currently living. If this is all you did as a result of this exercise, you would be making a huge step toward preparing your students for ***their*** future.

Using this approach, you can move through other subjects that are already taught in your school, as well as identify subjects that should be taught if our educational system is going to survive to the 22nd century. Remember to use the future to define the present, and not get caught up in a present that replicates the past.

The challenge is to take an honest look at the curriculum, pedagogy and tools of the 20th century and early 21st century, and then leave the present far behind and imagine what tools methods, techniques, and content might be present and relevant to students living in the 22nd century. Once you have done this, you take the visions for the *next* century and see what core ideas they contain that can be applied today.

This is tremendously important. We live in a rapidly changing world. Suppose that everyone is being taught to play baseball, but the world has an enormous need for ice hockey players. This is the kind of challenge we are facing today, and the playful approach we are describing has serious practical consequences, assuming you are willing to be an agent of transformational change.

This approach to the curriculum applies to the tools we use as well. Let's look at classroom presentations. Again, I will fill out the form, but to be honest, it is more important that you do this work independently. There is no one pathway to the future, and you and your colleagues need to explore lots of options. In fact, the conversations leading to the table entries are at least as important as the entries themselves.

Here's our take on classroom presentation technology:

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Century	20	21	22
Presentation tools	Blackboard	Computer projector	Holodeck

OK, now what is *this* all about? Well, for the bulk of the 20th century the blackboard reigned supreme. A few years ago many classrooms installed ceiling mounted video projectors and wall-mounted screens so computer-based presentations could be shown to the class. In many cases the new tool had little impact on teaching methodology.

Fast-forward to the 22nd century, and as any follower of Star Trek: The Next Generation (TNG) can tell you, there is cool stuff happening on the holodeck.

The holodeck is a special room that contains immersive 3-D replicas of real or imagined spaces. It can be a pirate ship one moment, and an active volcano the next. In addition to realistic images (and odors), the holodeck provides tangibility to this virtual world – objects that can be felt.

When we look at technologies in existence today, there are several 3-D projection methods ranging from the use of virtual images to holography. The challenge is how to make these objects feel real. The branch of research dealing with that topic is called "haptics," and it has come a long way in the past few years.

For example, many kids who enjoy action-based video games have acquired "force feedback" joysticks where the ease of moving the joystick is adjusted by signals sent to small motors in the device by the computer. So, if you have hit something with your virtual race car, you may find the joystick bouncing in your hand.

Recent developments at the University of Tokyo have connected haptics to 3-D computer displays so users can "feel" virtual objects as if they were real[8]. Amazingly, the underlying technology is pretty simple, suggesting that it will not take too long to bring holodeck-like technologies to the marketplace.

In other words, real holodecks may come into existence very soon, leaving even cooler technologies to be developed for the 22nd century. But, given that you can't install a holodeck today, what is the point of this exercise?

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The concern for us is to think about the implications of physical groups of students and teachers having shared immersive experiences in virtual worlds. Blackboards and computer projectors are similar in that they operate on the assumption that one person will be sharing ideas with a group of (relatively) passive observers. The holodeck, in contrast, is a shared group experience. So the question for us is how to set the stage for the future by growing the opportunities for shared group experiences. We have the capacity today (holodeck or not) to let teachers and students co-create and explore shared spaces where we can all learn together. In the past these were called "field trips." While these real voyages beyond the classroom walls can be of tremendous value, our current classroom technology can be harnessed to facilitate virtual field trips. While not quite as cool as the full holodeck, these experiences support different kinds of learning, and should be explored.

This kind of insight applies to other future technologies as well. Even if the technology does not yet exist, it is valuable to see what this new technology can facilitate that would be valuable, and to search for ways to achieve the same or similar value using tools we have today.

Looking at other educational technologies, you might explore the history and distant future of computers, cell phones, MP3 players, videogame consoles, handheld videogames, scientific probeware, microscopes, telescopes, and any other technologies you can think of. It is also good if you can imagine a technology from the future that does not yet exist. This is what we did at Xerox PARC when we invented the concept of the personal computer.

The same guideline applies when you go through this process on curricular topics. Be sure to include a vision of new subjects that need to be taught given *your* predictions for the 22nd century. These might include topics like these:

- The physics of hyperluminous particles
- Teleportation etiquette (e.g., why you should not beam someone to another location in the middle of an argument)
- Exploring the cuisine of Mars
- Introduction to Xirlian and other Cerean languages
- Black holes as dimensional transporters
- The ethics of time travel

Playful? Yes. Nonsensical? No. For example, if the Kepler mission and other joint NASA and SETI projects pay off, we may well encounter intelligent lifeforms from other planets before this century is out. Can you imagine teaching social studies from the context of

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preparing to communicate with intelligent beings from outside our solar system? If we were to simply use this hypothesis as a springboard for the teaching of social studies today, student engagement might go through the roof!

Don't forget also to create a vision for learning spaces. What will schools look like? Will they even exist as we know them? Again, using your vision of the distant future as a guide, let your imagination run free. For example, distance learning is getting a lot of attention today. Imagine how important this will become when learners and educators are located on different planets!

The point is to *really* push the envelope. The reason for this is, as we look at these subjects through the lens of today, we may find ourselves questioning some aspects of our current model of education, asking if it is truly meeting the needs of our students as they pave the way to the next century.

As this process evolves, you will likely find yourself making some powerful observations that are timeless: humans form communities, we share ideas with others, we build our own tools, we quest for the unknown, *etc*. Whatever list of "constants" you define can also serve as the foundation for education. We go to the future to find our origins as a species – that which makes us human.

Against this backdrop we ask not if we should transform education but if we can afford not to.

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About the authors:

David Thornburg, PhD

David is the Founder and Director of Global Operations for the Thornburg Center. He is an award-winning futurist, author and consultant whose clients range across the public and private sector throughout the planet. His razor-sharp focus on the fast-paced world of modern computing and communication media, project-based learning, 21st century skills, and open source software has placed him in constant demand as a keynote speaker and workshop leader for schools, foundations, and governments.

As a child of the October Sky, David was strongly influenced by the early work in space exploration, and was the beneficiary of changes in the US educational system that promoted and developed interest in STEM (science, technology, engineering, and math) skills. He now is engaged in helping a new generation of students and their teachers infuse these skills through the mechanism of inquiry-driven project-based learning. (For details, visit www.tcse-k12.org.)

His educational philosophy is based on the idea that students learn best when they are constructors of their own knowledge. He also believes that students who are taught in ways that honor their learning styles and dominant intelligences retain the native engagement with learning with which they entered school. A central theme of his work is that we must prepare students for their future, not for our past.

David splits his time between the United States and Brazil. His work in Brazil also is focused on education, and he is currently part of a team redesigning curricular practice for some schools in and near Recife, his home city.

Norma Thornburg, MA

Norma is currently the director of emerging technologies for the Thornburg Center where she shares her insights on trends relating to tools that help students learn more effectively. She has been a classroom teacher, a principal, a technology coordinator, and an educational consultant. Her work brings her all over the world.

She has worked for years on projects where students designed and built computer-controlled robots themselves that were programmed using the Logo language and is the author of the first books on Logo published in Brazil. Norma is a popular presenter at conferences where she can share her insights with educators.

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Norma has many years experience working in the field of inquiry-driven project-based learning (PBL) and was the lead designer of a five-year PBL program that, at its peak, reached over 15,000 students throughout Brazil. She splits her time between the US and Brazil and has worked to transform curricular and pedagogical practice in several schools.

Norma and David can bring the 22nd Century Design Workshop to your group or school. Contact them directly at normathornburg@aol.com, or dthornburg@aol.com.

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