

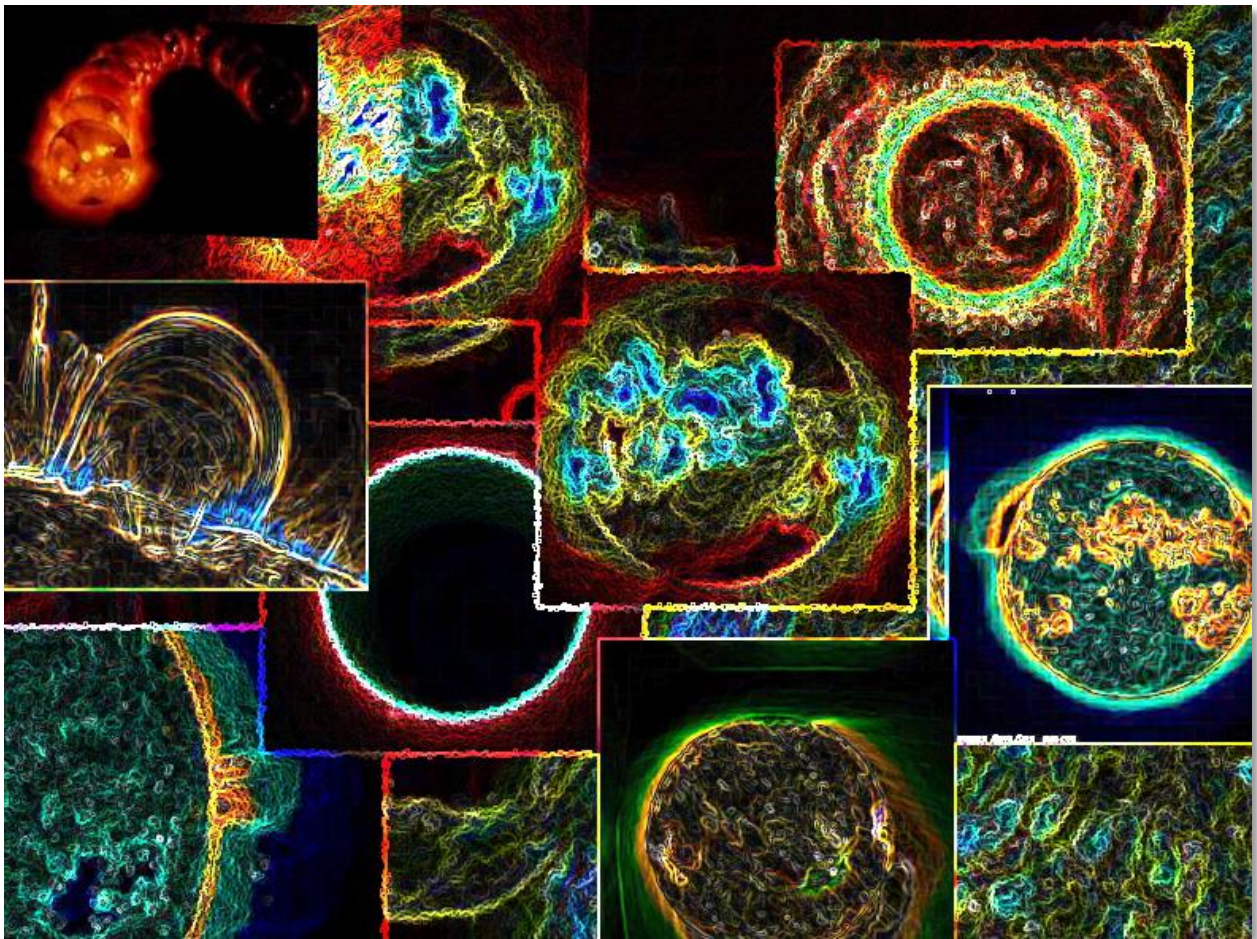
Motivate, Engage, and Empower Through Knowledge Visualization

In order to generate interest and defuse perceived difficulty in an assignment, knowledge visualization can be pursued to motivate, engage, and empower the student for maximization of cognitive learning in the classroom. The utilization of computer graphic arts software to generate digital art - a tangible product (byproduct) of the creative process - supports the cognitive aspects of the information searched/researched and its understanding. The creation of art - the making of something that comes from "within" - has always been a boon for the psyche, a gratifying experience that adds to self-esteem, and provides relevance. This creative experience is surround and exciting, which leads to greater motivation for a maximized understanding and retention of content. There is a phrase for this action - moving STEM (Science, Technology, Engineering, Mathematics) towards STEAM (STEM with an Arts component). To combine the Arts with STEM is to motivate, engage, and empower.

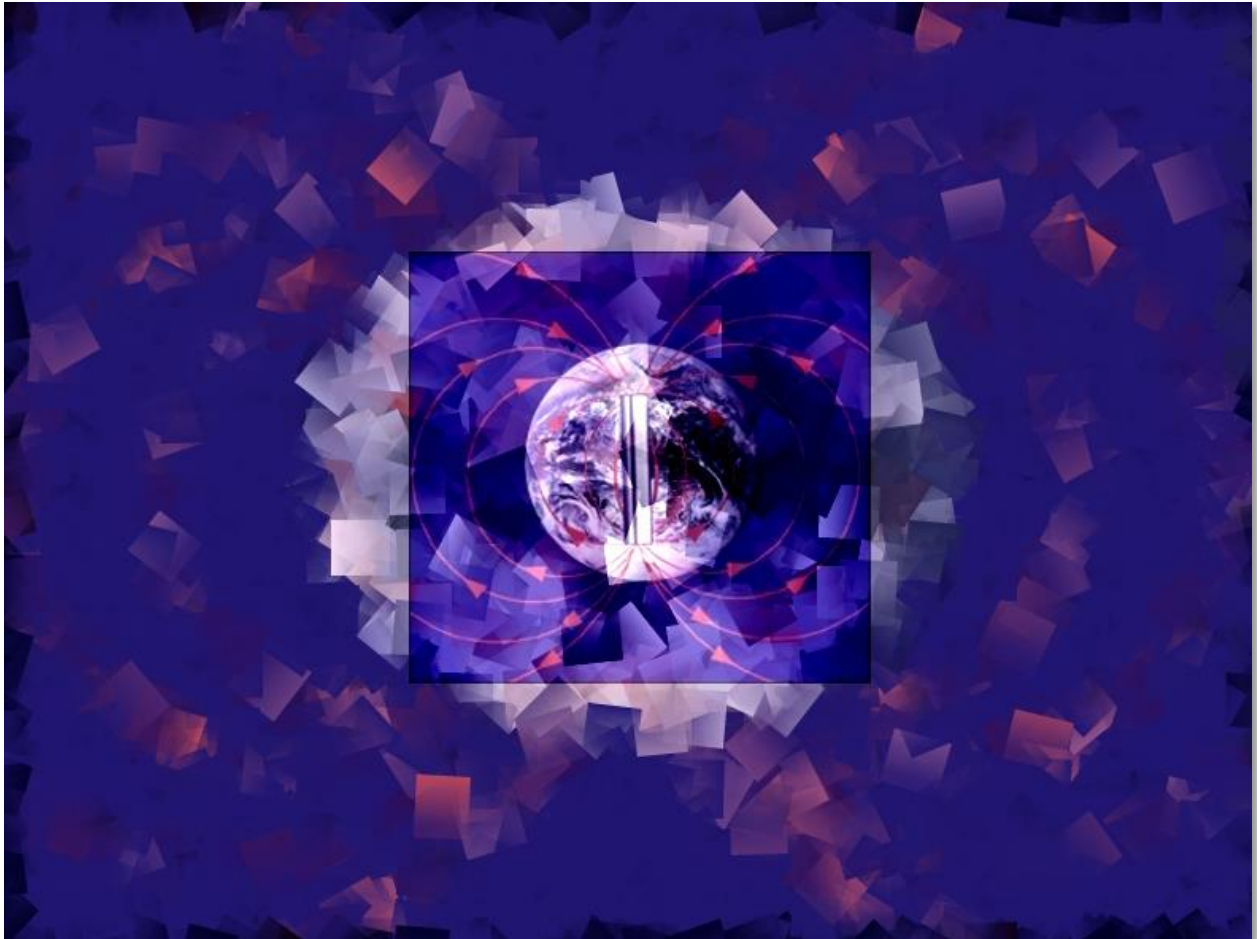
A case in point is the ongoing NASA Magnetospheric Multiscale (MMS) mission: a Solar Terrestrial Probes mission comprising four identically instrumented spacecraft that use Earth's magnetosphere as a laboratory to study the microphysics of three fundamental plasma processes: magnetic reconnection, energetic particle acceleration, and turbulence. The aforementioned processes are not only a "mouthful", but also an immediate put-off for today's youth (student) mainly because they (processes) are perceived as difficult and boring. Difficulty calls forth boredom for his young mind - any mind, perhaps - and consequently, there is no appreciable interest.

Knowledge visualization via computer graphic arts software can begin to offset this difficulty and boredom. The anticipation of generating digital art welcomes the search/research needed to compile, and understand the information. What is normally a chore for the student to endure - conducting research - becomes "child's play" as he lays the groundwork for visualization of his findings.

Two student examples follow showing the visualization process of various aspects of MMS and Space weather. These images are generated with graphic arts software. The visual results are based on a great deal of cognitive effort via search/research and creative fervor via the tools and filters of the software program.



Maria Guzman, eighth grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2011-2012.



Raul Martinez, eighth grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2011-2012.

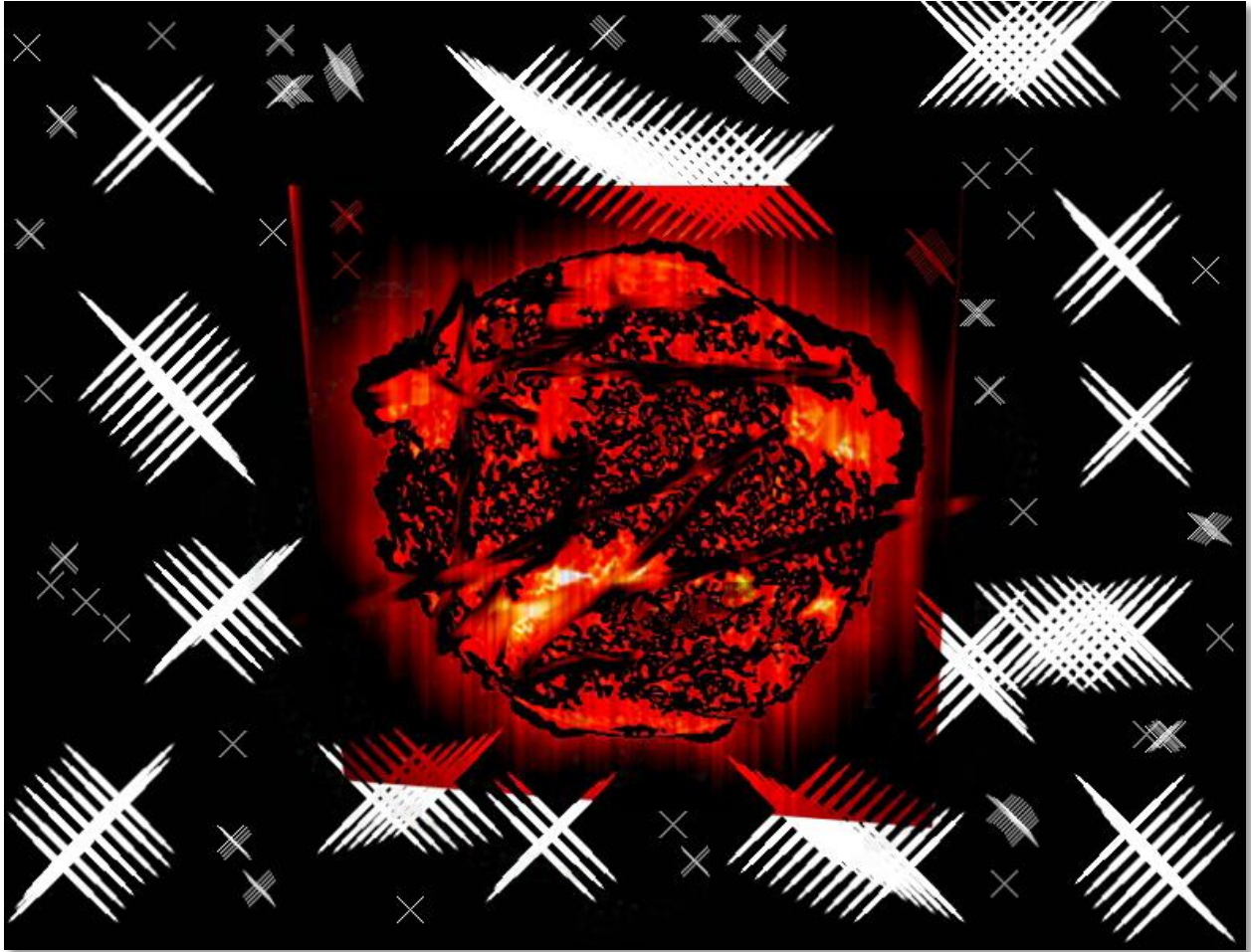
Again, the above students and their classmates took the Science research in stride because of the anticipation of making digital art. They utilized various NASA web pages and images to have a better understanding of Space weather and the purpose of the NASA MMS mission.

The topic of Space weather is about as far away from the student's mind as the Moon or Mars. It registers one or less on the Richter Scale for this youngster who is more interested in social networking on his cellphone than wading through information to gain an understanding of Space weather that comprises a glossary of over 40 terms such as: aurora, chromosphere, coronal mass ejection (CME), electromagnetic spectrum, heliosphere, magnetosphere, prominences, spectrum, solar wind, and others.

And when a complex project like the NASA MMS mission is added to the [lesson-plan] equation, the task for the teacher becomes formidable or even doubtable. In order to move the student in the direction of real desire and commitment to an assignment such as this, a "wired" and holistic approach is needed which parallels who he is and what he does as a "digital native".

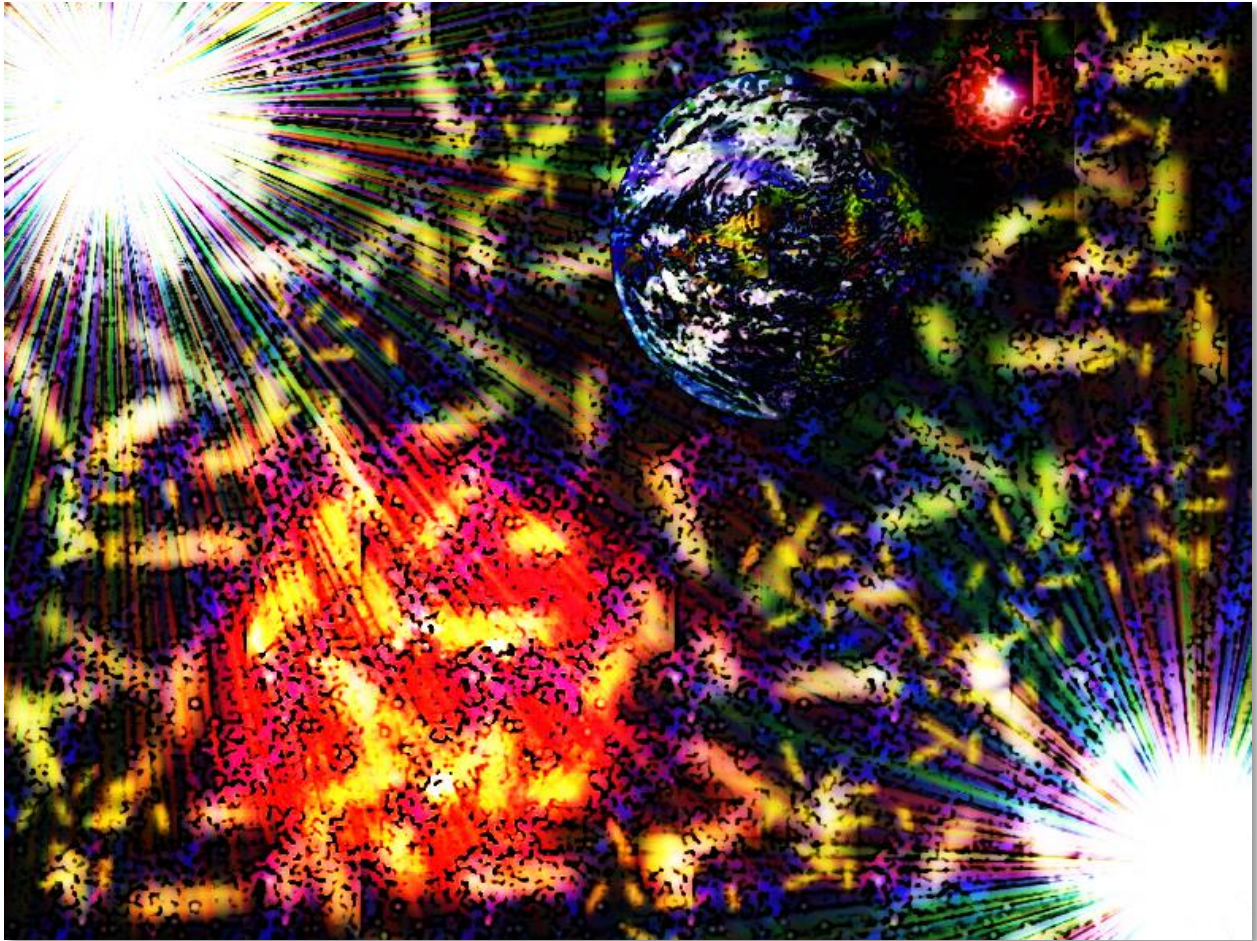
The above images and the two that follow by other students reflect an enthusiasm for the assignment - Space weather and the NASA MMS mission - because they were given an opportunity to immerse themselves in the "digital world" with creative control for generating or creating "product" - digital art. This teacher (author) heard time and time again from the students, "This is really cool!" What they meant is that the process of dealing with a complex topic in a "wired" and creative way (visualization) - and their way ("id" control) - was an exciting and satisfying experience. Unbeknownst to them, perhaps, is the fact that they indeed took part in a regimen of study regarding the Sciences.

To add transcendence, and play to their (students') social instincts, it was also understood at the onset of the lesson plan that they would convey their knowledge (gained) and graphic arts software skills (acquired) to students at another school district. They would become tutors/mentors of others. This understanding was also a motivating factor for the students to proceed with the research.



Jorge Rodriguez, eighth grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2011-2012.

When we look at the above image - and the others - there is an immediate indication of the effectiveness of the visualization process to maximize cognitive learning. Another aspect is the retention factor - being able to keep information in one's mind. Visualizing information as a "product" - digital art - nurtures this factor to a higher level because of the creative act and ownership of that being created. "This is mine, and I'm proud of it," the student says. He remembers the information via the "product".



Erika Lopez, eighth grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2011-2012.

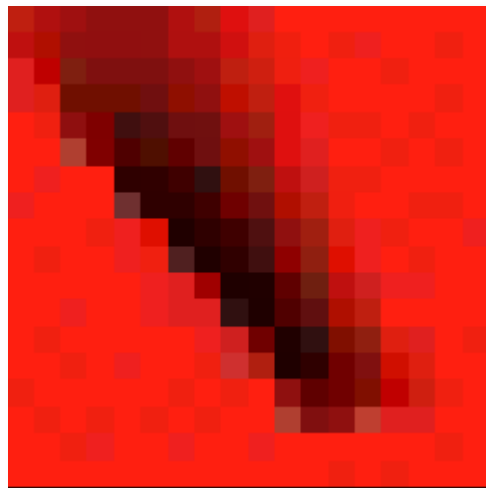
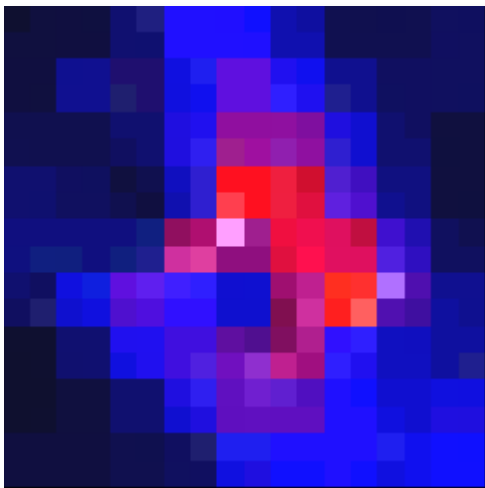
As mentioned, these students and their classmates also traveled to another school district to teach their students how to use the graphic arts software to do the same. Excitation levels were high, and empowerment came to the forefront for all the youngsters involved. The teachers present at the two-day, student workshop seemed secondary. My students were able to convey what they knew to other students, and those students were motivated through the Arts (and peer teaching) to produce “product” that was a translation of their Space weather and NASA MMS research activities. The images that follow show my students (in the maroon shirts) working with the students at the other school district.



They were empowered. The students at the other school district were not only motivated because of the “wired” approach of studying and creating digital art, but also because of the peer teaching. Or in other words, they were within their social context and the digital environment.

On a philosophical bent, a theater mask - an art piece in itself - is the means for the performer to understand and translate the drama and/or dance on stage. So is the art piece that is created in the classroom by the student to understand and explain subject content. These creative and cognitive experiences lead to greater understanding/retention of and an appreciation for STEM and its motivating component, the Arts – STEAM.

As not only an educator, but also a digital artist, the maximization of cognitive learning through knowledge visualization is very much a personal matter. For me, I consider this process a form of continued education as I pursue various projects that focus on the pixel as it relates to Abstraction, Minimalism and Suprematism. I generate “Pixelscapes” (isolated and magnified groups of pixels that comprise color fields) not only for aesthetics, but also as a means for greater understanding of mathematical relationships. Two examples follow.



In the above images, there is an immediate vehicle to motivate the student to work with calculations and mathematical relationships. Again, the cognitive and creative processes mesh as the student isolates and magnifies pixels from images (random) in graphic arts software to then calculate values (perimeter, area) and establish relationships (ratios). In an aesthetic sense, he makes digital art and in this case, within specific genres – Abstraction/Minimalism.

Another example of the mathematical model expanded via knowledge visualization is the introduction of other disciplines as they relate to the overall understanding and appreciation of practical application via calculations and relationships. “Panhandle Circle-square” (courtesy of Goggle Earth) is not only an approach to motivate the student to study Mathematics, but also a way to instill a greater appreciation of a particular sector of society - the farming community - not to mention, a bit of Geography. Two examples follow.



Scholars during the Medieval Period believed that there was something "divine" or "perfect" about the circle. The farmers of today in the Texas Panhandle believe in the practicality and efficiency of the circle via the utilization of center pivot irrigation of their crops.

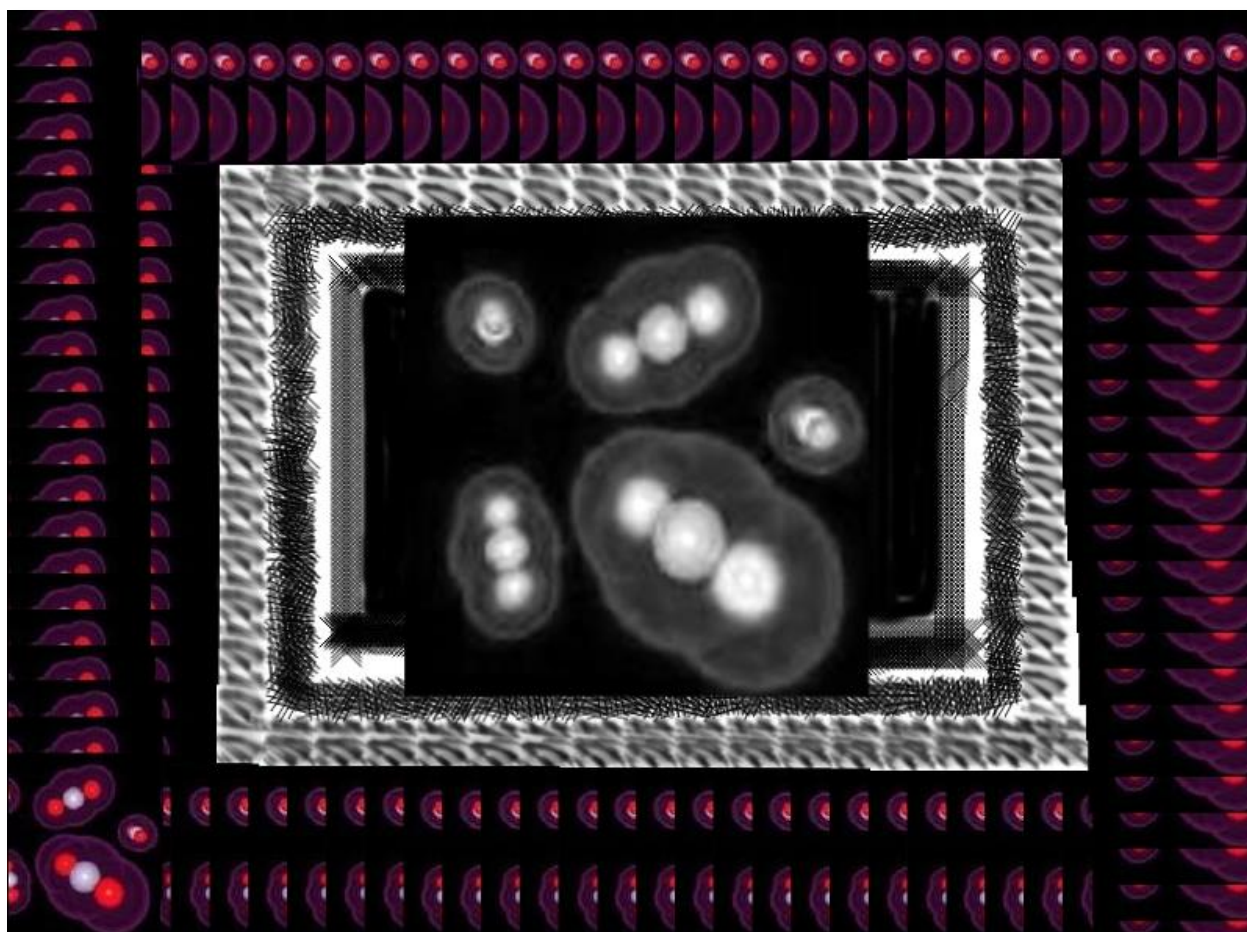
The "Earth canvases" above are a testament to the farmers' intuitive nature and mathematical skill of working with the dynamics of the circle and within the confines of a square (plot of land) to irrigate their crops. What's interesting is when these circle-square configurations are viewed as aerial landscapes - similar to "Aeropaintings" ("Futurism") - they rival the works of some non-objective artists.

The artist Kazimir Malevich (founder of Suprematism [non-objective approach to making art]) viewed the aerial landscape as a new and radical paradigm in the art of the Twentieth Century. In his mind, aerial photography had created a broad change in consciousness. Much of his work was inspired by or derived from aerial landscapes.

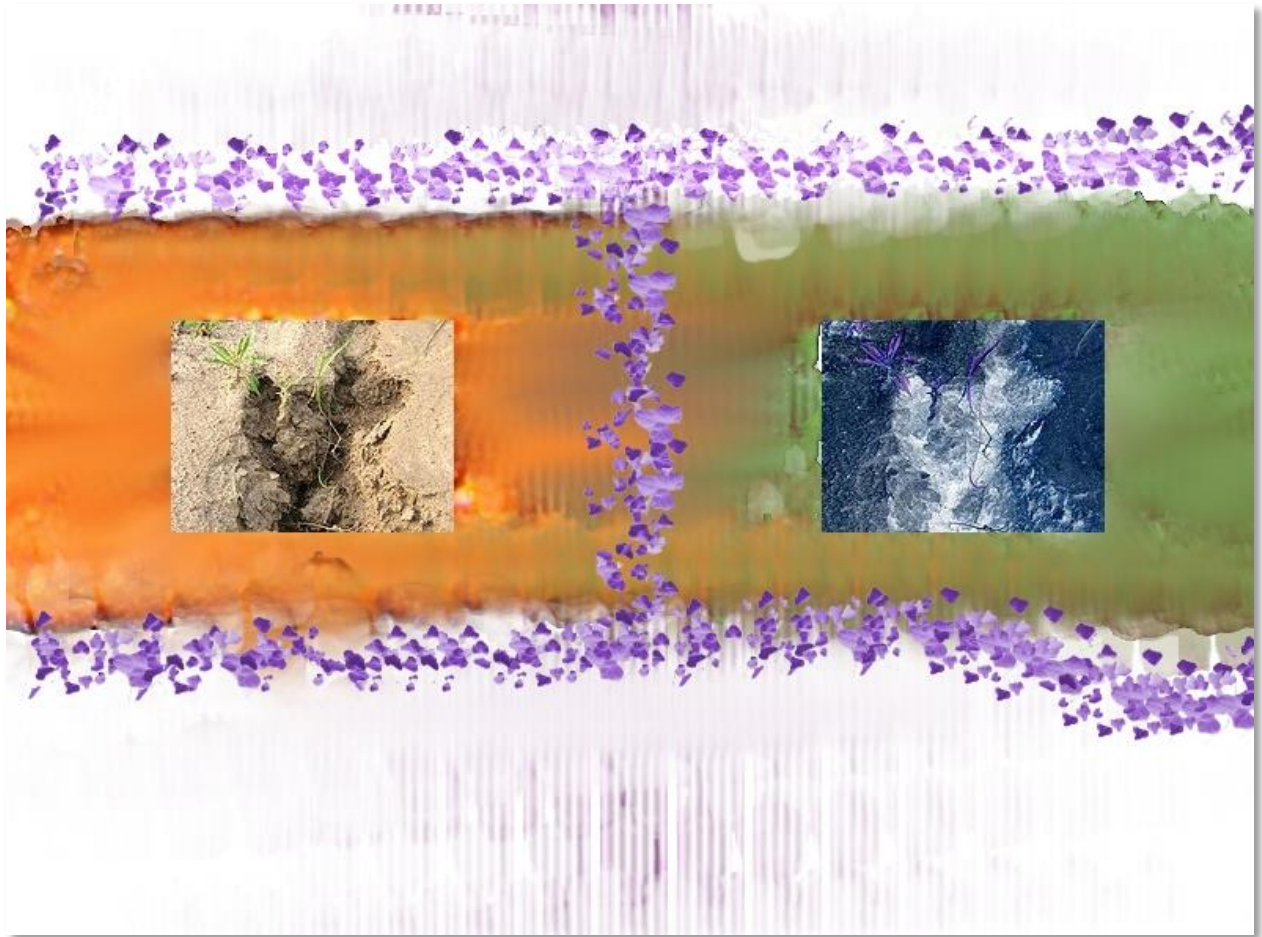
The science of accurately determining the terrestrial or three-dimensional position of points and the distances and angles between them - surveying or land surveying - can also be introduced as an additional component to the process since Mathematics is used to establish land maps and boundaries for ownership.

Maximizing cognitive learning through knowledge visualization extends in all directions/disciplines and by doing so, helps to combat aliteracy, the state of being able to read but being uninterested in doing so. The student can be immersed in various projects that center around relevance and visualization of content - exciting and motivating for him - and also require research/reading to support the projects. The student will take reading in stride - move away from his lethargic and alliterate behavior - because of the nature (mode of application) of the projects. Content relevance, hands-on hardware/software and the anticipation of "product" (end result) are motivating factors in combatting aliteracy among the student population.

Two student examples follow showing the visualization process of Science vocabulary via graphic arts software for a greater understanding of the word meanings. The students took this usually laborious and boring process in stride to be able to visualize their word meanings as digital art.



Change (physical), Gerardo Gonzalez, seventh grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2009-2010.



Erosion, Emiliano Garcia, seventh grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2009-2010.

When we look at the above images, again, there is an immediate indication of the effectiveness of the visualization process to maximize cognitive learning. And as mentioned, the retention factor - being able to keep information in one's mind - is enhanced. Visualizing information as a "product" - digital art - nurtures this factor to a higher level because of the creative act and ownership of that being created. Another student example follows.



Symmetry, Max Martinez, seventh grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2009-2010.

To move away from the Sciences and towards History, this discipline is more interesting for the older folk - the Baby Boom generation which I am a part of - than most of today's youth, the student. He is interested in the "now", so well supported via the social networking tools on the Internet. He becomes alliterate when asked to read, and study people and events of the past.

A case in point with a core group of sixth and seventh grade students studying Early American History, relevance to the study of this discipline was added by making a connection (field trip) with an individual - a real person who was born shortly after The American Revolution, lived through The War of 1812, and died after The Civil War - whose remains are at a cemetery, just a few feet below its headstone. This immediacy of the remains and the original headstone brought this history closer to the students as they documented the gravesite, and later, made digital art from their photographs to pay respects to "Sarah" for a greater appreciation of the past. Two student examples follow.



"Sarah", Rachel Arce, seventh grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2010-2011.



"Sarah", Mandy De Ochoa, seventh grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2010-2011.

When we look at the above images, it is apparent that the students took the History lesson in stride with the anticipation of making tribute pieces to a woman of the past, an individual who is far-removed from their (students') immediate lives. History was made relevant via knowledge visualization and ownership of "product" - digital art.

Knowledge visualization via computer graphic arts software can reverberate throughout the core subject content, or any content for that matter. Another case in point involves the student working with the condition of bullying for a greater awareness and understanding of this social issue. Again, he put aside his alliterate behavior, and conducted research on the Internet because of the anticipation of making “product” - digital art - a “commodity” of sorts, something he could own, and be proud of. Having said this brings me to that, or the topic of “MEE”, which I expounded upon at a teachers’ conference a few years back, but first, two student examples.



“Bullying”, Alejandro Casteneda, eighth grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2011-2012.



"Bullying", Hugo Irene, eighth grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2011-2012.

Motivate, engage, and empower translate as "MEE", and this holistic approach to the student psyche will nurture the "id" of the individual via innovation and best practices inside and outside the classroom. To ensure student success: 1) innovation must comprise cognitive planning via knowledge visualization that effectively meld core subject content with technological hands-on opportunities to motivate, and engage the student; 2) best practices must show relevance and a sense of ownership for the assignment or project to empower the student.

Challenging the student to take control of the learning process via knowledge visualization is tantamount to his enthusiasm for and desire to want to know, and complete the task. To take control is to own, and to own is to establish relevance, and give purpose to the process. What is missing in the majority of classrooms today is the address of this sense of “me” - the “id”, the self-centeredness that dictates a youngster’s being - that will transform his internalization to one of externalization.

This transformation process is one of situating the student in a learning environment that will respell me as “MEE”. In other words, precise motivation and engagement via cognitive planning and knowledge visualization (technological hands-on) will empower him to want to learn within the context of doing it his way that will provide meaning, excitement, and ownership in the finished product.

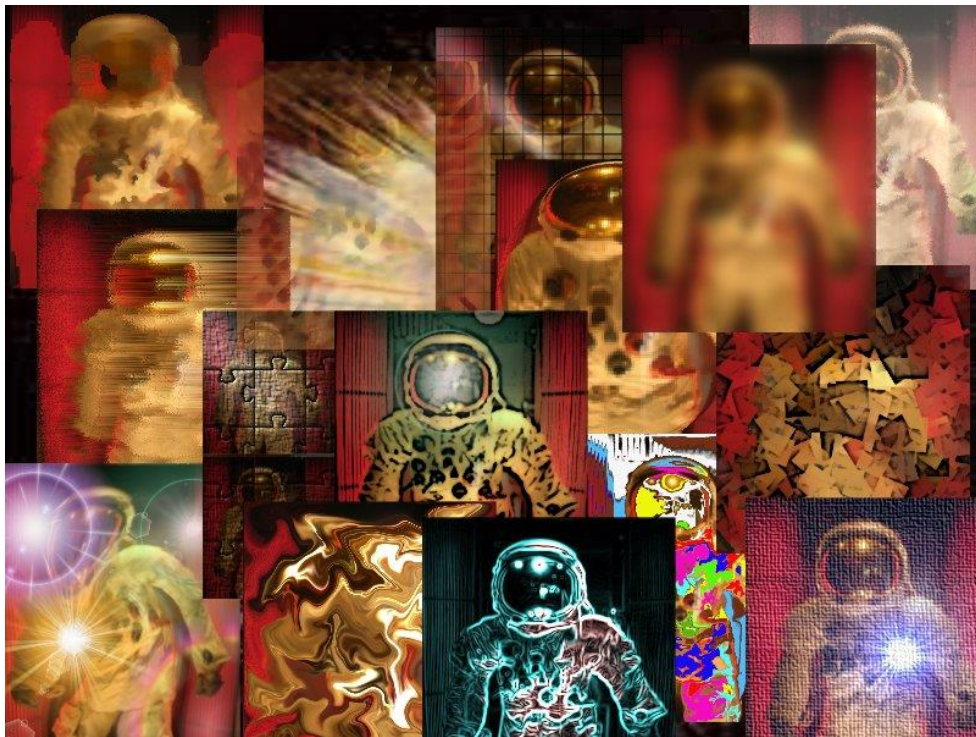
Add to that an element of transcendence. By finding ways to display student work in public places, students learn that their work is relevant. This in turn builds greater confidence, and enhances a student’s self-worth. When real world situations become part of a student’s learning path it may very well beckon him to begin to think about his goals and role in society. And this kind of thinking is a direct result of the student taking control of the learning process via knowledge visualization.

As a “digital native”, today’s student walks into the classroom eager to use technology tools within the curriculum. He has high expectations in this regard. If these expectations are not met by the teaching staff and administrators, the “id” of the student will not be nurtured at optimal levels. The overused adages of “tune in”/“turn on” and “tune out” are indeed significant for today’s classroom because the student has strong reactions to the digital versus non-digital world. As mentioned, when a student walks into the classroom from a world (digital) that he “tunes in” and “turns on” to at his discretion, and if the “world” of the schoolhouse is not conducive to who he is via his desires and activities, he will “tune out”.

The creation of “product” - and in many cases, digital art (art for art’s sake as a byproduct) - is the key in moving the student in the direction of desire for the assignment. He will be motivated to study, and produce with the anticipation of ownership via “product”. Give him the opportunity to explore his “conceptual self”/creative side based on the assigned content.

Conceptual/visual thinking at the personal and teaching (curriculum planning) levels is a direct conduit to the untapped, creative subconscious of the student. He flourishes in the world of knowledge visualization; and he is very adept at assimilating assigned content as “product” via various kinds of production software.

Two student examples follow and in this case, as it relates to Language Arts vocabulary building through knowledge visualization to generate digital art.



“Celestial”, Alondra Gonzalez, seventh grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2008-2009.



"Echo", Priscilla Cortez, eighth grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2008-2009.

When we view the above images, the visualization process is striking. The "Celestial" image is remarkable for its representation of the word and its numerous layers with various filter treatments. Not only did the student have the wherewithal to use repetition, but also a different filter treatment for each repetition. The same can be said for the "Echo" image, but an additional, creative force is at work - using an image in receding fashion to indicate the word meaning in a dramatic way. As we all know, an echo tapers off, gets weaker. The crux of the aforementioned is that each student went much deeper conceptually and aesthetically via knowledge visualization as compared to a surface result of writing down the meaning of the word.

The creative process as defined in the classroom is allowing the student to tap into his subconscious via intelligent and conceptual curriculum planning - giving him the opportunity via hands-on activities (in this case, hardware/software) to visualize assimilated content for greater understanding and retention of knowledge. He needs to be in control to expound upon the guidelines of the lesson plan.

Three student images follow that focus on web banners or banner ads seen on most websites for advertising and to generate revenue per click. Knowledge visualization via computer graphic arts software allowed these students and their classmates to have a greater understanding of advertising production (copywriting) and its economics on the Internet.



Jocelyne Arredondo, seventh grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2008-2009.



Adrian Bahena, seventh grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2008-2009.

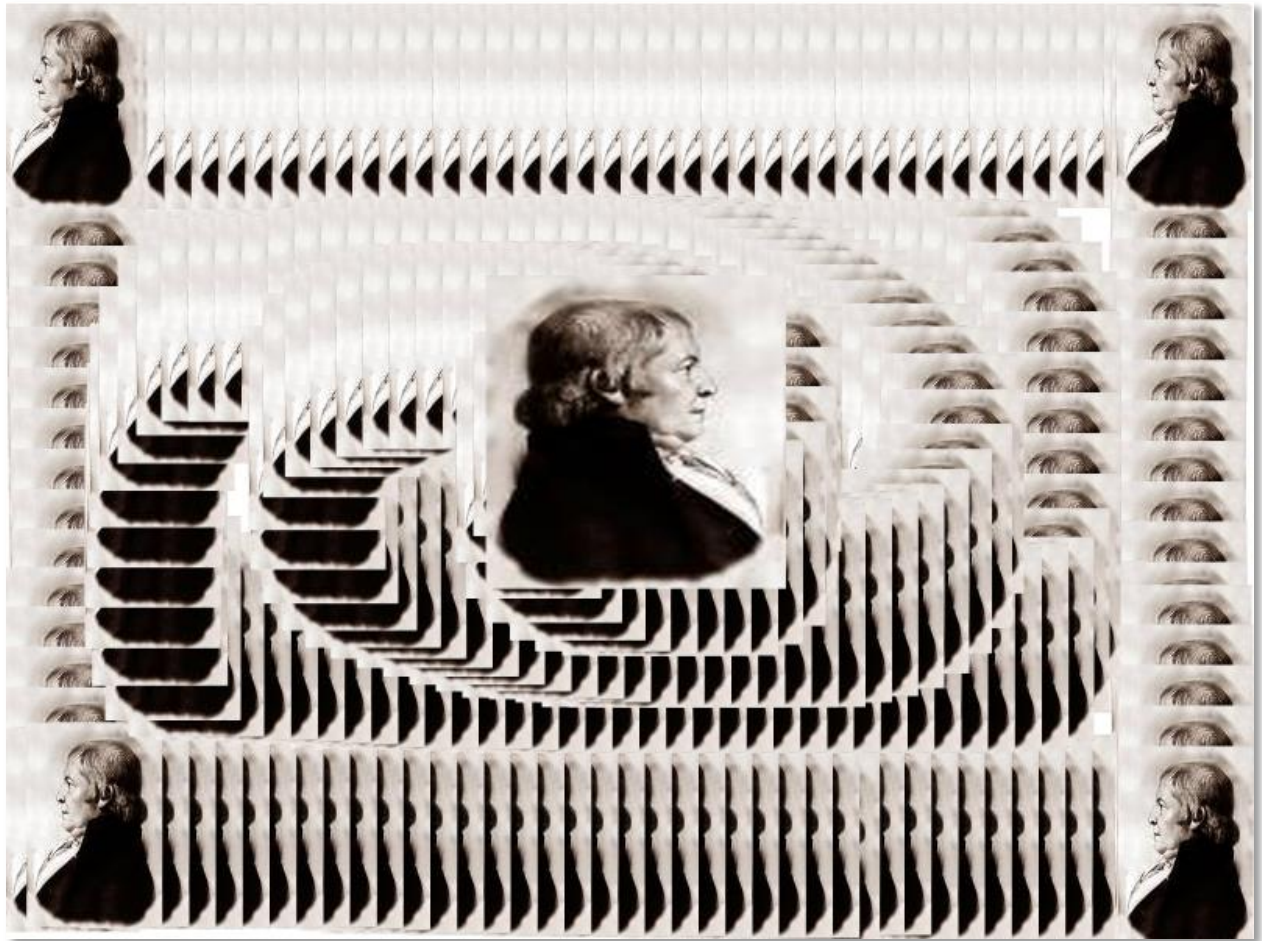


Christopher Castillo, seventh grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2008-2009.

Two student examples follow and in this case, as it relates to Early American History and Paul Revere's life and role during the American Revolutionary War. Knowledge visualization is utilized to maximize cognitive learning and at the same time, generate digital art.



Denorah Espinoza, seventh grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2009-2010.



Jasmine Perales, seventh grade, Raul Yzaguirre School for Success, Houston, Texas, USA, 2009-2010.

When we view the above images, the visualization process is noteworthy. The Espinoza image is remarkable for its treatment of the portrait of Revere - color scheme, layering, repetition, filtering and the brilliant distortion and transparency of the larger portrait. The Perales image is remarkable in its own right for the opposites in profile of the portrait of Revere and the ingenious treatment of using the portrait as a paint brush to create the tiling effect. Again, the crux of the aforementioned is that each student went much deeper conceptually and aesthetically via knowledge visualization as compared to a surface result of taking notes.

The creative process can be broken down into four distinct processes according to authorities over the years: preparation, incubation, illumination, and implementation. To transition these processes to the classroom for full benefit of the student - to “awaken” him, and maximize cognitive learning through knowledge visualization - relies on the conceptual “nature” of the teacher and his ability to convey/facilitate. Without this input from the “front end” - critical, curriculum planning - there will be no “back end” for greater understanding and retention of lesson plan content.

The composite image that follows shows the front slide of six PowerPoint presentations created by eighth grade students. These students and their classmates were challenged to take control of the learning process to make Science more exciting and interesting via knowledge visualization. They researched the concepts online, and then used visuals, text and animation to bring their presentations “to life”.

Several of these student presentations were used as a part of this teacher's (author's) presentation - “Technology and Creativity in the Classroom” - at the Region 4 Science Conference, Houston, Texas, USA, February 20, 2010.



The composite image that follows shows the front slide of six PowerPoint presentations created by seventh grade students. These students and their classmates were challenged to take control of the learning process to make Mathematics more exciting and interesting via knowledge visualization. They researched the concepts online, and then used visuals, text and animation to bring their presentations “to life”.



The creative process is very much at work in the above two projects and with a practical bent that equates the difficult topics of Science and Mathematics with the psyche of the student - via knowledge visualization - for greater understanding and retention of content. Animation is at a high degree of play - similar to the stimulus provided in gaming, perhaps - to motivate others (students) to study the various concepts of Science and Mathematics. So the creators of the presentations also become teachers for their peers. Not only have they (creators) maximized their cognitive learning through knowledge visualization, but also generated “product” in an applicable sense for others to use and learn from.

To move totally away from core subject content and to have the student focus on “inner-self” and emotions (feelings), a very personal approach to knowledge visualization via computer software is utilized. “Product” is generated under the namesake of “To know one’s parents ...”

Teacher’s (author’s) statement: “To know one’s parents is an important aspect of everyone’s life, and I regret that I never reached out to my mother and father to know what kind of individuals - human beings - they were. My parents passed away in the 1980s. All I know is that they were “mother”/”father” figures, and I will never know their interests, desires, fears, beliefs, expectations, disappointments, accomplishments, likes/dislikes, hobbies, family relationships, friendships - and the list goes on. I have a big “hole” in my heart because of not knowing who my parents were, and I don’t want you to have the same regret.”

The student is asked to interview his parents (take notes), convert the notes into third-person stories, read the stories onto a voice recorder, combine the voice recordings with music via Audacity (sound editing software), and then use the voice/music combinations with photographs via MovieMaker to produce movies (slide shows). Two student examples follow.



The interview process helps the student gain confidence in having dialogue with adults, the notes conversion to a third-person story hones his writing skills, and the multimedia approach immerses him in sound and movie editing software to hone his digital production skills. This multifaceted approach parallels the production process that is practiced worldwide in various industries that require sound and movie editing.

I believe this project - "To know one's parents ..." - moves the student towards seeing his parents in a different light. The project goes beyond "knowledge visualization to maximize cognitive learning". The student moves within a realm of enhanced awareness about himself and his loved ones.

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