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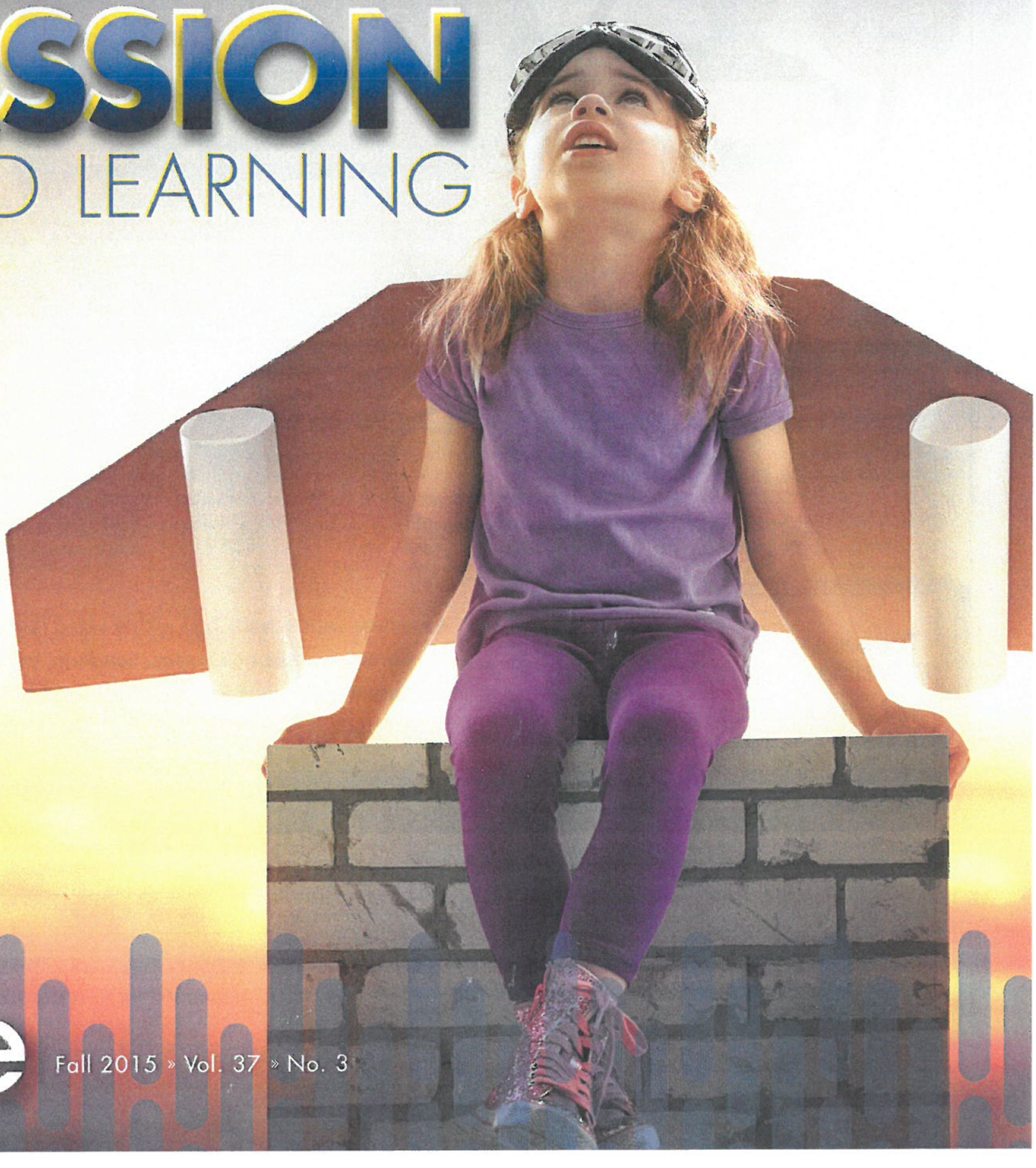

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MOVE OVER STEM - MAKE WAY FOR DREAMS EDUCATION

"Follow your passion, be prepared to work hard and sacrifice, and, above all, don't let anyone limit your dreams." – Donovan Balley

We often talk about tapping into our students' passions to help ignite learning but do we make this happen? The key to engaging our students comes down to a few basic tenants. We must give our students a purpose for their learning. It must be relevant. Learners must have some control over their own learning. Learning parameters such as determining who we work with on the task, how and when we spend our time, how we approach the task, and even what task we undertake are all elements that impact the learners' sense of control. Finally, we must make the learning fun and when possible we need to connect with ideas, projects, and tasks that the learner is passionate about. When we do this, learning naturally happens.

That is part of the push behind one of the hottest movements in education right now, STEM (Science, Technology, Engineering, and Math) Education. Linked together through a strong focus on technical and scientific studies, STEM Education is driving the educational conversation around how to link our students natural interests in these areas with relevant content and learning skills.

SHORTCOMINGS OF STEM

There is much to laud about the STEM model but it does have its shortcomings. The biggest flaw in this model is that it is less of a model and more of a collection of connected content areas. Although STEM does create interest and focus around these content areas, it does little to show learners or teachers how to connect these content areas or even how to find entry points into these rich curricular areas.

Finding relevant connections and subject areas that interest the learner has caused STEM advocates to try and expand the model. The most obvious approach to this is to add more content areas. STEM becomes STEAM when Art is added. This is great when trying to bring more student interest to the learning but incredibly difficult for the teacher when there is nothing in place to tie the ar to the math or science. It simply becomes one more content area in a string of content areas that may not connect in meaningful ways. It no longer matters whether there is a connection point or not, advocates from other disciplines are trying to tie their focus areas to the STEM bandwagon.

The final issue with STEM reflects the evolving role of technology in all learning systems. STEM calls out technology as a unique discipline requiring equal time with science, engineering, and mathematics. This may have been the case in the recent past, but technology is now infused throughout these disciplines. This is not to say that there are not unique careers to be found in technology There are and these careers should be explored. But technology should no longer be classified as a stand-alone content area. All of these content areas require a deep understanding of how technology interfaces with the discipline.

That is where DREAMS comes into the equation. DREAMS addresses this issue by focusing first on process skills and then applying those skills toward specific content areas. In this way, the natural connection with high interest content is matched with meaningful process skills so that students have the tools to pursue their passions in meaningful ways. Move over STEM and make way for DREAMS Education.

DREAMS DEFINITION

DREAMS or Design, Research, Engineering, Art, Math, and Science fills in some critical gaps in all current versions of STEM. DREAMS begins with a focus on two specific process areas. DREAMS begins with a focus on two specific process areas - design thinking and research. The DREAMS model then applies these process skills to the content areas of Engineering, Art, Math, and Science. Although STEM implies process, it does not delineate process in the model design. In this way, STEM provides little direction beyond suggestions for content focus. Design and research seem implied in the STEM model (since they are used by engineers and scientists) but they are not clearly addressed and their absence does not give the learner a starting point or a defined set of tools to explore the content.

Design thinking is a primary driver in DREAMS. Students start with a question to be solved, a problem to be fixed, or an interesting idea that takes them through the content areas. Research is also critical to the DREAMS model. Research gives the learner tools to gather and analyze information to support their work. In today's data rich learning environments, a learner must have a solid grounding in research skills to make sense of the world around them

Content is also important to the DREAMS model. Engineering, Art, Math, and Science provide the focus of investigation in the DREAMS model. The design thinking and research connect these content areas. The STEM model does not have this process glue to hold the model together or link the content areas. The inclusion of art in the STEAM version of STEM is a good example of this. As noted above, art in the STEAM model feels like a clunky add-on to the original STEM concept. It has limited connections to the world of science or math and only becomes relevant if one assumes a design process. In DREAMS, art is a critical component and becomes a necessary playground for much of the design work.

Figure 1

PROCESS SKILLS

Design (Thinking)

Research -- Information Literacy

Scientific Process

CONTENT AREAS

Engineering, Arts, Math, Science

DREAMS FOCUS ON PROCESS SKILLS

That defines this newer version of STEM but what does the DREAMS model actually look like in design and practice? The first part of the model is really about process skills. These include design thinking and research. Design is really more about design thinking than designing, although participants in a DREAMS programs will end up designing products. Research is the other process skill that all DREAMS participants will need. Research not only includes sound grounding in information literacy but also a thorough grasp of the scientific process. These process skills of design thinking and research can be used in any discipline although there is an emphasis on the delineated content areas.

DESIGN THINKING (PROCESS SKILL)

Design thinking has a rich history. Design thinking differs from the technical field of design because it is a process of work rather than a specific design task. There are many different models for design thinking and a number of excellent articles and books on this process. David Kelley who founded IDEO has written extensively in the area and has developed the IDEO model of design thinking. Rolf Faste helped make Stanford University one of the leaders in this field as far back as the 1980s. This work has been continued at Stanford through the Design Thinking for Social Innovation School and the work of Tim Brown who has written and spoken extensively in the area. Design thinking models vary based upon their purpose and audience but there are many similar features to the different models. I have taken the liberty to synthesize the various models into one that supports K-12 instruction and the work of educational institutions. This hybrid model includes the following steps: 1) Inspiration; 2) Ideation; 3) Exploration; and 4) Creation.

Figure 2

DESIGN THINKING MODEL

Inspiration

Ideation

Exploration

Creation

Inspiration in this design thinking model can originate from many different places. It can start with a question, problem, or challenge. How do we cut down on paper usage? How could we increase the number of students who purchase lunch? What does a 21st Century classroom look like from a student perspective? Inspiration can also be more directed. It can start

from a curricular topic, an assignment, or just an idea. The point here is that inspiration to start the process can come from the learner or from external sources and can be fully elaborated or simply a hint of an idea. Anything that starts the process forward is inspiration. In many design thinking models, inspiration often comes from looking at the needs of the customer or end-user.

Ideation is the process of creating a number of ideas or brainstorms around the inspiration. At this point in the process, the more ideas, the better. Look for connections, use word play, and put forward crazy ideas because the purpose here is to stimulate further thought.

Exploration is where ideas start to come to life. The work in this stage is concrete. Start to build something. Write it down. Make prototypes. Exploration builds from the ideation and turns the ideas into real things. Part of this process also involves testing and refining ideas, which in turn may lead to better models of the original idea or an entirely new model or idea.

Creation is the step where final production occurs. As noted above, it may not answer the original question or challenge but at the end of this process, a final product is created and usually shared.

As you can see, there are some unique attributes to this process. Design thinking by its very nature is experimental and not necessarily linear. Work in the exploration stage may lead one back to ideation or even begin a new inspiration. The purpose of design thinking is to spur creativity and that means that the process may lead in unexpected directions and solutions. Failure is an expected part of the process and early prototypes exist to discover flaws and lead to improvements. Design thinking is not meant to be a strict recipe but more of an approach.

One can see that design thinking shares many attributes of other learning models. Using the Acquire, Analyze, Apply Model (Baird, 2014) as a comparison, it is easy to see how the stages of design thinking fit nicely into this broader cognitive construct. Both models start by trying to understand the task, problem, or information. They work toward looking at the issue in new ways and ultimately lead to application or product. Design thinking differs somewhat with a greater emphasis on the ideation and exploration stages and with a less linear approach to the final outcome.

Project-based learning is another learning model that coexists smoothly with design thinking. Project-based (or problem based) learning almost always starts with a challenging question or problem to be solved and often is a long-term learning experience. Design thinking can easily be used in the project-based arena although once again, it is not as structured as project-based learning in its goal toward solving a specific problem.

The scientific process is closely aligned with design thinking. Both can start from a hypothesis and rely upon exploration (experimentation in the scientific process) to lead one to a right answer. The scientific process is not always designed to lead one to a final product and it is much more systematic in its approach through the process than design thinking.

Perhaps the most analogous model that teachers can relate to design thinking is the writing process. In the writing process, inspiration also comes from multiple sources. Prewriting or ideation takes place and through the process of writing multiple drafts, exploration and eventually creation occurs. The differences between the two processes are somewhat minor. Design thinking usually works best with a team unlike the writing process. The options for final product are much more diverse in design thinking than writing but the similarities outweigh the differences between the two processes.

The focus in design thinking is found within the ideation and exploration stages. It is not constrained to one solution or even one area of problem solving. A good example of this would be to look at a design team tackling the issue of heart disease. If the design team only approaches heart disease from the mindse of a pharmaceutical company, all of their solutions will be new medications. If that same design challenge were approached from the perspective of a personal fitness gym, the solutions will only improve physical fitness techniques. A dietary supplement company will focus on nutrition factors. This is not true design thinking since limitations of solutions were built into the ideation and exploration stations. True design thinking must be open to all new ideas. This is what makes it different from other learning process models. This type of thinking can support an organization in pushing boundaries to find new creative ventures.

RESEARCH (PROCESS SKILL)

The information literacy and the scientific process are the research components of DREAMS. They require specific background knowledge but they both, like design thinking, are really more about a learning process.

Today's learner must know where to go to seek out information. They must be able to work in a variety of media. They must be able to sift through mountains of potentially valuable resources to find the most pertinent information related to their work. They must be able to discern reliable information from false information. This requires a specific set of skills known as information literacy.

Passion-Based Learning often starts with information literacy. Learners will spend hours asking questions, tracking down articles, videos, and little known facts about things they love or want to learn more about. The library, media center, or learning commons has long been the center for this type of study. Nowhere else is this idea of every individual seeking out their own area of interest more relevant than the library. Today's school library takes on even greater significance then in this information literacy quest. Rather than being relegated to an antiquated tool that has no significance in the digital age, the school library has begun to transform into a hub that has the potential to empower and connect every learner to their unique passion in a number of exciting ways. The power of today's library is further enhanced when students possess information literacy.

Acquiring information literacy skills may seem like a daunting task. The amount of information is increasing at an incredible speed and many learners can become overwhelmed by the sheer amount of information available. That is why the American Association of School Librarians developed a set of information literacy standards for K-16. This easy to use set of standards gives learners the tools to locate, evaluate, select, use, and share information in an effective way.

The scientific process is the second arm of research in the DREAMS model. The scientific process is well known to all and has already been discussed as a companion tool to design thinking. When dealing with the sciences, students must always be prepared to develop a hypothesis and then test it by controlling for various variables. Information literacy along with a deep understanding of the scientific process will allow DREAMS learners to be effective researchers.

DREAMS FOCUS ON CONTENT AREAS

The fields of engineering, art, math, and science are rich with learning opportunities. These areas also overlap in many ways so that students may use their knowledge of math and science to tackle an engineering project. Through their use of art and design, they can then move forward with the development of a unique product that meets a specific need. Steve Jobs and the team at Apple used this approach when they invented the Macintosh computer. Having new technology was not enough. How the technology looked, felt, and interfaced with the user was just as important. Knowledge of the content areas and the attempt to answer questions found within the content areas give DREAMS education a reason and place to focus.

DREAMS EXAMPLE

How does the DREAMS model work in the real world? One example comes from the Encinitas Union School District. Fifth and sixth grade students at two of the district's schools were presented with a challenge. The district was located along the Pacific Coast in the San Diego area. Students were presented with the challenge that our oceans were becoming polluted from our waste and storm water runoff. Our schools were part of this problem. So what could we do about this? Thus the Storm Water Pollution Prevention Plan Team was created.

Working with outside experts and district teachers, students were first presented with the challenge to make a difference. Many students became so involved with the project that it quickly changed from a once a week classroom-based experience to a more frequent free time choice activity at recess and after school.

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Students began with the process skills of information literacy. Utilizing experts, articles, and videos, they learned more about the problem and its causes. They then moved into the role of scientist. They tracked the water flow from their campus to the ocean. They took water samples along the way and tested them. They worked with scientists at a local wastewater treatment plant. They became experts themselves in the science and math behind the problem. They then went back to design thinking. They prepared a detailed report of the issues and they brainstormed solutions to the problems. In this phase, they engineered a number of strategies to keep waste out of drains including the use of new types of filters. They tested and retested. Finally, they brought in art and creativity to design an advertising campaign to bring their new solutions to life. At the end of the process, the student researchers presented their findings to the school board and the county board of supervisors. They submitted their plan and went to work implementing it and monitoring results. Throughout the project, these students learned that their actions could make a big difference when the DREAMS model was used.

Design, research, engineering, art, math, and science make up DREAMS education. This new STEM based learning model has the potential to inspire an entire new generation of students to follow their dreams and pursue their passions.

Timothy B. Baird, Ed.D.
Superintendent, Encinitas Union School District

The Encinitas Union School District (EUSD) has a long-standing reputation of high student achievement and has been acknowledged for its innovative learning opportunities. As Superintendent, Dr. Baird led the implementation of a one-to-one digital learning program, which includes a suite of digital curriculum, for all students and EUSD has been recognized as an Apple Distinguished Education Program. Dr. Baird's leadership in green initiatives and environmental stewardship has garnered state and national recognition for the district's conservation efforts, including selection by the U.S. Department of Education as a National Green Ribbon District. EUSD, with generous support from the Paul Tudor Jones Family Foundation and Sonima Foundation, has developed and implemented an award-winning, comprehensive Health and Wellness Program that incorporates yoga and character education classes for all students. *www.eusd.net*

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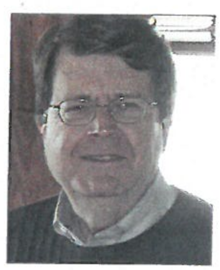
to implement network infrastructure within schools and to provide school districts with utilization information for optimal decisions. The K–12 High-Speed Network may partner with county offices of education or other local educational agencies to provide statewide access to training and resources.

- $900 million: Three-year competitive grant program for high quality career technical education partnerships with businesses and the community. The program will allocate $400 million in 2015-16 to small, medium and large partnerships.

For updates: Go to CUE.org for updates and additional information. Also, go to cde.ca.gov/ for current details on these and other State funded programs.



John Cradler is President of Educational Support Systems and the Legislative Policy Consultant for CUE. He has been actively involved in developing policy and legislative proposals for educational technology at the state and national levels for the past 25 years. He played the lead role in the development and advocacy for State legislation that established CTAP and SETS (SB 1510) as well as other State legislation related to staff development (SB 1882) education technology and assessment. He has been conducting formative and summative evaluations of state and Federally funded statewide, regional, and local educational technology prgrams and projects for the past 35 years. He has served as Director of Technology for WestEd, the Council of Chief State School Officers, a Teacher Education and Computing Center (TECC), and the South San Francisco Unified School District. Contact him: *cradler@earthlink.com; and visit cue.org/advocacy.*