# Introduction to Design Standards and Objectives:

## Seven Habits of Highly Creative People

| Creative Habits | Competencies/Standards | Objectives | Skills & Considerations |
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| **Habit 1:** Creative people ask "Why." *(Einstein & Infeld, 1938; Guilford, 1959; Schank, 1988; Wakefield, 1991; Runco, 2004; NCEE, 2007; Sinek, 2009; Sternberg, 2012; Scott, 2015)* | (H1.S1) Students will identify new problems/ opportunities by routinely questioning considerations such as sustainability, utility, aesthetic appeal and accessibility of existing designs, processes and products. | (H1.S1.O1) Students will Critique existing products/ designs and will consider how aesthetic value can be added by employing Design Principals. (CCSS, 2010; Visual Art Essential Standard B.CR.1) | Design Principles: Proportion, Balance, Harmony, Alignment, Repetition, Contrast & Emphasis. Students will utilize Elements of Design: Line, Space, Color, Texture, Shape & Value. (Visual Arts Essential Standards) |
| | | (H1.S1.O2) Students will critique existing products/ designs and will consider how products can be re-designed for more efficient usage or re-purposed for novel uses. They will "apply the Engineering Design Process to produce solutions to problems." (TED 4.01) | Engineering Design Process (TED 4) |
| | | (H1.S1.O3) Students will critique existing designs/ products and will consider the extent to which products are ecologically sustainable. | Next Generation Science Standards |
| | | (H1.S1.O4) Students will critique designs/products and will consider how products and environments are economically and physically accessible to the public. | Entrepreneurship I Blueprint |
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| **Habit 2:** | (H2.S1.O1) Students will gain the ability to | (H2.S1.O1) Students will | |

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| Creative people access pertinent information. *(Amabile & Hennessey, 1987; Csikszentmihalyi, 1996; Ward et al., 1997; Partnership for 21st Century Skills, 2010; Scott, 2014)* | access knowledge in an effort to thoughtfully define and analyze problems. | "Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation." (ELA CCSS, 2010) | |
| | | (H2.S1.O2) Students will collaborate and access expertise of peers. | |
| | | (H2.S2.O3) Students will come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. (ELA CCSS, 2010) | |
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| **Habit 3:** Creative people are able to critique current practice as they analyze/deconstruct the problem at hand. *(Schank, 1988; Csikszentmihalyi, 1996; Weisberg, 1999; Sinek, 2009; November, 2012; Scott, 2015)* | (H3.S1) Students will gain the ability to thoroughly define given problems. | (H3.S1.O1) Students will "analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt." (Math CCSS, 2010) | |
| | (H3.S2) Students will gain the ability to ask thought-provoking questions. | (H2.S3.O1) Students will engage in open whole group and small group discussion and student led | |

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| | | critiques where questioning will be modeled and expected. | |
| | (H3.S3) Students will gain the ability to consider issues of usability, sustainability, aesthetics and accessibility when analyzing a problem as potential avenues by which they may divert from an established path. | (H3.S2.O1) Students will deconstruct ideas, processes and products. They will identify its essence or most basic function, and will learn to use such conceptions as a new starting point to take the idea, process or product in a new direction. (Sternberg) | |
| | | (H3.S2.O2) Students will become "engaged and open-minded—but discerning—readers and listeners. They (will) work diligently to understand precisely what an author or speaker is saying, but they also question an author's or speaker's assumptions and premises and assess the veracity of claims and the soundness of reasoning." (ELA CCSS, 2010) | |
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| **Habit Four:** Creative people are fluent, flexible and original in their generation of ideas. *(Torrance, 1972; Guilford, 1986; Gardner, 1993; Simonton, 1999; Lewis, 2009)* | (H4.S1) Students will gain the ability to alter point of view in order to become flexible in their thinking. (ELA CCSS, 2010) | (H4.S1.O1) Students will learn to visualize possible solutions. Students will employ visual reasoning, rotation, transformation, synthesis etc. (Daniels in Davis, 2013) | |
| | (H4.S2) Students will gain the ability to utilize metaphors and analogies as vehicles for the conception of new and pertinent ideas in order to improve the flexibility of their | (H4.S2.O1) Students will consider "extreme adjectives" as a means of increasing the originality, fluency and | |

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| | thinking. | flexibility of their ideas. | |
| | (H4.S2) Students will seek inspiration from a variety of sources in order to conceive of original ideas. | (H4.S2.O1) Students will seek inspiration from exemplars and nature (i.e. form, space and proportion) | Golden Mean<br>Fibonacci Sequence |
| | | (H4.S2.O2) Students will seek inspiration from existing innovations and works of art. | |
| | | (H4.S2.O3) Students will learn to combine ideas across varied domains. | |
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| **Habit Five:**<br>Creative people are able to effectively transition ideas from their heads and into the real world. *(Csikszentmihalyi, 1996; Sternberg, 2003; Scott, 2015; Wagner 2015)* | (H5.S1) Students will gain the ability to quickly record ideas. | (H5.S1.O1) Students will routinely sketch ideas within sketch books as a means of quickly recording ideas. | |
| | (H5.S2) Students will utilize the Design Process. | (H5.S2.O1) Students will plan and develop solutions to design problems. | |
| | (H5.S3) Students will learn to model and represent their ideas in a form that can be understood and effectively communicated. | (H5.S3.O1) Students will create “coherent representations” of the problem at hand and their proposed solutions. (Math CCSS, 2010) | |
| | | (H5.S3.O2) Students will learn to solve problems through the process of modeling. Students will understand the role of modeling in linking "classroom mathematics and statistics to everyday life, work, and | |

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| | | decision-making. (Math CCSS, 2010)." | |
| | | (H5.S3.O3) Students will access technology to model and refine their solutions. | Auto-Cad; Adobe Creative Suite; Inventor |
| | (H5.S4) Students will gain the ability to evaluate ideas, accept constructive criticism and make adjustments as deemed necessary. | (H5.S4.O1) Students will analyze and evaluate solutions. They will effectively communicate ideas and defend the value of their design solutions. (TED 4.05) | |
| | | (H5.S4.O2) Students will "monitor and evaluate their progress and change course if necessary." (Math CCSS, 2010) | |
| | | (H5.S4.O3) Students will "justify their conclusions, communicate them to others, and respond to the arguments of others." (Math CCSS, 2010) | |
| | | (H5.S4.O3) "Students will propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions." (ELA CCSS, 2010) | |
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| **Habit Six:** Creative people are motivated. They persevere through set-backs and overcome obstacles. | (H6.S1) Students will gain the ability to view failure as an inescapable part of the Creative Process. | (H6.S1.O1) Students will routinely offer and accept criticism within the context of student led critiques. | |

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| *(Renzulli, 1979; Boden, 1990; Csikszentmihalyi, 1996; Sternberg, 2003; Wagner 2012)* | | | |
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| **Habit Seven:** Creative people take sensible risks. They buy low and sell high. They pay attention and look for opportunities to add value to existing products or processes. *(Csikszentmihalyi, 1996; Amabile, 1997; Sternberg, 2003; Pink, 2008; Wagner, 2012)* | (H7.S1) Students will learn to see design problems as potential projects that can add value and create wealth. | (H7.S1.O1) Students will employ entrepreneurial discovery strategies to generate/evaluate ideas for business ventures/products. (ME11 2.01) | |
| . | (H7.S2) Students will consider the marketability of innovative ideas and products and how innovative ideas and products can be used to launch, re-create and/or sustain a business. | (H7.S2.O1) Students will access technology as a means of effectively communicating ideas to the public. | |
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**LCO Checklist**

**Facility Needs:** Only Classroom Space

**Equipment/Supplies**

1. Adobe Software
2. Large Format Printer
3. Color Printer

**3rd Party Assessment Provider:**

**Assessment Name:** Torrance Test of Creativity.

**Assessment Provider:** STS Testing

**Proficiency:** Scores are based on a national percentile ranking. We intend to access growth in creative thinking by way of comparing the pre-assessment to the post-assessment.

**Cost:** Approximately $6.00 per student.

**Rationale for the creation of the course**

*"Therein lies the key, I think to Einstein's brilliance and the lessons of his life. As a young student he never did well with rote learning. And later, as a theorist, his success came not from the brute strength of his mental processing power but from his imagination and creativity."*

*(Isaacson, 2007 p.7)*

The study of creativity is a local need because it is a universal need. Rockingham County has experienced a major shift in its economic base. The manufacturing industry that provided the citizens of Rockingham County with opportunities to earn a living performing relatively low-tech and routine work has all but vanished. Rockingham County is intent upon developing a workforce that will meet the demands of the new economy in which we find ourselves. It is an economy that is driven by knowledge and innovation rather than man-power. Rockingham County Schools would like to play a pivotal role in preparing students for new opportunities within a new economy. The course which we entitled "Intro to Design" was initially conceived to develop the creative capacity of our students who are interested in STEM careers. We intended to emphasize creativity with this group of students because we understand that 21st Century Industries are demanding "engineers who think like artists and artists who think like engineers." However, we also realize that the development of creative capacity can positively impact virtually all career choices. As a result, we believe that this course can serve as foundational class to virtually all CTE programs which we offer in our high schools. It is expected to be a high

interest and high demand class targeted toward rising 9th grade students. The course will increase their creative capacity by helping them to develop the following habits which we extracted from the research on creativity:

- **Habit One:** Creative People ask "why."
- **Habit Two:** Creative people access pertinent information.
- **Habit Three:** Creative people are able to critique current practice as they analyze/deconstruct the problem at hand.
- **Habit Four:** Creative people are fluent, flexible and original in their generation of ideas.
- **Habit Five:** Creative people are able to effectively transition ideas from their heads and into the real world.
- **Habit Six:** Creative people are motivated. They persevere through set-backs and overcome obstacles.
- **Habit Seven:** Creative people take sensible risks. They buy low and sell high. They pay attention and look for opportunities to add value to existing products or processes.

The habits listed here were compiled based on extensive research on creativity. We hope that the habits outlined will increase the level of creativity among students within the class. Specifically we hope to increase the student's ability to become fluent, flexible and original in their idea production as measured by the Torrance Creative Abilities Assessment. We have achieved a measure of success. Several students achieved a 99 percentile ranking on the post assessment. The class attempts to integrate the design processes

that are employed in the arts and engineering. The course seeks to help develop the type of adaptive reasoning that is sought after by the writers of the Mathematics Common Core State Standards (Math CCSS, 2010).

We also developed the course with the understanding that the course itself has to remain innovative and pertinent. This will be done by employing a yearly assessment of the units and projects that are provided. Students will evaluate each of the major projects. This process allows us to reflect upon the effectiveness of our units and projects in developing student capacity to create. Furthermore, the students themselves will be responsible for providing much of the fuel that is necessary for the course to continuously evolve. This will be accomplished by a course requirement that students periodically bring emerging technologies, applications and software to class for discussion and consideration. This will provide students with new tools that may be useful in subsequent projects and will keep the teacher up to date on emerging tools and technology that would impact his/her conception of the following year's objectives and projects.

## Importance of Creativity

*"The dominant ideologies of education are now defeating their most urgent purpose: to develop people who can cope with and contribute to the breathless rate of change in the 21st Century- people who are flexible, creative and have found their talents."* (Robinson, 2001 p.57)

The development of creativity represents the confluence of three fundamental reasons for educating people- economic need, cognitive development and psychological well-being. The Intro to Design course is intended to support the economic need of our region by increasing student capacity to "think" creatively (NCEE, 2007; Friedman, T. 2005; Florida, R. 2005; AMA, 2010). It is

intended to support student cognitive need by employing the higher order thinking skills that are necessary for the development of creative ideas (Anderson, L. & Krathwohl, D. 2010; Cs Guilford, J. 1986; Gardner, H. 1982). And it is intended to support student interest and intrinsic desire to create (Maslow, A. 1967; Pink, D. 2009).

## Creativity as an Economic Need

*"If we are to make real strides in boosting the creativity of scientists, mathematicians, and all upon whom society depends, we must arrive at a much more detailed understanding of the creative process… The study of creativity must be seen as a basic necessity."*
(Amabile & Hennessey, 2010 p 570.)

The type of thinking that sustained our economy over the past century will be inadequate in the 21st Century. The Partnership for Twenty First Century Skills (P21), lists the development of creativity as a skill that will be crucial for success in the 21st Century within their recommendations for the reauthorization of the Elementary and Secondary Education Act. The partnership recommends that the reauthorization define college and career readiness as "mastery of core content knowledge *and* competencies in essential, higher-order thinking skills. The act should specify the fusion of the full range of core subjects and essential skills, such as critical thinking and problem solving, communication, collaboration, and *creativity* and *innovation*" (NCEE, 2007).

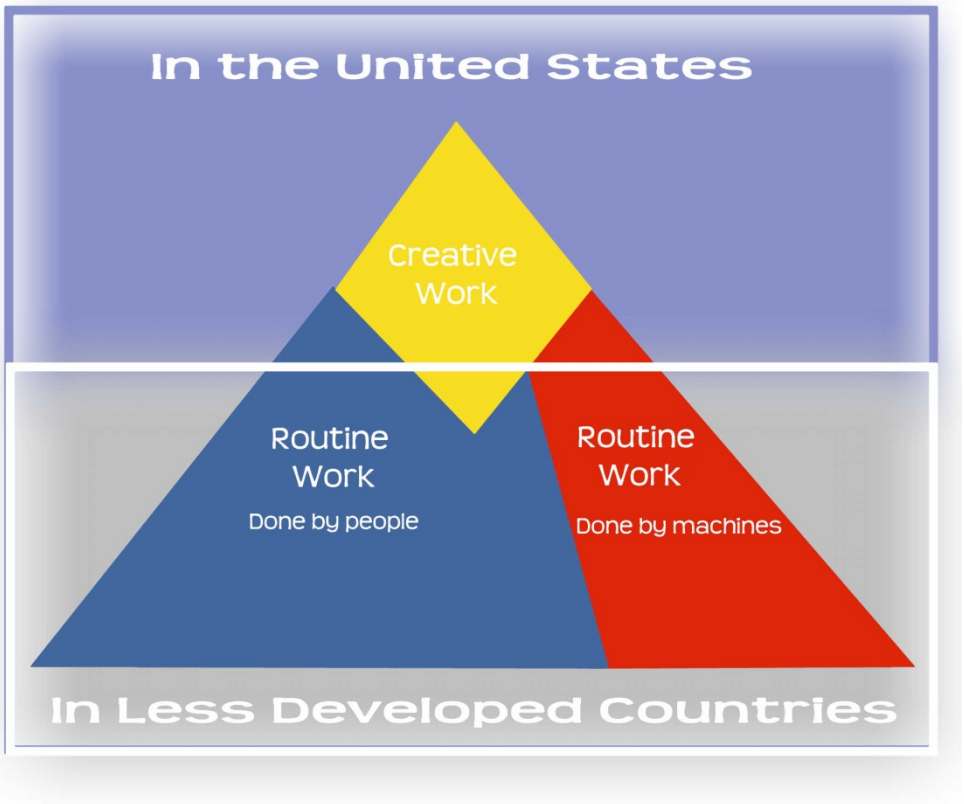
The American Management Association (AMA) contends that success in the 21st Century will be dependent upon the development of skills beyond the *3 Rs* of reading, writing and arithmetic. The AMA includes *creativity* along with *collaboration, communication*, and *critical thinking* (the 4 Cs) as skills absolutely necessary for success in the 21st century. The AMA joined forces

with the P21 to conduct a survey of 2,115 managers and executives. According to a survey, 93% of the employers surveyed identified creative thinking as “most important” or “somewhat important” in helping to grow their organizations (AMA, 2010).

Richard Florida, author of “The Rise of the Creative Class” considers the age that we are entering the *Age of Creativity* “because the key factor propelling us forward is the rise of creativity as the primary mover of our economy (*Florida*, 2006).” Florida placed the importance of the development of creativity in the following context:

> The United States is currently undergoing a dramatic economic transformation, more dramatic even than the previous transformation from a farm-based economy to an industrial economy. This has been variously described as a transformation to an “information economy,” an “internet economy,” a “technology economy,” a “high-tech economy,” a “knowledge economy,” or even a “post-industrial society.” Those are all wonderful terms, but I prefer the term “creative economy” because, intuitively or emotionally, I find it more inclusive. Every single human being is creative. The great challenge of our age is to tap and harness all of that creativity (Florida, 2006 p. 22).

The New Commission on the Skills of the American Workforce developed a report which forecasts what the US economy would look like in ten years if all goes well. The commission contends that “The best employers the world over will be looking for the most competent, most *creative*, and most *innovative* people on the face of the earth and will be willing to pay them top dollar for their services” (NCEE, 2007). The report establishes creative work as the key to the country’s continued prosperity. Their forecast is detailed in the graphic below:




The factory line workers that sustained the economy during the industrial age are rapidly being replaced by atomization. Education responded to the needs of the industrial complex by producing vast numbers of line workers who could be counted upon to do largely routine and low-tech tasks. As a result the public schools in the United States not only produced the type of workers that we required of at the time but by and large reflected in its schools the same type of assembly line model of productivity that existed in the

Industrial Age factories. It is a system that has for the most part gone unchanged as we enter a new age with vastly different demands (Cuban). In the words of Stephen Heppell, "We have spent the entire 20th Century perfecting a 19th Century model."

## Creativity as a Self-Actualizing Need

Not only will creative thinking produce the outward manifestation of new and meaningful products and ideas, but research also indicates that the ability to create is a manifestation of psychological health. It is the research of Abraham Maslow, and the writings of Daniel Pink (2009) and Peter Senge (2004) that provided us with the assumption that students possess an innate desire to create. Maslow contends that "the concept of creativeness and the concept of the healthy, self-actualizing, fully human person seem to be coming closer together, and may perhaps turn out to be the same thing (Maslow, 1967 p.43)." We hope to capitalize on this desire to create by using the course to introduce students to a variety of design oriented Career and Technical Education courses where students can continue to develop creative habits.

## Cognitive Development

Cognitive psychologist, Robert Schank argues that "schools need to focus on cognitive abilities, not scholarly subjects (Schank, 2011 p. 13)." We can therefore conceive of education in its most general terms as helping people develop the capacity to think. The relationship between intelligence, domain specific skills and creativity has been the source of much debate within the research. The majority of researchers indicate that intelligence and domain specific skills are necessary but not sufficient for the development of Creative thinking (Amabile & Hennessey, 1987). High levels of cognitive processing are necessary but something else has to grow

alongside of the development of domain specific skills if one is to develop the capacity to create. John Dewey claimed “You can have facts without thinking but you can’t have thinking without facts.” We understand like Dewey that facts are necessary for thinking, but will also understand as Anderson and Krathwohl imply in their revision of Bloom’s Taxonomy (below) that deep and critical thinking is necessary for the production of creative thinking. Thus we can add to Dewey’s contention by stating that “you can have thinking without creativity but you cannot have creativity without thinking.” We understand that using domain specific facts and thinking deeply about those facts establishes the raw material from which creative ideas can emerge.

The configuration of the hierarchy suggests the other mental processes are necessary for creative thinking to occur. One must thoroughly understand, analyze, and evaluate in order to have a chance of developing something that is both new and meaningful. Researchers, Teresa Amabile and Beth Hennessey (1987) contend that:

> "Domain relevant skills which include factual knowledge, technical skills, and special talents, can be seen as the set of cognitive pathways one can take to solve a given problem or do a given task. The larger the set (of domain specific skills), the more numerous the alternatives available and the greater the possibility of producing something new, of developing a new combination of ideas."

We believe that it is very possible that the manner in which students learn may make the difference in those students who develop the capacity to create as adults and those students who may be equally intelligent but fail to develop the capacity to generate new and meaningful ideas later in life. In other words, one is learning to be creative by "creatively learning." If students learn by habitually asking questions, wondering, considering, reflecting, criticizing and imagining alternate possibilities, then these habits may affect their approach to their work later in life. Seymour Papert, inventor of Logo computer programing language argued that "if children get into the habit of exploring the problems before them- instead of solving the problems routinely like rats in a maze- they might just carry this creative habit into their adult lives (Amabile & Hennessey, 1987 p. 16)." So, in the context of the classroom, an appeal to creative thinking can be viewed as a strategy in service of deep understanding so that later in life such deep understanding (along with the manner in which concepts were understood) will place "understanding" in service of creativity. One of the most

important considerations conceived of when developing this course is that while “learning” the concepts contained within a particular domain is important, how students learn what they learn- the habits that they develop as they learn, may constitute an indispensible factor in how they handle new problems and whether or not they will attain the capacity to generate new and meaningful ideas of their own as adults (Willoughby, 1968).

## Common Core State Standards

The newly adopted Common Core State Standards (CCSS) have re-conceptualized prior standards in education similar to the manner in which this course is conceived. Both the Language Arts standards and the Mathematics standards establish certain thinking “habits” as the key to a beneficial education. For instance the math standards identify eight “practices” that students should develop- where the specific standards or content of any math class would contribute to the development these habits (Math CCSS, 2010 p. 6-8). Some of these CCSS math practices overlap substantially with the habits that are conceived of in this course. For instance, both the habits identified in this course and the practices identified in the math CCSS call for students to develop the capacity to:

- Make sense of problems and persevere in solving them
- Reason abstractly
- Construct arguments and critique the reasoning of others
- Model
- Use tools strategically

Similarly, the English Language Arts Standards identified seven habits or capacities of the “literate” person. Several of the capacities identified in the ELA standards overlap with the development of creative thinking as well (ELA CCSS, 2010 p. 7). The Intro to Design course will support student ability to:

- Understand the perspectives of others
- Comprehend and critique
- Use technology and digital media strategically and capably
- Build strong content knowledge (research**)**

## Assessment

The most widely used test of creative thinking is the Torrence Tests of Creative Thinking (TTCT). The test is established as the criteria by which many other tests of creativity have been validated (Amabile & Hennessey, 1987; Torrance, 1972). The test attempts to assess fluency (the production of a large number of ideas); flexibility (the production of a variety of ideas); elaboration (the development of and embellishment of ideas); and originality (the use of ideas that are not obvious). We intend to measure student progress in these areas by providing a TTCT pre-test at the beginning of the course and a TTCT post-test at the conclusion of the course. The Scholastic Testing Service will score the tests at a rate of $7.10 per booklet. The testing booklets cost $61.30 for the first set of twenty and 51.30 for each additional set of twenty. Given that we intend to test a total of 28 students next year, the total for the pre and post-test would be $612.80. We realize that the assessment of creativity cannot be completely reduced to pencil and paper

assessment. The vast majority of assessment will take place by the teacher, student, and other professional assessment of student products. Teachers will use rubrics to assess the quality of student work. Students will use rubrics to assess their own work and the work of others within the context of formal student led critiques. Professionals from industry and post-secondary institutions will be invited to participate in the assessment of the final project and other student work when applicable.

## The Seven Habits

**Habit One:** Creative people ask "why." They not only solve problems but they identify them.

The ability to seek opportunities for the improvement of existing products/ideas by helping students learn to consistently question such products/ideas using a variety of different considerations constitutes the standard that will help develop Habit One. Such considerations include but are not limited to concerns of sustainability, utility, aesthetic value and marketability when evaluating a product or idea (Wakefield, 1991). The projects are intended to provide students with practice in deconstructing or abstracting designs into basic elements and principles and to evaluate the designs based on the creator's use of such elements and principles (Sternberg, 1997).

**Habit Two:** Creative people access pertinent knowledge.

We realize that we have entered a "Knowledge Age" where seemingly infinite amounts of facts and information are instantaneously available to anyone with an internet connection. As a result information is expanding exponentially. We believe that

the people who will be most successful in the 21st Century will be those people who can effectively access information, make sense of it, and create something new and meaningful from it. The Common Core State Standards do not discount the assimilation of facts, but they promote the assimilation of facts as the beginning of learning rather than the end. Facts, nonetheless, are essential to the formation of ideas as demonstrated in the graphic below:


Students will be expected to access information from a variety of sources during the planning and development of a project. Current and historical exemplars will be accessed to provide students with the raw material for the development of new and meaningful solutions (Schank, 1988; Ward, 1994). Projects will be designed in such a way as to help students:

- Determine which facts are the most relevant to the problem at hand.
- View the facts from multiple perspectives.
- And draw facts from multiple disciplines**.**

Furthermore, this habit underscores the manner in which we define creativity. The research establishes that an idea has to be new and meaningful in order to be considered creative. This course is concerned not only with the initial flash of insight or inspiration that might begin the creative process but it is also concerned with the hard work that is involved in bringing meaning, structure and value to the idea. Defining creativity in this manner would tend to help wrestle the concept of creativity from the sole ownership of the

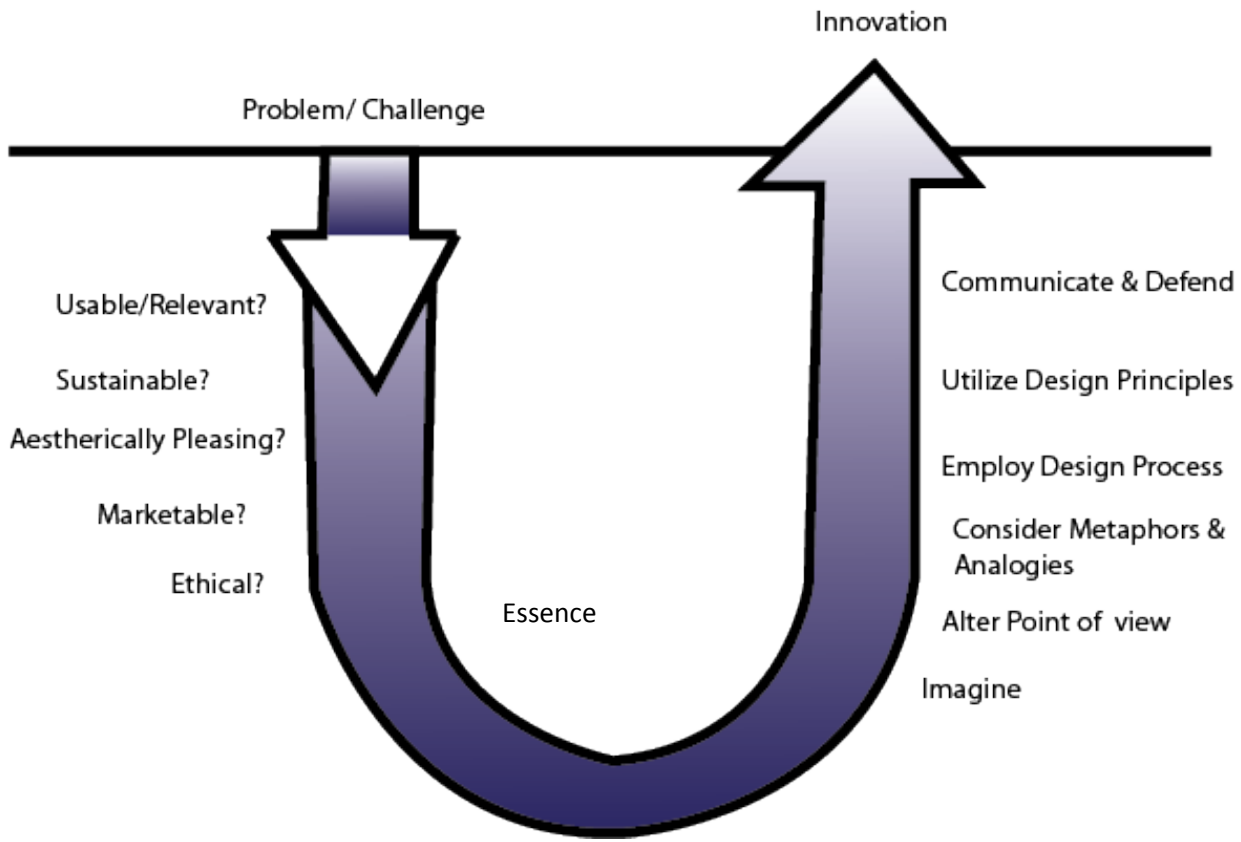
arts department in our schools. Meredith Davis of the North Carolina School of Design addressed the peril of an incomplete view of creativity. She remarked:

> "Popular assumptions about creativity also jeopardize students' early success in college design programs (i.e., in the professional study of architecture, graphic design, industrial design and interior design). Encouraged in high school art classes by perceptions that design is about spontaneous, eccentric solutions, beginning college students often resist the hard work of analysis and synthesis that characterizes much of design problem solving. The evaluative criteria of appropriateness, usability, usefulness, viability, and sustainability often get lost in a quest for the curious, personal, or dramatically different (Davis, p. 3)."

**Habit Three:** Creative people are able to critique current practice as they analyze/deconstruct the problem at hand.

Creativity is dependent on both analytical thinking and critical thinking. (Scott, 2015; Wagner, 2015). If an individual is able to generate ideas that are different from an established path then the individual has to not only be able to deeply analyze a problem but must be able to question the discovered information along the way. As an individual moves from a shallow analysis of a problem to a more fundamental analysis, the individual who is able to look for avenues of departure during this process is more likely to arrive at a creative solution. In short the process of analysis establishes "what is," the process of critical thinking questions "why it is," and creative thinking considers "why not? or "what if." The course calls for students to deeply analyze problems and to think critically

(ask questions) about the usability, aesthetic appeal, sustainability, and marketability of products and ideas in an order to divert the from an established way of thinking.



**Habit Four:** Creative people are fluent, flexible and original in their generation of ideas.

The first four Habits are interdependent. John Dewey once remarked, "You can have facts without thinking, but you cannot have thinking without facts." The facts that Dewey speaks of refer to Habit One. The "thinking about the facts" refer to Habit Two (analysis) and Three (critical thinking). We took Dewey's comment one step further and assert that you can have thinking (analytical and critical) without creativity but you cannot have *creativity* without *thinking* analytically and critically. The standards in Habit Four are concerned with specific strategies that can be employed to think creatively (break away from an established path.) The standards contained within Habit Four are intended to increase the fluency, flexibility and originality of student ideas once they have reached a certain level of understanding and analysis of the problem at hand. The project assigned will help students to identify relationships, consider diverse points of view, and conceive of analogies/metaphors as a means of increasing fluency, flexibility and originality of their thinking.

**Habit Five:** Creative people are able to effectively transition ideas from their heads and into the real world.

Habits One through Four have to do with helping the individual gain the ability to conceive of creative ideas. Habit Five begins to consider the would-be creators relationship with his/her environment. The standards contained in Habit Five constitute an acknowledgement that creative ideas are of little value if they are not developed and presented in a form that can be understood and evaluated. The standards in contained

in Habit Five rely heavily on the Design Process. The standards call for student to be able to quickly sketch ideas, use technology to model and refine ideas, create prototypes & evaluate ideas, receive and provide constructive criticism, and effectively communicate/market ideas.

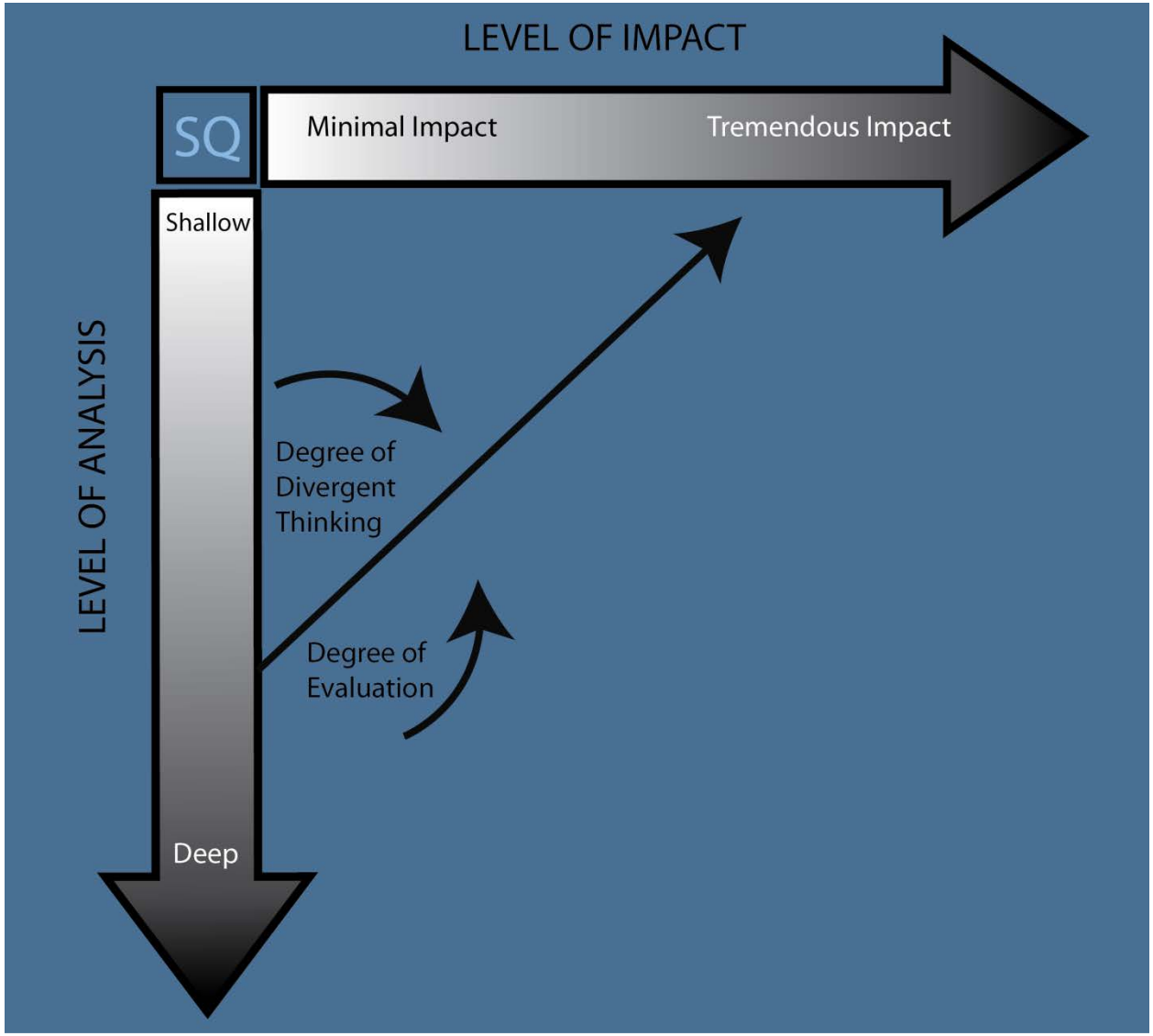
**Habit Six:** Creative people are motivated. They persevere through set-backs and overcome obstacles.

Habit six is based on the realization that any idea that breaks from established way of thinking will be met with resistance. Hence, motivation has been established as an essential factor in the development of creativity if one is going to be able to endure the criticism that always accompanies a new idea. (Csikszentmihalyi, 1996; Maslow, 1971, Pink, 2009). The course is designed to set up the environmental conditions and culture within the classroom that will motivate students to think creatively (Seelig, 2011). We understand that much of the success of entrepreneurs and inventors has to do with character traits that they have developed such as the willingness to persevere**.** We conceptualize perseverance as a manifestation of self- motivation. Projects will be administered that will require students to continuously identify and surmount obstacles. (Sternberg, 2003; Wagner, 2012). As a result of student collaboration and student led critiques, students will gain experience in receiving critical feedback and will begin to view failure as an inescapable part of the Design Process.

**Habit Seven:** Creative people take sensible risks. They buy low and sell high. They pay attention and look for opportunities to add value to existing products or processes.

Similarly high motivation and self-confidence afford creative people the capacity to take sensible risks. (Sternberg, 2003; Wagner, 2012) They buy low and sell high. (Sternberg, 2003) They pay attention and look for opportunities to add value to existing products or processes. The standards necessary to develop this habit are intended to help students to actively seek opportunities and provide them with the capacity to bring their ideas to market. The projects within these standards will help them develop the capacity to defend design solutions with the knowledge that

many novel solutions are initially met with resistance. The projects are intended to help students learn to see design problems as potential projects that can add value and create wealth. Student motivation will be nurtured by balancing the necessity for ongoing evaluation with class activities that are fun, frivolous, and free of evaluation. We hope to build enough collaborative opportunities with appropriate protocols into the course work where students will feel comfortable expressing ideas (Seelig, 2011; Amabile, 1983; Maslow, 1971).


LEVEL OF IMPACT
SQ
Minimal Impact
Tremendous Impact
Shallow
LEVEL OF ANALYSIS
Degree of
Divergent
Thinking
Degree of
Evaluation
Deep

**(Scott, 2015)**

## References


Amabile, T. & Hennessey, B.A. (1987). Creativity and Learning. Washington, D.C. National Education Association.

Amabile, T. (1983). The Social Psychology of Creativity. New York, NY. Springer-Verlag.

Anderson, L. W., & Krathwohl, D. R. (2010). Merlin C. Wittrock and the Revision of Bloom's . Taxonomy. Educational Psychologist. 45(1) p 64-65.

CCSS. (2010). ELA Common Core State Standards Retrieved from: http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf

CCSS. (2010). Math Common Core State Standards Retrieved from: http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf

Csikszentmihalyi, M. (1996). *Creativity: Flow and Psychology of Discovery and Invention*. New York. Harper-Collins Publishers.

Csikszentmihalyi, M., Feldman, D. & Gardner, H. (1994) *Changing the World; A Framework for the Study of Creativity.* Westport, CT. Praeger Publishers.

Cuban, L. (2010). As Good as it Gets. Cambridge, Massachusetts. Harvard University Press.

Davis, M. (2010). Creativity, Innovation and Design Thinking. Unpublished.

Florida, R. (2005). The Flight of the Creative Class. Liberal Education. 92 (3), p22-29.

Friedman, T. (2005). *The World is Flat*. New York, NY. Farrar, Straus and Ginoux.

Gardner, H. (1982) *Art, Mind and Brain. A Cognitive Approach to Creativity.* New York, NY. Basic Books Inc.

Guilford, J.P. (1986). Creative Talents: Their Nurture, Uses and Development. Buffalo, NY: Bearly Limited Publishers.

Isaacson, W. (2008). Einstein, His Life and Universe. New York, NY. Simmon and Schuster.

Maslow, A. (1971). The Farther Reaches of Human Nature. New York, NY. Viking Press.

National Center on Education and the Economy (2007). *Tough Choices or Tough Times*. Washington, D.C. Retrieved from http://www.skillscommission.org/wp-content/uploads./2010/05/ToughChoices_EXECSUM.pdf

National Science Foundation (2012). Teach Engineering. Retrieved from:

http://www.teachengineering.org/engrdesignprocess.php

Pink, D. (2009). Drive. New York, New York. Penguin Group USA.

Robinson, K. (2001). Out of Our Minds. West Sussex, UK. Capstone Publishing Limited.

Scott, K. (2015). Creativity; Conceptions of a Group of Exemplary Teachers (Doctoral Dissertation). Retrieved from: https://libres.uncg.edu/ir/uncg/listing.aspx?id=18183.

Schank, R. (1988). The Creative Attitude. New York, NY. MacMillan Publishing.

Schank, R. (2011). Teaching Minds. New York, NY. Teacher's College Press.

Seelig, T. (2011). InGenius. New York, NY. Harper Collins.

Senge, P. (2004). *Presence.* New York, NY. The Double Day Broadway Publishing Group.

Sternberg, J. (1997). Successful Intelligence. New York, NY. Penguin Group.

Torrance, E.P. (1972). Can We Teach Children to Think Creatively. The Journal of Creative Behavior. 6(2) p 114-143.

Wagner, T. (2012) Creating Innovators. New York, NY. Simon and Schuster.

Wagner, T. (2015) First in Class. New York, NY. Simon and Schuster.

Wakefield, J. (1991). Outlook for Creativity Tests. Journal of Creative Behavior. 25(3) p. 184-193.

Ward, T. (1994). Structured Imagination: The role of conceptual structure in exemplar generation. Cognitive Psychology. 27 p. 1-40.

Willoughby, S. (1968). Secondary School Mathematics. In William's Teaching for Creative Endeavor. Bloomington, Indiana. Indiana University Press.