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Influencing Performance Development in Student Design Groups through Relational Development*

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In this paper, a review of a workshop directed by the author, as part of the 2012 Capstone Design Conference held at the University of Illinois, Urbana-Champaign, May 30–June 1, is presented. In the workshop, a theoretical approach that interprets how students form relationships, and how relational environments form student thinking, was presented that gives insight toward how to create high-performance teams in a very short time. The theory and reflection that were shared with workshop participants are based on the author's own experience with his clinic program, and the methods are based on the value-memetic theory known as Spiral Dynamics, originated by Clare Graves in the 1950s, and further developed by his student, Don Beck. During the workshop, the format of a capstone design clinic, measurably successful from an industrial recruitment and a project completion perspective, was presented, and the differences between the fundamental relational structure of this type of clinic, where independent, trust-based relationships are emphasized, vs. one with more traditional grading and policies, and instructor-assigned groups were contrasted. Following this, theory of relational development that all students were subjected to was discussed, and case studies from the workshop director's own program were distributed, highlighted and discussed.

Keywords: capstone design; project based learning; relational development; psychology of learning; theory of mind; Spiral Dynamics; empathy in learning; structure of knowledge; global engineering; student development

1. Introduction

In the last twenty years, there has been a large focus on changing educational practice to improve conceptualization outcomes and the amount of knowledge learned by students through the processes of active learning. In short, active learning is 'learn by doing', or experiential learning. It has become relatively well developed from a team-based perspective, especially in engineering and the design sciences. Problems are supposed to be given to students that are both open-ended and often unexplored, to spur the process of creative inquiry. There are numerous books written on active- and project-based learning [3, 4], and certain institutions, such as Aalborg University in Denmark [5] have devoted their entire institutions to its implementation. In Dym and Little's text [6], constructed from their experience with Harvey Mudd College's Clinic, these principles were established as best practice in engineering education.

The advantage to an active learning approach is that besides promoting the development of lifelong learning skills, it more closely resembles the work environment that students will confront upon graduating. Typically a customer will not approach an engineer or team of engineers for what is already an off-the-shelf solution. They will deal with a known question with an unknown answer, or multiple answers that may be more or less correct, dependent on optimality criteria.

Active learning also is organized around functional teams that must complete these open-ended assignments. This also matches the demands of the work environment, since engineers graduating from educational programs today must be able to work with others in a team, often collaborating with other individuals or teams in other countries. The most sophisticated design efforts currently extant embody what is called the 24/7 design cycle. Teams around the world will share a common product database, and pass progress as the globe, and the work cycle turns to partners around the world. Such work practice has been made practical by the ubiquity of the Internet, as well as Product Lifecycle Management software such as CATIA.

But what do new graduates integrating into industrial product design teams need to know? Much research talks about the difficulty in structuring assignments for accessing retained information, as well as weaving together larger conceptual maps of already acquired declarative and procedural information. For the interested reader, one can reference [8, 9]. Other, more recent research efforts point to the inherent problems in retention of academic material. In a paper under review by Andrews et. al., engineering education researchers attempted to assess retention of a variety of knowledge types, including procedural, as well as multiple types of declarative knowledge, including basic facts as well as geometric constructs. Without larger contexts, students struggled to remember even the most basic information [10].

Additionally, most of the subject material in a

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contemporary engineering curriculum is transmitted in algorithmic format, where the students must master a series of complex rule-following routines in order to derive answers for a fixed problem set that typically only has one answer. While developing a strong skill set in engineering analysis is absolutely necessary for the starting engineer, and many limited design problems can be resolved through an algorithmic approach, a large number of engineering design problems cannot be resolved with straight analysis. Inevitably, some level of a heuristic approach must be assumed, if only for the reason of dealing with customer input and preference.

Add to that the standard academic emphasis for students to work alone, or certainly be tested alone, at a relatively constant pace and there is further disincentive for group work. And academic evaluation of a student's performance can range from the relaxed to the rigorous, but one thing that most universities share is its constancy. Work is graded throughout a semester, at a pace that were it not an accepted practice, would drive any normal person to the edge of sanity.

Yet students also, after having endured this set of practices, go on to become successful engineers, and over time develop the ability to work with other engineers. Some even survive with a fair amount of creativity intact. And the author's observations have confirmed that students often can quickly relearn specific material they have been taught earlier, and can develop professional mastery if placed in an environment where that certain skill set is required.

But in the end, it is not at all clear if students learn because of current instructional practice, or in spite of it. The only consensus that really exists, from the students' perspective, is that engineering school is not 'The Real World', and as such, is something that must be largely endured by students on their trek toward a career.

If the academic system in engineering, as a professional school, is charged with creating future engineers, then what are academic programs in engineering really doing? And how can it be understood? And even more important, how do we evolve students in the context of going to school, or evolve our programs so they capture the necessary levels of sophistication that students can go on to solve the next generation of society's problems, which are likely to be even more multi-dimensional, cross-cutting, and complex than the past?

Consider a problem like global warming—it is clearly obvious that there is not going to be a single techno-fix that will suddenly save the day and the planet. And even if there were a single device that could scrub CO_2 out of the air and magically transport it beneath the Earth's crust, there would be still be the problems of overpopulation, water supply shortages, and epidemic disease and such that would still require a next generation of thinking that has largely not been described. So what does that thinking even look like? The standard model for education would add a number of courses with increased exposure to different subject models; all required to be taken by the individual, with the belief that this curricular broadening would somehow give that person the ability to independently sort out the larger problem and identify potential solutions.

But the likely reality is that the engineer in charge of designing a particular part of the solution to the problem will be involved with a plethora of other technical professionals. The real challenge will be figuring out who on the team can be trusted to do good work, and supply proper data. This can only be done through enhanced empathy. And there is no question that it will certainly involve relationships between stakeholders of increasing complexity, and because of this, will require enhanced relationship-building skills based on independent data assessment more than ever before.

But because of the emphasis on individual learning and complex rule-following in the engineering education environment, explicit independent relational development is largely neglected. Instead, the largest volume of relational constructs rely on external definition—professor/student/counselor, with the status that is brought to bear with titles, instead of the independently generated relationships mentioned above.

This is enormously problematic, as social organization of actors in a group is a dominant influence in how individuals develop their own cognitive styles. If we want to predict, apriori, what any group of individuals will do, there is a need to access some set of principles of social organization. In this paper, the theory that will be used to understand how and why people develop neurologically, or what has been termed memetically, is called Spiral Dynamics.

2. Spiral dynamics

In the '50s, a different approach toward understanding relational dynamics was pioneered by Clare Graves, a professor at Union College, and further advanced by Don Beck and Chris Cowan, students of Graves and authors of [1]. Graves, originally performing research to validate Maslow's Hierarchy of Needs in a relational context, found that Maslow's Hierarchy was incomplete. He found that societies and individuals traversed well-defined relational modes dependent on the challenges faced by those societies at their particular moments of

crisis. Further, these modes were split into two dominant forms—"I" modes, where some aspect of an individual was expressed, to "We" modes, where individuals sacrifice their well-being to the larger good of the group. These levels were color-coded for ease of discussion, though the colors do not have any independent meaning.

In understanding the I/We dichotomy, Beck posits that developmental growth happens through first a self-directed (I) set of learning and experiences, brought about by the desire to improve the life-state of the individual undergoing the transition. This is consolidated through a return to a larger group state, where the skills and development learned in the earlier mode are brought to bear for the benefit of the larger community containing the individual.

An example might be understanding the transition between performance-based thinking, which is emblematic of the Performance/Materialist/Achiever v-Meme, and the individual human-centric thinking prevalent in the following Communitarian/Relativistic/Sociocentric v-Meme. In developing performance-based thinking, which is critical to good design, an individual must develop within themselves a rational, data-driven outlook in order to make sure that any design generated meets specifications, obeys physical laws, and can satisfy a market so it can be sold. Instead of right/wrong answers and dichotomous thinking, multiple solutions must be considered, and each of those evaluated with optimality of a number of constraints in mind. The thinking patterns developed through this mode of thinking then turns out to be directly applicable in the next We v-Meme on the Spiral, which is fundamentally communitarian in nature. In evaluating each individual as an independent actor in larger humanity, data must be collected and analyzed on each person to determine their role in that larger community. Since there is an inherent recognition that there are multiple different members in a given group of people, each with different roles and purposes that may change over the course of a lifetime, the We mode thinking patterns require the same type of design optimization evaluation thinking patterns established in the earlier I mode performance-based v-Meme.

In increasing complexity, the different relational modes, what Beck [1] has coined the "psycho-social DNA" of a society, are, from lower on the Spiral, to highest, are given below. The color-coding used in Spiral Dynamics has no deliberate meaning, and is used only to facilitate discussion.

1. Survival/Automatic/Instinctive (I–Beige)–characterized by individual survival needs (water, food, shelter).
2. Magical/Tribalistic/Animistic (We–Purple)—people in this v-Meme are characterized by group-shared rituals and belief structures, but no strong leadership structure.
3. Authoritarian/Egocentric/Exploitative (I–Red)—Groups of people organized with this v-Meme are roughly ordered into a power hierarchy/gang, with an individual or groups of individuals occupying stratified positions of power and privilege in the group, as well as limited independent decision-making authority save for the very top people.
4. Legalistic/Absolutistic (We–Blue)—Groups of people following this v-Meme organize into hierarchies that, like the authoritarian structure, occupy stratified positions of power and privilege, but are subject to a body of law that applies to all, and restrains individual power and decision-making capability.
5. Achievement-oriented/Materialist (I–Orange)—Societies that follow this relational mode, or have some of this feature embodied in their structure are the first to value highly independently selected and formed relationships, and use trust as an evaluative tool in deciding relational formation. Instead of a rigid hierarchy of people or laws, group structure is dependent on achieving a goal or some level of culturally desirable performance.
6. Communitarian/Relativistic/Sociocentric (We–Green)—People-oriented societies that highly value each individual in the society, and are based around egalitarian principles and laws that enshrine the individuals' rights in the context of the group dominate this v-Meme.
7. Global Systemic/Integrative (I–Yellow)—Individuals in this v-Meme recognize the relational dynamics present in all lower levels and opportunistically combine these to achieve higher goals and purposes. This v-Meme was the first in what is called 2nd Tier v-Memes, which have a step function of higher awareness of self and world.
8. Globalist/Renewalist (We–Turquoise) This v-Meme is a combination of various Yellow 'I' mode thinkers devising larger systems that span larger expanses of cultural relational dynamics and incorporating these together to achieve goals on a global level. There are currently vanishingly small numbers of individuals in this v-Meme state currently extant.

It is important to remember that though individuals and societies can and do traverse up and down the Spiral as situational needs dictate, a given individual or society can only use relational modes at or below the maximum developmental stage of the indivi-

dual, or in aggregate, a society. Thus, a society that has developed into a communitarian model can still use authoritarian structures (there are still prisons in Sweden), but societies that have only developed to the authoritarian level cannot have intrinsic communitarian organizations that can stand independently. A king may have a relief society for poor people, but poor people will still stand in diminished status in that society, and their privileges are still dependent on the largess of the king, an individual at the top of a hierarchy. If the king is displaced, such aid organizations may also necessarily be displaced.

This is a very important notion to understand when using Spiral Dynamics at all, because there is a tendency in the larger community to identify certain issues with certain Spiral levels. SD does not inform on specifics. At some level, it is best understood as a meta-philosophy, in that any particular set of data can manifest itself in any given level of the Spiral. Rather, it informs on meta-level relational approaches to issues. As in the above example, taking care of the poor can occur at virtually any Spiral level. But the approach to taking care of the poor will definitely involve the relational level that a given society has evolved to.

And indeed, part of the problem with using SD is that SD as a field is relatively poorly developed. There is a sparse rigorously peer-reviewed literature documenting its ramifications, and because of many people seeking alternate spiritual perspectives, it is often co-opted by many either as a tool to hierarchicalize ostensible human enlightenment, or serve as a springboard for alternate out-of-the-mainstream religious practice.

This is unfortunate, because the insights of Spiral Dynamics as applied to preparing engineers for design practice actually come from lower on the Spiral. For example, consider the problem of defining the 'global engineer.' One might posit that a true 'global engineer' must have a dominant v-meme structure that is characterized by 'Global Holistic' or Turquoise. This is a misinterpretation. An individual only needs to make an individual difference in a small part of an organization that may have an international division, which does not require an all-encompassing view of the world to make that change. A well-practiced engineering design process can do just this.

In fact, one can use the Spiral and understanding the various colors and combinations of relational modes to interpret corporate culture and build bridges among organizations with different relational modes.

A couple of interesting artifacts on the Spiral have emerged from the author's thought work on it. One of the most interesting is what the author calls the "Trust Boundary"—a line separating the hierarchically dominated Blue and lower modes, and the Orange and higher modes. The Trust Boundary delineates the breakpoint between modes where externally formed definitions of relationships are the most dominant, to the modes where independent relationship formation in pursuit of goals, learning and experience dominate. In levels below the Trust Boundary, individual empathy is not an important aspect of human relationships. Above the Trust Boundary, empathy comes to dominate thinking about relational development inside the social system and between individuals.

For example, in a Red/Blue—dominated hierarchy, similar to a contemporary university, the most valuable relationships an individual has are the ones that are defined by the institution. Being a full professor holds more status, and is "better" than being an associate professor; likewise, from an ethical perspective, many times titles even dictate who can talk to whom. In such a hierarchy, for example, a professor must always first talk to his department Chair before broaching a controversial subject with the Dean. Though independent relationships have some value within the university, for the most part, students are on the bottom, and faculty and administrators are on the top.

Contrast to an entrepreneurial company. There, independent relationship formation, if it results in company success, does not hold a discriminatory edge because of an individual's title. If collaboration manages to save the company money, it does not matter if it is between the vice-president and the janitor. Achieving the goal—all monetary savings—is good, regardless of the external relational context.

The other differentiator between relational modes above and below the Trust Boundary is the value of empathy in relational formation. Hierarchies are notoriously anti-empathetic, while communitarian structures are created around the concept. One way to understand this in the context of Blue v-Meme thinking vs. Green v-Meme thinking might be to understand the pros and cons of applying empathy in a situation. Empathy is going to involve more complicated thinking styles than pure algorithmic thinking—to use the vernacular, thinking with one's 'head' as opposed to one's 'heart'. However, a cursory intellectual evaluation indicates most pure algorithmic thinking is going to be performed in the pre-frontal cortex of the brain, whereas empathetic thinking is going to involve elements of the limbic system, as well as the pre-frontal cortex. In a research context, not having an empathetic bias may well help to reject data that might distort the actual truth. However, in human relationships, not being able to read facial cues or

moods may produce a result that is disastrous, depending on the situation. If there is any lesson to be learned from this, it is that one must be very careful about applying positive or negative value judgments to particular Spiral modes.

Further, different types of organizational structures and relational modes tend to bring on dramatic differences in performance and ownership. Red/Blue societies, where either the Boss is in charge, or the Rules are in charge, lead to a loss of larger ownership and responsibility in the individuals over time, as well as the loss of the ability of individuals in that society to form successful independent relationships. Comparing similar relational patterns with other authors, it is also clear that others have written extensively about this area of transition, such as Covey, in *Seven Habits of Highly Effective People*, though obviously not using Spiral Dynamics verbiage.

3. Students—past, present and future

In 1994, in response to a combination of student demands, program accreditation changes, and a desire to increase the work-ready posture of undergraduate mechanical engineering students in the School of Mechanical and Materials Engineering at Washington State University, the author decided to re-work the curriculum for the 'capstone' class for the degree program. The idea behind a capstone class is that it must integrate all the ways of knowing that a student has aggregated in the last four years of the degree program in a way that allows the student to approach the next set of beginning career challenges in a way that will permit success and mastery.

At the time, the class, though it had been required as part of the accreditation process for some time, involved students working in arbitrarily-assigned groups, usually with a professor directing the students on a research project. The projects were poorly organized, and the actual results were usually not usable. By the author's evaluation, less than 20% of the projects were even completed, and both faculty and students expressed large-scale dissatisfaction with the course.

Upon assuming responsibility for the course, the author immediately switched to corporate projects given to him by alumni that students could work on. No money was involved, but while the projects were easily collected, and the students approached the projects with enthusiasm, actual performance left much to be desired. As before, most of the projects still did not come close to completion, and often companies, after doling out the projects, would retreat and not communicate with the students. Student frustration would quickly build, and real work was rarely accomplished.

It was through intervention from a chief engineer at one of the oil refineries on the Washington Coast that changed the situation. He contacted the author, and notified him that he had heard about the change in curriculum. He also stated that he wanted to give a project to the program. And most importantly, he stated that he wanted to pay the university upon completion of the work.

All of the sudden, the former low-responsibility mode of project execution was not going to work. If the project failed, there were stakes—a noted alumnus would 'lose face' in his workplace. Additionally, the author had to confront the ubiquitous notion that students, even though they were graduating seniors, were not capable of real work—because the project was real work.

The actual details are lengthy, and described in this paper [2]. But the upshot was that watershed moment led to large changes in the program, including the formalization of the design process, clear definition of goals and deliverables, and a process of accountability, both externally generated, and independently emergent, within student groups. The design process that evolved and is in use contains the standard elements that are accepted in most of the literature, such as [7]. The sequence and approximate time necessary for completion are in Table 1.

But most importantly, the main thing that happened was that a performance mentality based on satisfying authentic customer needs was established in the context of the clinic. The students gained an authentic audience—the project sponsor that was paying for the work. And it became no longer good enough to just 'take a B' and graduate. If the work was not completed, there would be real consequences for all involved. Status of participation was no longer good enough. Unlike most academic work in the undergraduate curriculum, the work itself had to matter.

Table 1. Project workflow for the Industrial Design Clinic

Task	Weeks in Semester
Project Assignment, and Specifications/ Requirements	1–4
Conceptual Design/Morphological Analysis	5
Preliminary Design and Rough Dimensional Analysis	6
Design Review and Preliminary Design Down-Select	6
Final Detailed Design	7–10
Prototype Manufacturing and Construction	11–13
Benchmark, Test, and Minor Redesign	14
Final Presentation	15

4. Spiral dynamics and the classroom

Students in the vast majority of academic classes function inside the academic hierarchy, which in Spiral terms consists primarily of externally defined relationships: there are professors, and students. The roles behind these titles define the simple relational set that exists in the classroom—the students are passive receivers of information, and the professor is the active deliverer. The professor, though potentially and independently possessing some level of empathy for the students, must occupy a non-empathetic role inside of the constant grading environment that is required for the dominant authoritarian/legalistic (Red/Blue) v-Memes that predominate. Only in certain, externally sanctioned situations does a professor even have the authority to flex requirements or make exceptions. In fact, much of the advances in education involve what the author calls 'legalistic, fine-scale propagation' through the use of rubrics and other grading devices, primarily designed to achieve completeness and uniformity in grading. And while defining rubrics does have some merit for student learning—students can clearly understand the learning goals that professors may have in a classroom—it is not clear that rubrics actually accelerate student learning.

Spiral theory informs us that this creates a status-based, hierarchical environment, where one person, with some set of criteria, determines the performance, and students must learn how to please this individual if they are to succeed. If this person is reasonably fair-minded, then there may be well-defined and rational, data-driven rules (Legalistic/Blue meme) on how to achieve a particular grade. Very sophisticated absolutistic thinkers will use precise gradations, such as grading rubrics, for creating logical extensions for grading policies. However, other professors may created complex coupled grading dynamics based on external status considerations, like assigning grades based on probability distributions (curving the grades) that will satisfy external authorities. While this may seem fair, the reality is that this type of grading policy, though statistically supportable, is somewhat arbitrary. It implies that there is no fixed body of knowledge or mastery that any given class must achieve, and that it is totally relative to the class in aggregate at the time of participation. This may seem reasonable for a liberal arts class, where variations may be acceptable. But professional degree-granting programs are supposed to inculcate a corpus of knowledge that is required for ethical levels of competence.

Additionally, though these types of policies are changing, there can be extreme penalties associated with students working together, even for ancillary work, such as weekly assignments and homework. While a complete discussion of the pros and cons of this type of grading policy are beyond the scope of this article, one thing is for sure—in many instances, students develop shared understanding and coherence at the risk of an academic ethics violation.

After sixteen years of such an educational system, it is not surprising that students are mostly passive, and the best students are the ones that are the most eager to please the professors. And while it is important to understand this type of system with the backdrop of the former need for the university to stand for a more absolutistic v-Meme set that would prevent knowledge corruption (think of the Irish clerics of the Dark Ages), in today's world, the main challenge present to all people is managing the vast sea of information that is placed before them. Students must parse this knowledge, and then selectively use the parts that will help them solve real problems. Engineers are not paid for conducting theoretical exercises. Bridges and planes must be built—and they must also not fall out of the sky. In the words of the researchers in [8], relevant models must be built on the basis of both declarative and procedural knowledge, and these must be woven together, as well as chosen appropriately, if a satisfactory outcome is to be achieved.

Therefore, the main challenge as defined by Spiral Dynamics in a capstone project-based environment is this: transformation of the students from hierarchical Authoritarian/Legalistic (Red/Blue), passive, belief-based low responsibility participants to Performance-Based Communitarians with an active stake in the outcome of the project. The main thesis of this paper is not only will students see the benefit in learning how to develop and manage trust-based, independent, data-driven relationships. The thinking developed in doing so creates an environment that encourages rational thought as the dominant mode because of the relational environment. If the relationships are rational and intuitive, this thinking process will spill over and become the dominant mode for problem-solving as well. And intuitive rationality is the basis of great, innovative design.

5. Relational construction in the context of the design clinic

One of the most obvious ways to evolve the students' relational v-Meme set is to give them situations where they must exercise relational development, in an appropriate setting with appropriate responsibility. This is done in a number of steps, outlined below:

1. Dismantle the absolute authority of the professor (announce that standard Red v-Meme

behavior will not be the order of the day.) This is done at the beginning of the class, by announcing that the professor has negotiated the project, but does not know the answer.
2. Shift the responsibility to student groups for the answer. Because, at the onset of the class, it is unfair to assume that the majority of the students have access to higher v-Meme behavior, this is done by telling the students they must complete the project in order to graduate. Though this appears to be a combination of Red/Beige v-Memes, the reality is that the professor and client have assumed the responsibility that the scope of the project is reasonable. Otherwise, denying seniors the right to graduate would be more than unfair—it would also be unethical, and would dismantle the necessary Blue v-Meme legalistic scaffolding necessary for project success.
3. Arrange students in groups with a combination of their consent, and the needs of the project. This is actually Orange and Green v-Meme structuring that sets up performance for later. Independent friendships are considered, but not held pre-eminent in-group assignments.
4. Have students travel together to visit the client company. Students are given a Blue v-Meme script on how to form independent relationships over such events as lunch, and must practice getting to know each other over a pre-visit dinner that is sponsored.
5. Students are also instructed on how to assemble a specification for a product that they can apply to their particular situation. This is a Blue v-Meme Spiral Ladder, in that the document will contain voluminous performance-based Orange v-Meme information, and must be assembled through collected data, but is relatively constrained in form. Much of this information must be collected from the project sponsor, so students are forced to form a measured, data-validated trust-based relationship with the sponsor, who is proscribed to act like a customer for the first half of the semester.
6. Students are left to themselves for the first six weeks of the semester until the initial design review. They are given group-member accountability tools, an on-line Project Management system, and instruction in communication so that they can form valid relationships with each other.

After these steps, and approximately six weeks, student ownership of the project, as well as motivation toward success, is sufficiently high that the project sponsor, who is initially given the charge of acting only as a customer, can intervene with design knowledge and facilitate overall group performance through suggestion and review of ideas, without students grinding to a halt without immediate overseeing or direction. Independent initiative, along with group coordination, has been established as the dominant relational set.

What happens if the project sponsor intervenes too early, and gives groups ideas or direction before this formation process is complete? Performance dramatically suffers. The students, because of their past training/ingratiation in the Authoritarian/Legalistic v-Meme set, are all too willing to let a new authority figure replace the professor in the classroom. What then happens is that the students, if they do not receive prompting or information will wait for instruction and direction. And in a time-limited project, this is an anathema.

5.1 Case studies/application examples

What follows are a series of management incidents encountered by the author, and how they were handled in an attempt to reinforce the Legalistic $->$ Performance-Based (Blue $->$ Orange) transition. Explanations of action taken by the Clinic Director follow the situation description.

1. Students are 2/3 of the way through the project. Students miss a conference call with the project sponsor, and the project sponsor upbraids them for their mistake. Student morale is low because the project specs are poorly defined, and are unsure about how to complete the project. What is the path forward?

In order to understand what must happen, one has to analyze correctly the dominant v-Memes of the respective parties. In this case, the author had been tracking the student group, who displayed a formulaic (Legalistic/Blue) v-Meme toward progress, which is typical for students making the Blue/Orange transition. The project sponsor was a young engineer, fresh from a conservative graduate program. By not notifying the students or giving the benefit of the doubt regarding the incident (Communitarian/Green), it became obvious that the customer was displaying status-based Authoritarian/Red behavior. He was the authority, and was slighted because the students missed the call.

As the instructor, there were choices to be made. Upon communication with the students, it was discovered there had been a timing mistake by an individual, where someone had incorrectly written down the conference call time. The author advised the students to apologize to the project sponsor, but ignore the emotional impact of the lecture given by the project sponsor, and

present the sponsor with a series of Up/Down choices (Absolutistic/Blue) for final specifications. The students were then tasked to form a collaborative work plan whereby no task was left to a single individual to complete (Communitarian/Green). The author reviewed each of the tasks with respect toward their ability to be accomplished, and conducted a check-up with the students to make sure each student was moving back toward completable performance (Performance/Orange).

The key lesson from this case study is how to reinforce the desired v-Memes to students who have gotten off-track from achievement due to Spiral devolution in interaction and management with a project liaison.

2. Students are working with a company that has given many projects to the design clinic. A particular individual is usually appointed as the mentor for the students. This person is likable, and well-meaning, but lately has started adding tasks to the project solely because he thinks the students 'need the experience.' What do you do?

Ancillary tasks given to students are par for the course in academia, but severely corrupt any promise of authenticity, and the decision making that real project exigencies demand. Adding unnecessary tasks for completeness is an Absolutistic/Blue behavior, and should be avoided—primarily because it confuses students about what is really important, as they lack the discriminatory ability to tell when something is solely for practice or something really matters. Since especially at the outset of a project, the students themselves are Absolutistic/Blue, if extraneous material is given, they will start questioning the authenticity of all of the material, displaying the dichotomous thinking process that dominates this mode, and is the anathema of good design thinking.

In this case, the author had a long-standing friendship-based professional relationship with the liaison. The issue was informally discussed, (Communitarian/Green) but with the next contract, the author capped the amount of money to be spent on extra activities outside of project scope, so they were not completable without an additional appropriation (Legalistic/Blue).

3. Because of enrollment pressures, you have taken a project from an individual who has a poor understanding of the laws of physics. He has 'Second Law' issues, but the work he has requested is within the scope of the Clinic. He insists on being closely involved with the students, and it becomes evident that he is now supervising the students. 2/3 of the way through, it is also obvious that the students will not complete the project, though most of the blame does not rest with the students. The students are obviously stressed. What do you do?

When such a situation happens, it is obvious that the clinic director has, at some level, failed at their job through inappropriate anticipation of behavior of the sponsor.

The students are going to have a difficult time achieving a Performance-based/Orange result because such a result is not physically feasible. However, students can complete the ensemble of documentation for the project (Legalistic/Blue) and be taught strategies for dealing with Authoritarian figures who have control over their temporary fates. Students are required to complete the potential work, and leave a well-documented result for meeting class and accreditation requirements, and are given a completion.

4. You have a student who obviously disapproves of the way the class is run. She does not appreciate that students are not graded, as she has been an 'A' student her whole career, and is suspect of her fellow colleagues. How do you manage to stay out of the Director's office and deflect this student's potential complaint?

Students such as these are perhaps the most difficult problem to deal with in the context of running a performance-based clinic. Students such as this have been rewarded heavily in the status-based environment of the university, and are loathe to share the limelight (Egocentric/Red) with other students. Worse, because of their rigidity, they are likely to view the more flexible Performance/Orange environment with suspicion that it is fundamentally corrupt. Because external relationships are the ones that primarily dominate this student's v-Meme set, friendly overtures, as well as pointing out that other students are thriving (Communitarian/Green) are gestures that are likely to make things worse—not better.

In this situation, the best response is to direct, if possible, the student to tasks that more heavily capitalize on their analysis capabilities, where they can execute the complex rule-following behavior they have mastered in their education, and they can gain status inside their group. It is also important to inform one's chair/director early on about the status of the class, and any students like this, in case there are future complaints to be dealt with. These types of activities fit well within the Author-

itarian/Red and Legalistic/Blue that are common in universities.

5. You have one student who never shows up for class. It's approaching the end of the semester, and you're wondering if he's done anything at all. What do you do?

Students who egocentrically exploit the communitarian nature of such a program as previously outlined force activation of lower-level v-Memes. Notification of grossly sub-par performance for the student is the first step, followed by failure or an incomplete. Spiral theory says that evolution to a given v-Meme lets the individual use all the v-Memes at or below the highest point of evolution. Sometimes there are cases where activation of Red v-Meme behavior is the only alternative.

6. You have a group of three students, who appear to be only modest performers. The group stops coming to class for three weeks, but you have not heard any complaints from the project sponsor about work not being completed. The project sponsor is a multi-year sponsor, and as such, is sophisticated in evaluating work. What do you do?

If, after checking with the project sponsor, and reviewing whether students are meeting the syllabus requirements for the class, if the students are doing a great, self-directed job, they likely have already evolved to a Performance/Orange v-Meme. Appreciate their performance.

In this case, two of the three students went on to start their own companies after graduating from the university. They had already developed appropriate focus and work modulation techniques that would serve them well in their careers.

7. A very influential Advisory Board member comes up to you in the middle of Capstone Design Poster Presentation Day, and in front of a group of students, compliments you on so many successful projects. What do you say to her?

Thank her and tell her that the students did the work. In an Orange/Green performance-based community, you will be telling her the truth.

5.2 Caveats

Needless to say, this approach will not work without sponsors who understand higher-performance behavior themselves. Red v-Meme sponsors will inevitably quickly assume control of the students, often with disastrous results. Because there is a high probability of arbitrary incentives placed with any pure Red v-Meme behavior, which are necessary to manipulate the individuals lower in the hierarchy (in this case, the students) , communication up from the students to the sponsor regarding areas of ignorance and lack of information inevitably collapses, leading to project failure.

5.3 Spiral ladders

In order for this approach to work, both the professor and sponsor must agree apriori to construction of what the author has termed 'Spiral ladders'. Spiral ladders are ubiquitous in servant leadership, and can be found in all successful organizations, including political, corporate and religious. One of the classic Spiral ladders is the 'Golden Rule' in Christianity. Jesus himself said 'do unto others as you would have done unto you.' From a v-Meme perspective, this is a plea for empathy (Green v-Meme behavior) for fellow beings from an egocentric, Red v-Meme perspective. The fundamental idea is to cause reflection in the potential actor and have them consider historic consequences in their actions involving others.

Spiral ladders abound in the design clinic practice. Here are a few examples:

1. Specification writing is emphasized, which underlays the performance-based multiple-ideation process with a heavy Blue v-Meme backstop.
2. Students are coached on how to hold appropriate personal/professional conversations to build trust in mealtime settings. By acting appropriately and following a code of Blue v-Meme behavior, the groundwork is laid for professional friendships that will result in efficient information transfer and a web of mutual obligation between sponsor and student.
3. All major communications between sponsors and student groups must be attended by at least two students. After any communication of any import is completed, a report must be generated and archived on the on-line project management system for all the students to see. This transparency protocol (Blue v-Meme) builds trust among both students and sponsors, creating a larger Green community behavior. It also has the effect of accelerating Orange v-Meme behavior in that mistakes are caught early, and fixed, before they are allowed to propagate in the design.
4. Through archival recording with the Wiki, students are encouraged to discuss all shared protocols and their impacts. The Wiki itself generates a Green v-Meme front for the Clinic, because students are told that they are responsible for changes if they find information to be incorrect.

6. Conclusions

One of the major challenges in understanding what happened in a workshop setting is what participants actually learned while taking the workshop—a period of only 1.5 hrs. Many of the ideas laid out here are complex, and not easy to digest. The idea of building an objective relationship with self is not something that happens in a couple of hours—any individual in a practice of social evolution will spend a lifetime of work on understanding their perspective, which then will modify their ability to understand truly the students' perspective.

That said, in assessing the performance of the workshop, there was the largest interest in understanding and modifying the various situations and case studies that were placed in front of the workshop participants after the instructional session was completed. Discussion was vigorous amongst participants, but it is important to remember that the whole idea that students are, at some level, unique and independent agents swimming in an ostensible relational sea that is primarily responsible for the way students will approach problems is a paradigm shift for most people. It is broadly accepted in Western culture that individuals will have their own perspective, and this perspective will depend on background culture and independent experiences. What is less obvious (though it is discussed somewhat in [8]) is how the trust environment established in the classroom will influence results, as well as the professor's role in establishing what will the rules that will govern that dynamic. The workshop gave many case studies that illustrated the concepts outlined in this paper.

Takeaways from the workshop include a set of relational development tools mapped to actual design process and practice by using the v-Meme evolutionary map of Spiral Dynamics. The primary result is a roadmap toward developing high-performance teams, and establishing a backstop toward guiding changes in the curriculum that will yield higher levels of individual and team student performance.

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