

Establishing an Agile Mindset and Culture for Workforce Preparedness: A Baseline Study

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Abstract— This Research Paper presents our work using the **Organizational Culture Framework** to better understand the educational and operational culture of the Department of Computer Science at Tennessee Tech University. A large percentage of graduates with computing degrees will enter corporate environments dominated by the use of Agile development methods, including Scrum. A significant part of these methodologies is grounded in establishing cultural norms that emphasize teamwork, communication, reflection, and action. We conducted a study using an *organizational culture framework* to better understand both the ideal and current cultures of our department as well as the levers that can be used to move the current toward the ideal. The design of the study is based on the notion that by identifying an ideal culture and measuring the current culture we can identify the gap between the as-is and the to-be culture of the department. Our results demonstrate a marked difference between the target ideal culture identified by both the Agile experts and faculty/staff and what the students perceive the current culture to be. The results of the survey serve as a baseline for our ongoing effort to create a pathway for transitioning students towards adopting an Agile mindset that will ease the commencement of careers of graduates as practicing software engineers.

Keywords—*Agile Development, Constructive Culture, Organizational Change, Workforce Readiness*

I. INTRODUCTION

In the late 1990's and early 2000's, the software development industry was bogged down in a glut of failed projects caused, in many instances, by an inability to cope with the complexity and uncertainty of ever changing requirements. In 2001, a number of thought leaders in the software industry gathered to develop what they called the Manifesto for Agile Software Development [1]. Core to the creation of this then new development approach was the adoption of an Agile mindset that is grounded in the concepts of process control: inspection and adaptation. In particular, the values, principles, and practices most often associated with Agile Development encourage and promote the notion that iterative reflection

(inspection) and action (adaptation) through consistent and frequent communication provide the best avenues for adapting to complexity and the unknown when trying to move towards some desired but uncertain future. In many ways, the Agile mindset is a mindset of growth and change.

This paper presents our work using the Organizational Culture Inventory (OCI) to better understand the educational and operational culture of the Department of Computer Science at Tennessee Tech University. A large percentage of graduates with computing degrees will enter corporate environments dominated by the use of Agile development methods. A significant part of these methodologies is grounded in establishing cultural norms that emphasize teamwork, communication, reflection, and action. The Agile Mindset [2] focuses on continuous learning and improvement in a constructive environment where members of self-organizing teams work closely together to develop products. Teams work in close collaboration with engaged stakeholders with a focus on introspection in order to adapt processes and interactions to best suit team needs and dynamics. We are interested in establishing a departmental culture that is based on these same norms - with faculty, staff, and students expected to practice reflective learning with an eye towards easing the transition of students from a university context to Agile organizations. Our goal is to interweave Agile into the fabric of our departmental community as a way of relating, learning, educating, and operating. Our intent is to not only teach Agile practices to students but also to make it a cultural mindset that affects every aspect of our interactions [3]. The mindset ideally will permeate across all departmental activities including advising, curricular design, evaluation, assessment, research, department operations, committee work, outreach, and recruiting. In the end, not only will students learn about Agile as a way of working on teams and developing software, but they will also experience Agile as a way of reflecting on experiences, taking ownership of their learning, and adjusting to the dynamics of campus life (and eventually their professional life).

We conducted a study using the OCI to better understand both the ideal and current cultures of our department as well as

the levers that can be used to move the current toward the ideal. The design of the study is based on the notion that by identifying an ideal culture and measuring the current culture we can identify the gap between the as-is and the to-be culture of the department. We surveyed external Agile experts ($n = 4$), department faculty and staff ($n = 9$ representing 75% of total), and students ($n = 190$). The student population consisted of first-year computer science students, first-year non-major engineering students, and junior/senior computer science students. Our results demonstrate a marked difference between the target ideal culture identified by both the Agile experts and faculty/staff and what the students perceive the current culture to be. In particular, the Agile experts identify an ideal culture that is constructive, while students identify the current culture as leaning towards aggressive/defensive norms. The results of the survey serve as a baseline for our ongoing effort to create a pathway for transitioning students towards adopting an Agile mindset that will ease the commencement of careers of graduates as practicing software engineers.

The remainder of this paper is organized as follows. Section 2 describes background information in the areas of Agile Development and organizational change (via the Organizational Culture Framework), and provides a profile of our department in order to set the context within which this study is being performed. Section 3 presents the methods used to conduct the surveys as well as an overview of the data that underlies the analysis for the baseline. Section 4 presents the results of our baseline study, including identifying the different groups that have been surveyed using the OCI. We include results that highlight differences between some of the major sub-groups contained within the data such as majors and non-majors, class standing differences, and gender differences. Section 4 discusses the results and identifies open issues that arise from the examination of the data. Finally, Section 5 draws conclusions and suggests future investigations.

II. BACKGROUND

A. Agile Development

Agile organizations are built upon defining a set of values, principles, and practices [2,4,5,6,7] that are meant to embody the Agile Manifesto for Software Development. The manifesto identifies a set of foundational values that prioritize aspects of software development practice that were found to lead to success over the established norms of the industry. In particular, the authors of the manifesto stated the following [1]:

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value: Individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a plan. That is, while there is value in the items on the right, we value the items on the left more.

Upon these foundational values, Agile organizations establish a culture that adopts a set of “humanistic” values that underpin the manifesto. Principles that define qualities of

working, collaborating, and communicating are used to establish the ways in which the values are incorporated into the culture of the organization. Practices define how products are delivered based on the principles and values, and processes define the contexts and domains in which the practices are applied.

Academic departments operate within a very volatile and dynamic environment. While we know that calendars are fixed (i.e., semesters always begin and end at certain times), we also know that human and financial resources are ever changing, enrollments fluctuate, and the science of computing is ever advancing and undergoing technological innovation. Furthermore, students come from a wide variety of backgrounds and experiences, faculty are dealing with increasing demands on their time to meet curricular, scholarly, and service goals, and staff numbers are dwindling as administration finds ways to adjust to increasingly higher costs of education. It is precisely within this kind of environment where complexity and uncertainty are commonplace in which we are seeking to adopt a strategy that sets us on a path towards mastery of an Agile mindset through development of a revolutionary change in culture, behavior, and curriculum. Our goal is to interweave Agile into the fabric of our departmental community as a way of relating, learning, educating, and operating. Specifically, our intent is to not only teach Agile practices to students, but to make it a cultural mindset that affects every aspect of our interactions. The mindset will permeate across all departmental activities including advising, curricular design, evaluation, assessment, research, department operations, committee work, outreach, recruiting, and so on through the use of various practices that focus on reflection and adaptation. In the end, not only do students learn about Agile as a way of working on teams and developing software, but also they will experience Agile as a way of reflecting on experiences, taking ownership of their learning, and adjusting to the dynamics of campus life (and eventually their professional life).

B. Organizational Culture Framework

For the purposes of our work on Agile, we view organizational culture as a system of shared values and beliefs that can lead to behavioral norms that guide the way that members solve problems, approach their work, and interact with one another. Consistent with this definition, the Organizational Culture Inventory® [8] is a research-based and validated survey designed to measure the strength of norms and expectations for twelve different behavioral styles associated with three types of cultures: Constructive, Passive-Defensive, and Aggressive-Defensive (See Figure 2.1). The survey has been translated into over 30 languages and used for the development of organizations in a wide range of industries, and administered to assess organizational culture to support academic studies carried out by researchers throughout the world [9,10,11,12,13,14].

The conceptual framework for the OCI—and the twelve different yet interrelated sets of behavioral norms it measures—is based on two underlying dimensions. The first dimension differentiates between: (1) behaviors reflecting a concern for people and those reflecting a concern for tasks and (2) behaviors directed toward fulfilling higher-order

satisfaction needs and those directed toward protecting and maintaining lower-order security needs. Based on these two general dimensions, the twelve norms are placed around a circumplex and categorized into three general clusters or types of organizational cultures as mentioned above and as shown in Figure 2.1. Constructive cultures are characterized by norms for achievement, self-actualizing, humanistic-encouraging and affiliative behaviors. These norms encourage organizational members to interact with people and approach tasks in ways that will help them to meet their higher-order satisfaction needs. *Passive/defensive* cultures, characterized by *approval*, *conventional*, *dependent* and *avoidance* norms, encourage or implicitly require members to interact with people in ways that will not threaten their own personal security. *Aggressive/defensive* cultures, encompassing *oppositional*, *power*, *competitive* and *perfectionistic* norms, drive members to approach tasks in forceful ways to protect their status and security. A description of the four behavioral norms associated with the *constructive* type is provided in Table 2.1 along with sample items (in italics).

The constructive styles also are typically viewed as most appropriate and efficacious on a special form of the inventory, the OCI-Ideal, which measures values and the preferred culture for organizations. Members consistently indicate that the constructive styles should be expected to maximize motivation, performance, and the attainment of organizational goals. Given such responses and the research results outlined above, we expected that constructive cultural norms would be consistent with Agile principles and support the movement toward the implementation within the department.

C. Department Profile

Tennessee Tech University is located in Cookeville, TN, the largest and most centrally located city in the Upper Cumberland region – a primarily rural area. The University is committed to the lifelong success of its students, and while its open admissions policy allows it to serve students from around

the country and world, it maintains a special commitment to enrich the lives of those representing the Upper Cumberland region of Tennessee. Tennessee Tech's mission as the state's only technological university is to provide leadership and outstanding programs in engineering, the sciences, and related areas that benefit the people of Tennessee and the nation. The mission of the College of Engineering, the largest college at Tennessee Tech, is to graduate innovative engineers who solve technological challenges to meet societal needs. The college is composed of basic engineering, chemical engineering, civil engineering, electrical and computer engineering, manufacturing technology, mechanical engineering, and computer science.

The Computer Science program at Tennessee Tech currently has four concentrations: Software and Scientific Applications concentration, which is ABET accredited, and three newer concentrations that meet the ABET standards and are expected to be reviewed during the next accreditation cycle: Data Science, Cyber Security, and High Performance Computing. The undergraduate program is delivered using a largely traditional lecture/laboratory approach. We do not teach our undergraduate courses off-campus or offer them as distance education courses. We do use web-based content delivery to supplement and support our in-class efforts. Many of our faculty use lecture-capture technology to record and post their lectures as supplemental material for the students. Our Program Educational Objectives have been developed by the department, and our External Advisory Board consists of representatives from our program constituencies: program alumni; employers in the state, region, and the United States federal government; and the people of the Upper Cumberland and Tennessee.

The faculty consists of thirteen (13) full-time faculty members with two (2) of the 13 being full-time lecturers and the remainder being tenured or tenure-track professors. The tenured faculty members consist of 6 full professors, 4 associate professors, and 1 assistant professor.

Total enrollment of undergraduate students in computer science increased from 327 to 431 between Spring 2016 and Fall 2017. The total enrollment of first year students rose from 90 to 108 between Fall 2016 and Fall 2017. The majority of the population is male, as is common nationwide. The total number of enrolled junior students was 95, 91, 88 and 109 during Spring 2016, Fall 2016, Spring 2017 and Fall 2017 respectively. The total enrollment of senior students was 90, 94, 112 and 122 during Spring 2016, Fall 2016, Spring 2017 and Fall 2017 respectively. In our study, we surveyed students in the boundary between the junior and senior year as there is a gray area in defining class standing in that period.

D. Related Work

Research utilizing the Organizational Culture Framework and the culture survey has shown that constructive cultures are related to positive outcomes across industries—including quality in manufacturing organizations [15], client outcomes in human service organizations [16], and effective problem solving in nuclear power plants [17]. At the group or team level, both the strength and intensity of constructive norms have been shown to be positively relative to cooperation and teamwork [12]. Similarly, constructive cultures have been found to have a positive impact on organizational members,

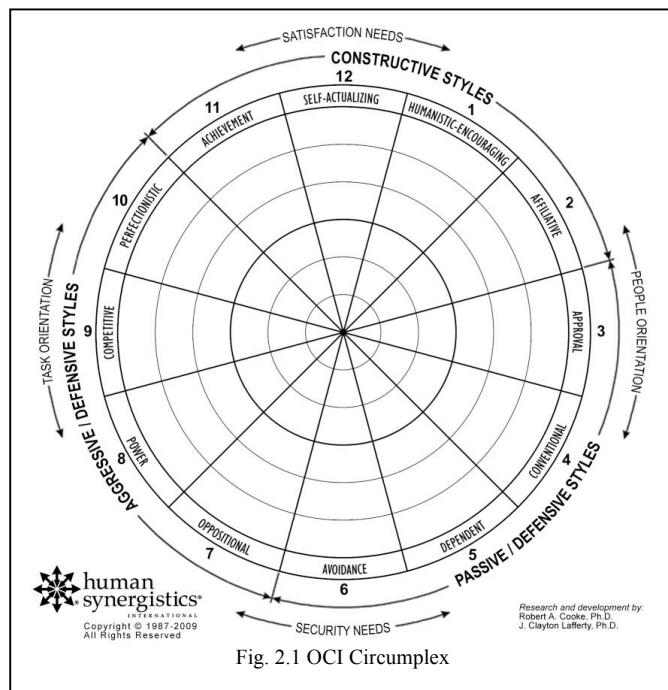


Fig. 2.1 OCI Circumplex

Table 2.1. **Constructive Norms** (Cultural Styles Promoting Satisfaction Behaviors)

Achievement - An Achievement culture characterizes organizations that do things well and value members who set and accomplish their own goals. Members are expected to set challenging but realistic goals, establish plans to reach these goals, and pursue them with enthusiasm. (*Pursue a standard of excellence; Openly show enthusiasm*)

Self-Actualizing - A Self-Actualizing culture characterizes organizations that value creativity, quality over quantity, and both task accomplishment and individual growth. Members are encouraged to gain enjoyment from their work, develop themselves, and take on new and interesting activities. (*Think in unique and independent ways; Do even simple tasks well*)

Humanistic/Encouraging - A Humanistic-Encouraging culture characterizes organizations that are managed in a participative and person-centered way. Members are expected to be supportive, constructive, and open to influence in their dealings with one another. (*Help others to grow and develop; Take time with people*)

Affiliative - An Affiliative culture characterizes organizations that place a high priority on constructive interpersonal relationships. Members are expected to be friendly, open, and sensitive to the satisfaction of their work group. (*Deal with others in a friendly, pleasant way; share feelings and thoughts*)

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including trust in their supervisors and their organizations [18], individual well-being [19], and motivation, job satisfaction and performance [20,21,22]. Passive-defensive and aggressive-defensive cultures have been shown to be negatively related or, at best, unrelated to such outcomes [23,24].

Researchers have identified cultural principles, values, and practices as critical factors in recruiting and retaining female students in STEM fields [25,26,27], the shortage of which constitutes a significant concern in both the academic and professional world. The Agile framework fosters a distinctive cultural environment that may address these cultural barriers.

Situational Learning theory emphasizes the significance of context for student learning [28], while the trend in analyzing and developing learning spaces demonstrates current applications of these theories [29,30,31,32]. The Agile model has the potential to straddle theory and application, providing a significant conceptual bridge for the enhancement of discipline-specific learning environments and communities, all drawn from real-world experience.

The Agile model proposes to blend industry-based and academic-based practices into an alternative model that emphasizes intrinsic reward through practices such as shared governance, autonomy, collaboration, and continuous improvement. The long-term challenges and opportunities associated with such a shift should provide significant contributions to the literature on organizational change in higher education [33,34,35,36,37,3].

III. METHODS

This section describes the study conducted in our department including a summary of the survey instrument, methods, and target survey population.

A. Survey Instrument

The OCI asks respondents to “...think about what it takes for you and people like yourself (e.g. your co-workers, people in similar positions) to “fit in” and meet expectations in your organization.” Respondents are then asked to review 120 statements that describe some of the thinking and behavioral styles that members of an organization might be expected, or

implicitly required, to adopt in carrying out their work and interacting with each other. They are provided with five options from which to choose for each behavior. Some sample statements measuring the Constructive style were provided in italics in Table 2.1; statements for the Aggressive/Defensive and Passive/Defensive styles include:

- Point out flaws
- Compete rather than cooperate
- Do things perfectly
- Personally run everything
- Cast aside solutions that seem different or risks
- Always follow policies and practices

To supplement the 10 items associated with each of the twelve styles, the OCI includes 12 items to assess outcomes of culture such as satisfaction and role clarity. In addition, we added 13 questions that measure attitudes towards Agile principles. Individual members’ scores along each of the 12 OCI styles were aggregated to the organizational level and profiled against normative data collected from members of approximately 1000 organizational units (a research-based subset of the 3 million members of thousands of organizations that have employed the instrument). This profiling of raw scores on the normed circumplex generates a picture of the strength of expectations for the 12 styles within our organization relative to other organizations. The longer the extension along each sector, the stronger the expectations for the style—with the concentric circles on the profile representing (from the inside out) the 10th, 25th, 50th, 75th, 90th and 99th percentiles. Results for various groups will be presented on this profile throughout the remainder of this paper. In addition, our data includes internal measures for each style such as a raw score, standard deviation, and a calculation of a *p*-value using a *two-tailed independent samples Student’s T-Test* to identify internal differences within the local sample.

B. Survey Methods

The surveys for this study were conducted during two separate periods in the Spring and Fall semesters of 2017. The first-year major and non-major students, Agile experts, and faculty/staff cohorts were surveyed in the Spring of 2017 while

the junior/senior cohort was surveyed early in the Fall 2017 semester. The data were compiled and analyzed by Human Synergistics International. Students were recruited on a volunteer basis, with respondents having the right to opt-out of participation. Agile experts and faculty/staff were recruited on an opt-in basis. No incentives were provided for participation.

C. Survey Population

A summary of the survey population is shown in Table 3.1. This baseline assessment was carried out in part to enable us to accurately measure culture change as we work toward developing an Agile mindset. As noted above, we created a set of supplemental questions that are relevant to Agile culture (i.e., an OCI+Agile instrument) and can also be used to measure change. We administered this survey to several groups, including Agile experts, faculty and staff, computer science first-year students and junior/seniors, and non-major first-year engineering students.

Agile Experts. We recruited a handful of experts ($n = 4$) in the field of Agile Development and organizational change to participate in the project study. This included professionals at executive and consultancy levels as well as external university administrators and researchers with intimate knowledge of Agile practice. In this study, we asked these experts to complete just an OCI *Ideal* assessment with an eye towards identifying an ideal organizational culture based on Agile principles for the purpose of creating a reference point for our project. When placed in the context of how a culture study would be applied to a corporate culture transformation, it would be akin to inviting these Agile experts to directly consult on our efforts.

Faculty/Staff. Faculty and staff ($n = 9$) in the Department of Computer Science completed the survey instrument. These respondents were used to measure the *current* culture of the department using the OCI.

Students. In order to capture a baseline of student perceptions of the *current* culture we surveyed both majors and non-majors ($n = 190$). For majors, we recruited first-year students as well as students in the border between the junior and senior years. For non-majors, we recruited first-year engineering students. The mixture of first-year and junior/senior students provides us with a mechanism for comparing a current state with students that have either recently entered the program or will imminently be exiting the Computer Science program.

D. Research Question

It is our intent to perform a longitudinal study that compares attitudes across approximately four-years, with the

Table 3.1 Surveyed Population

Group	Description	Size
I	Agile Experts	4
fs_c	Faculty-Staff, current	9
ts_c	Total student, current	190
mf_c	First-year, current	32
mjs_c	Junior-Senior, current	70
nf_c	First-year non-majors, current	40

baseline capturing culture perspectives from the cohorts shown in the following table. Note that the total number of students surveyed ($n = 190$) is greater than the students shown in the mf_c , mjs_c , and nf_c subgroups as a number of students chose to not self-identify a subgroup.

Our ultimate aim is to answer the following question: *have our efforts to create an Agile culture been effective?* In particular, we hope to determine whether the perception of culture in the department has moved towards the ideal culture as identified by the Agile experts. In addition, we also intend to examine various subgroup comparisons to determine effectiveness of establishing an Agile culture. Finally, we will also perform a global comparison against data from other organizations that have used the instrument.

In the remainder of this section, we present the results of performing the baseline study through the measurement of the cohorts as identified above. In addition, there are a number of subgroups based on gender and class standing that we highlight and provide commentary on.

IV. BASELINE RESULTS

In this section we present the baseline results from using the OCI to measure the perceived cultural norms of our department. We use the OCI Circumplex to depict the histogram-based percentiles of the responses of each of the surveyed subgroups against the global data collected by HSI.

A. Ideal and Current Cultures

Figure 4.1 shows the OCI Circumplex for the ideal culture as identified by our group of Agile experts. The results show that according to these participants, an ideal Agile organization strongly associates with a the constructive norms of the How Culture Works model. With respect to each of the wedges within the constructive norm area, the Agile experts

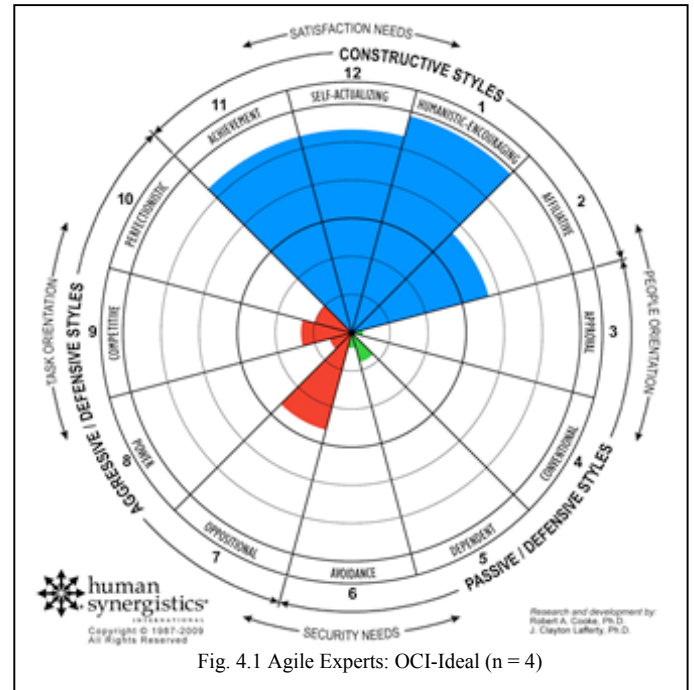
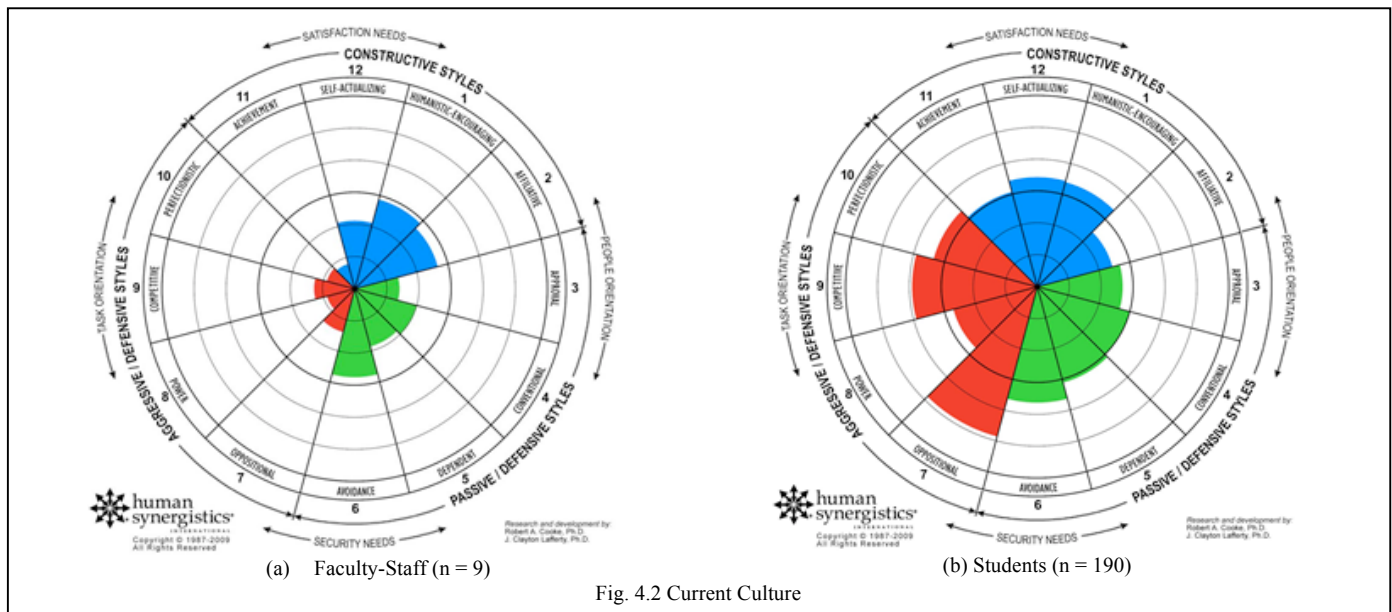


Fig. 4.1 Agile Experts: OCI-Ideal ($n = 4$)



rate achievement, self-actualizing, and humanistic-encouraging all above the 90th percentile, while the affiliative wedge falls between the 50th and 75th percentiles. In the Aggressive / Defensive style region of the circumplex, the ideal culture shows some oppositional attitudes, although the reported responses are below the 50th percentile of the HSI dataset containing over 3 million responses. We interpret this to mean that within an Agile environment, some level of (healthy) opposition is required while evaluating ideas.

Figure 4.2 shows the current culture as determined by the faculty staff (fs_c) and current student respondents (henceforth referred to as “the aggregate”). The circumplex for each of these groups paints a different picture from the ideal organization from Figure 4.1. In particular, the faculty staff cohort leans relatively towards both the constructive and passive/defensive styles when compared to the aggressive/defensive style. However, in all cases, each falls below the 50th percentile, with some falling below the 25th. The student responses, on the other hand, are far more balanced with a leaning towards the aggressive / defensive style. Furthermore, the students indicate a strong affiliation with the *oppositional* norm, indicating they perceive an environment where, as put in Table 1, “members gain status and influence by being critical and thus are reinforced to oppose the ideas of others”. The visual comparison of the circumplex for the *ideal*, *faculty staff current*, and *student current* groups show a pronounced difference in desired culture against the perceptions of the current cultures. These differences form the basis for which our project is focused: we desire to eventually move the perception of the department culture by students towards the ideal culture.

B. Comparisons by subgroups

The aggregate for the students was compared along a number of dimensions in order to determine whether there are any differences in the baseline that may lead to other interesting questions to explore moving forward. The natural groups that we identified were the first-year majors (mf_c),

junior-senior majors (mjs_c), and first-year non-majors (nf_c). In the remainder of this section we highlight some of the differences from these groups as well as the corresponding perceptions within corresponding male and female gender subgroups.

1) Majors and Non-Majors: First-Year and Junior-Senior

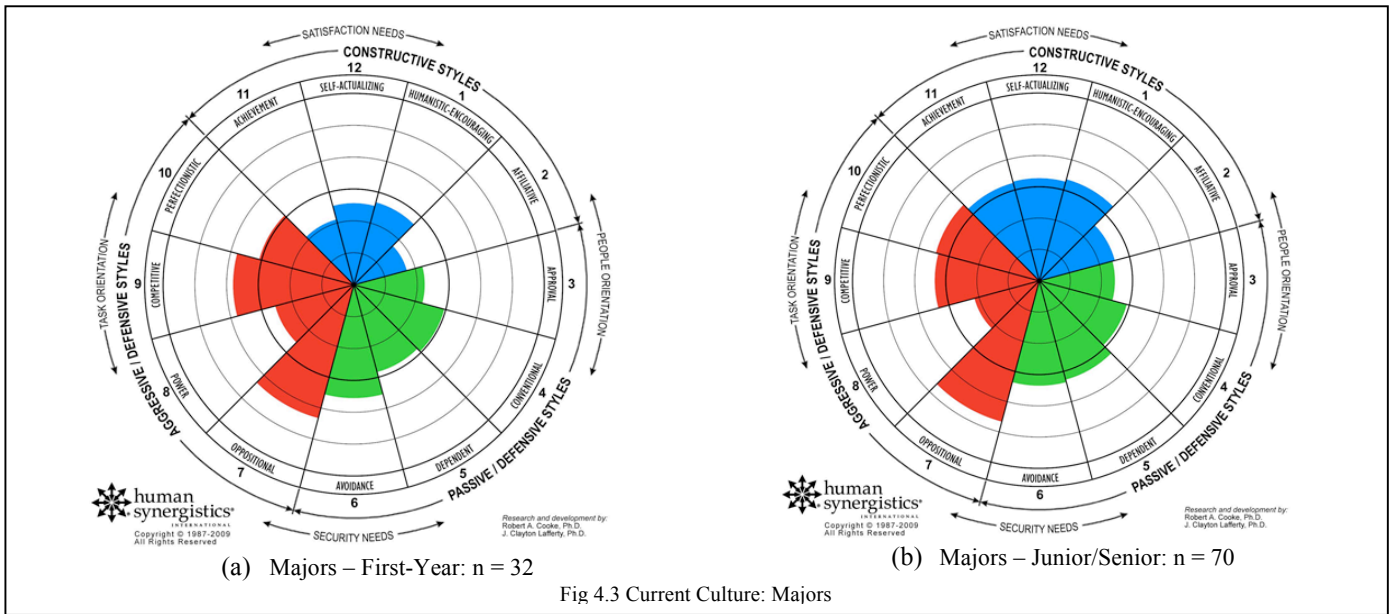
Figures 4.3(a) and (b) show the circumplex diagrams for first-year majors and junior-senior majors, respectively. For the first-year cohort, one wedge (achievement) does show a statistically significant lower measure against the aggregate ($p < .05$). For the junior-senior cohort, the *competitive* wedge is also statistically significant lower ($p < .05$) in comparison to the aggregate. None of the remaining the major normative areas (i.e., *constructive*, *passive-defensive*, and *aggressive-defensive*) indicate statistically significant differences when compared against the aggregate.

Figure 4.4 shows the circumplex for the first-year non-major nf_c cohort. When compared against the aggregate of Figure 4.2 (b) the diagram shows statistically significant differences in all of the aggressive defensive normative styles. The p-values for each of the raw score comparisons against the aggregate for oppositional, power, competitive, and perfectionistic were 0.01, 0.01, 0.001, and 0.05, respectively. While we can certainly hypothesize over the difference between the mf_c and nf_c cohort responses, at the very least this difference provides the seed for future study.

2) First-Year and Junior-Senior Majors by Gender

Figures 4.5 (a) and (b) show the circumplex diagrams for males in the first-year major mf_c and junior/senior major mjs_c cohorts, respectively. In regards to the comparison to the aggregate group, the males in mf_c show no significant differences from the aggregate. The males in the mjs_c cohort have a significant difference (low) with $p < 0.05$ in the *power* and *competitive* style wedges.

Figures 4.6 (a) and (b) show the circumplex diagrams for females in the mf_c and mjs_c cohorts, respectively. The responses for the female first-year students show no statistical difference from the aggregate cohort. Note that the $n = 6$ females represent roughly half of the females in the total



student population of first-year students. The responses for the females in the *mjs_c* cohort are noteworthy in a number of the styles. First, the responses show significant differences in the *humanistic-encouraging*, *achievement*, and *self-actualizing* styles with p-values less than 0.05, 0.01, and 0.05, respectively. In addition, while the male counterparts in this cohort showed a lower outcome compared to the aggregate in the *power* and *competitive* norms, females exhibited no statistical difference.

V. DISCUSSION

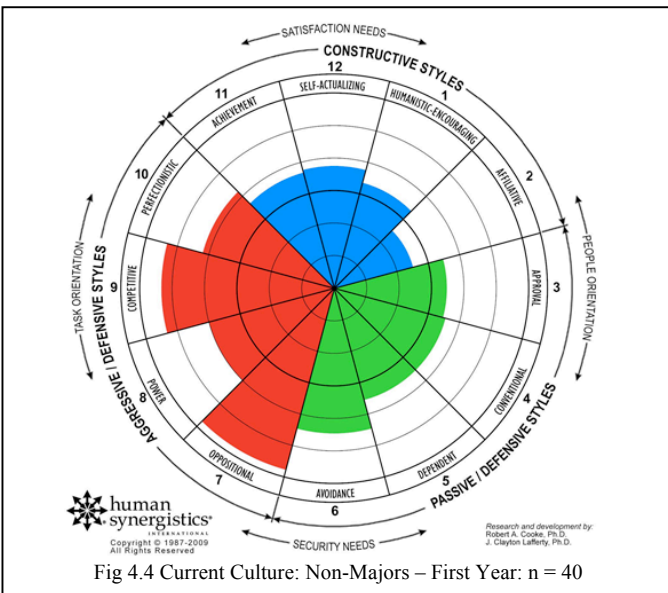
It is natural to try to hypothesize as to the reasons for the results observed in the cultural norms data. A large part of the motivation for our research is to measure whether we can establish a culture within the department that is closer to the ideal culture, as identified by the Agile experts surveyed. We believe that the baseline data that we have collected (and partially summarized in this paper) provides a stimulus for asking a number of questions beyond what we have identified here. For instance, it should be of interest to determine

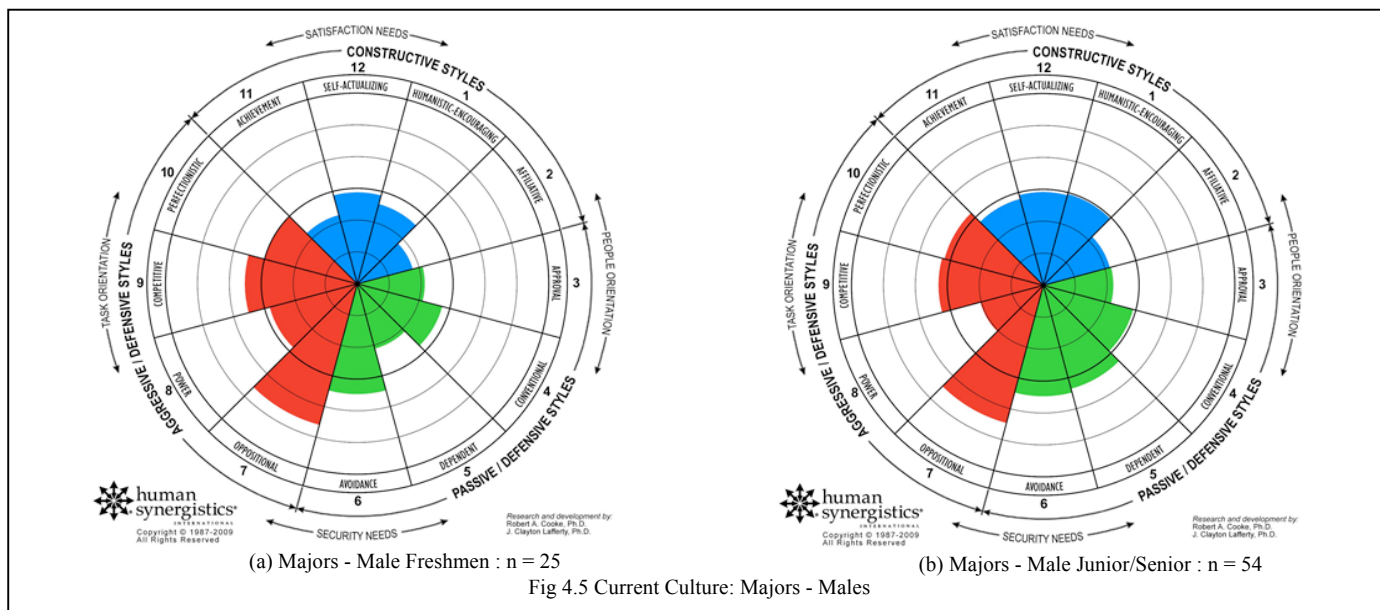
whether organizations that use Agile development practices align with the ideal culture. For our part, based on the baseline data, we have made a few observations that we wish to explore further, as outlined below.

Female Perception of Constructive Styles. The responses by the female junior-senior students in the major exhibited extremely high perception of a *constructive style* culture compared to the aggregate and the historical organizational data, while at the same time being relatively high in some of the aggressive/defensive styles. The corresponding females in the first-year cohort, on the other hand, enter the program perceiving the culture in a manner that is entirely consistent with the aggregate. We hypothesize that the programs we have in place for attracting females into our program via the NCWIT Aspirations in Computing program and the local ACM-W Student and CyberEagles chapters coupled with strong mentorship from our women faculty have had a positive impact on the female students. We plan on exploring this via focus group contact with both subgroups.

Male and Female Perception of the Aggressive-Defensive Styles. The difference in the responses of the junior-senior male and female students to the *power* and *competitive* norms, with the females responding higher than the males in each category raises a question to be studied further, and while we have no hypotheses yet as to the reason behind this, we have found this result to be surprising. Furthermore, while the female first-year response to the *competitive* norm was not statistically different from the aggregate, it was on the surface higher than their counterparts and raises a flag for future study.

Non-major aggressive-defensive. While our main focus has been on Computer Science majors at Tennessee Tech, the surveying of non-majors for the baseline uncovered an interesting result in that the ratings by these students were both statistically higher than the aggregate AND have percentile scores that are high when compared to the historical data. We have to date not attempted to hypothesize the reasoning behind this outcome.



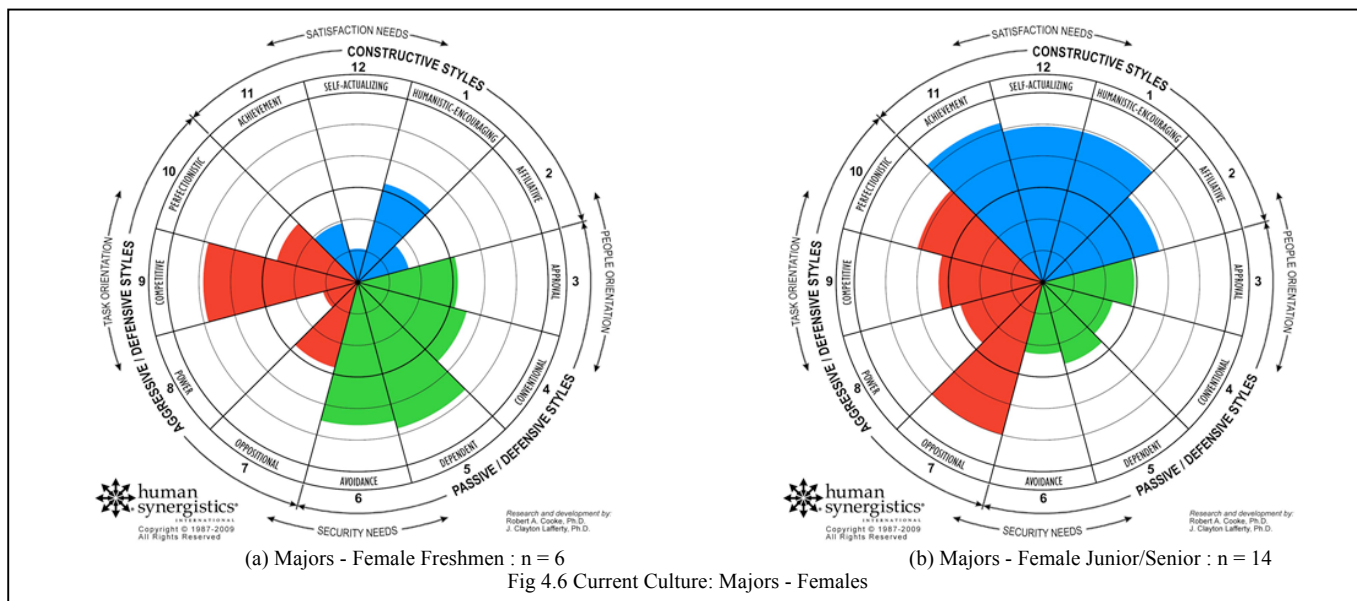


VI. CONCLUSIONS AND FUTURE INVESTIGATIONS

The culture of an organization, be it educational, corporate, for-profit, or non-profit, plays a large role in the satisfaction of the members of the organization. The graduates of our program will very likely move into organizations that espouse an Agile mindset [38]. From the perspective of experts in the use of Agile development, the *Ideal* culture is one that aligns very closely with the *constructive styles* identified by the Organizational Culture Inventory [39]. Our overarching goal is to establish a culture within our department that prepares students to move into these kinds of organizations. By aligning our culture as closely as possible to the *ideal*, we believe that students will be better served to be successful in their careers. In addition, we believe that the *constructive* styles make for a better experience regardless of whether the culture aligns with the *ideal*. The baseline results described in this paper not only paint a picture of our

department that indicates much work has to be done in many areas, but that some encouraging aspects already exist, especially considering the responses provided by female students situated in the latter parts of our program.

We have established a strategic plan within our department that is meant to address, in part, the goals of the research question posed earlier: can we effectively establish an Agile culture in our department? Our future investigations will include enacting a three-pronged approach towards enabling agility in all aspects of our operations, advising, and program management while providing traditional instruction on Agile approaches at points in the curriculum where it is most appropriate. As part of this, we will perform the assessment surveys on culture at various checkpoints over the short and near terms.



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