

ENGINEERING AND SCIENCE CAREER DEVELOPMENT: SELF-REFLECTION
AND OTHER METHODS USED TO STEER PROFESSIONAL DEVELOPMENT

by

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ABSTRACT

With Baby Boomers leaving the workforce in large numbers ready for retirement, large skill gaps are being created in the workforce. Years of experience present today are gone tomorrow. In highly technical fields, such as NASA, the challenge of how to transfer this knowledge gathered from employees who have years of experience to those with less experience can be daunting. Typically, the method of transferring the information is through hands-on experience over time. However, time is a limited commodity and there is not enough of it to spend before workers who have the knowledge leave. This study attempts to determine if using more experienced employees in training opportunities, using real-world examples, can effectively transfer knowledge and assist employees in self-reflection and career planning. A group of twenty-six newer, less experienced employees at NASA Marshall Space Flight Center participated in four training sessions taught by thirty-three senior leaders and held over a period of several weeks. The content was built around the NASA Life Cycle Process, the backbone of planning, executing, and ending a program or project. Normally, understanding this process takes up to fifteen years. In addition to the training, participants completed feedback forms, a pre and post-survey, a portfolio questionnaire and one-on-one interviews. The data showed the training was highly effective in transferring sophisticated levels of knowledge applied to how work is done. And, though it also showed an impact in an employee's awareness of actions they can take to steer their career, it brings in to question their motivation and initiative to assert self-directed development.

INTRODUCTION AND BACKGROUND

The NASA Marshall Space Flight Center (MSFC/Marshall) is located in Huntsville, Alabama on an Army installation known as Redstone Arsenal. MSFC was established on July 1, 1960, leasing approximately 1800 acres from the Army and employing over 4,600 civilian employees. Marshall Space Flight Center's first director was Dr. Wernher von Braun who, along with his team of German engineers and scientists, led the United States in the space race and eventually on to the moon.

Today MSFC employees are the NASA leading experts for in-space propulsion and heavily support all types of space transportation, engineering, science, space operations, and program/project management. Today's highly technical workforce at Marshall consists of approximately 2,400 civil servants and 3,500 contractors. Currently, thirty-six percent of the MSFC civil service workforce is, or will become, eligible for retirement in the next five years, with an additional twenty-eight percent becoming eligible in the following five years. Or, simply stated, sixty-four percent of the MSFC workforce is eligible for retirement in the next ten years. This means that if the younger employees are not well developed and the knowledge of near-term, future retirees is not captured and transferred; the technical and leadership capability that exists at Marshall now will potentially not exist within the next decade. This presents a new urgency and overwhelming challenge in how we develop employees. We find ourselves in a potential knowledge shortage of sorts, at risk of losing over half our employees in a short period of time. These senior employees will take with them years of expertise in technical, leadership, and project experience. We must find a way to transfer this knowledge before it leaves.

Additionally, adult learners at MSFC seem to lack the guidance needed to identify and develop in areas they need for current and future work. I suspect this is related to their unfamiliarity of the parts or pieces associated with their program or project. They are most likely not familiar enough with the “big picture” to layout a plan for their own development. Also, they may lack understanding of their peers’ roles and responsibilities. I am not sure employees spend enough time thinking about how well they perform certain, seemingly unrelated, tasks that greatly impact themselves and others. They often do not think through the nuisances of the progression of where they want to go professionally or what they need in order to be more efficient where they are. Moreover, branch managers, who are usually responsible for informing and developing employees, are overwhelmed with work responsibilities and find little time for one-on-one coaching and mentoring. Budgets are shrinking and employee hiring is down, therefore workload is increasing. All of these issues leave gaps in the employee’s ability to grow and develop.

As a Training Consultant in the Marshall Training and Incentives Office it is my responsibility to help develop and train employees. Training Consultants must consider the Agency and Center mission as well as business and strategic plan when helping guide managers and employees in career development. That means I must be familiar with: Center processes, multi-dimensional targets and goals, the make-up of the workforce, who I serve, and near as well as long term strategies for the Center. I serve all levels of employees from those newly hired to those who are eligible to retire, those fresh out of college up to senior leaders. It is the urgency of Marshall’s needs as well as personal responsibility that has lead me to pursue action research in the area of creating tools that

assist employees with career development. I would like use this research to create a way for employees to have guided tools that help them better understand where they fit in the mission, how to engage in career conversations, and identify what kinds of experiences they should pursue in order to develop their career.

Marshall needs a well-informed workforce who can holistically approach their work from the “big picture.” We need employees who can reflect and self-assess in order to steer their own development. Therefore, the primary question considered in this action research will be: In what ways will a novel approach to knowledge transfer assist less experienced employees in applying this knowledge to their work? Secondary questions include the following:

- 1) In what ways can novel approaches to knowledge transfer impact an employee's ability to self-reflect?
- 2) How can knowledge gathered by these experiences help guide employees in steering their own development?

CONCEPTUAL FRAMEWORK

In most careers today, two major challenges exist for both employee and employer. The first is how to stay current in the skills needed to survive and thrive, especially in highly technical fields such as NASA. Technology and knowledge advances so rapidly; learning how to learn is critical to job success (Rothwell, 2011). Secondly, how can an organization successfully transfer knowledge from those who hold most of the knowledge (those who are usually older) to those with less experience (those who are usually younger)? At Marshall, most workers with the highest skill level and expertise (having the true, complex knowledge of the work) will soon be eligible to retire

thus posing a serious threat to knowledge capture and transfer. Complicating things further for the Human Resources Specialist, when examining the learning and development activities of older employees and younger employees we see that their goals can be quite different as described in studies by Bromley, Boran, & Myddelton (2007) and in Tones, Pillary, & Kelly (2010).

Research suggests these issues can be addressed through some form of self-reflection and self-assessment (Gordon & Wong, 2011). Furthermore, when the data is collected and shared in collaborative groups, such as focus groups and interviews, a cross-cluster analysis can be performed and used to further validate data and generate ideas. When performed on a continuous basis, self-reflection can serve as a powerful tool for learning from experience. This method nurtures the thought process of setting standards or expectations for oneself, capturing of information about one's experiences, measuring performance, encouraging solicitation and interaction with others, and motivating employees to grow in their personal development. Employees who use self-reflection are more likely to ask for feedback and accept failure as a learning process, a very common misunderstanding for most NASA engineers. If encouraged, self-reflection can become a lifetime successful learning tool (Marienau, 1999). This is best described in a quote by a student in Marienau's (1999) self-assessment study:

Self-assessment means looking critically at one's performance or work efforts and then acting upon areas that display personal strength or a need for improvement. It relates not only to post-effort reflection and action, but also to the prior process of first setting an appropriate personal standard and then measuring one's effort against that standard. In this way, self-assessment involves personal standards and expectations, task

performance, reflection and critique, and then usually a corrective action for improvement. Such as process becomes an ongoing personal cycle.

To assist employees in developing their skill of self-reflection and further develop their career paths, most research covers three basic types of instruments. These include: portfolios, self-rating surveys or questionnaires, and conversations with peers and mentors. Since it has been found that 90 percent of all development occurs as people do their work (Rothwell, 2011), employees and employers can use these instruments and activities to capture information about what employees know, what they need to know, and help guide them in what they need to do (Van Tiem, Moseley & Dessinger, 2001).

One common method is the portfolio, sometimes referred to as the Professional Development Plan (Beausaert & Segers, 2011). In this method questionnaires are developed to support the goals of the organization, helping clarify the connection between what is known, what is needed, and where the employee fits. The information can be analyzed to determine what is lacking and what needs the most attention; from this a training plan can be developed. It is important to note, the use of a portfolio as voluntary or required can impact its use and cause it to be viewed differently by the employee. Voluntary use of a portfolio is less likely to be continued, but encourages informal assessment conducive to professional development. Mandatory use invites more of a formal, self-review but tends to be used more as a “check the box” exercise. In either situation, research shows to increase successful use of portfolios the manager or mentor should actively provide feedback to the employee (Smith & Harm, 2001).

Sometimes the use of self-reflection and career planning is best captured in a self-rating survey or questionnaire. These are often constructed to identify and measure life-

long learning and adaptive development within the context of work (Tones & Kelly, 2010). This type of tool can measure learning related to organizations, learning climate, and employee engagement as well as disengagement. For example, Enos (2002) wanted to measure lifelong learning and adaptive development. He developed a questionnaire to measure informal learning among government workers focused on core leadership behaviors. From this he was able to determine what kinds of activities were most used to develop leaders as well as the impact from supervisors, co-workers, and organizational support. Additionally, he was able to determine that younger workers are more likely to use their cognitive resources to apply what they learn to their job while older workers may be more likely use their cognitive resources to overcome constraints to new ways of doing work. Straka & Schaefer (2002) explains Human Resources departments can use these types of data to connect interrelated concepts across organizations or make ties between similar learner types. These tools are also useful for capturing skills employees have already mastered. To achieve high impact, Human Resources should make clear the work-importance of the information and strategies needed to implement it. Similar to portfolios, this process is also most successful when colleague or supervisor feedback is shared and used among appropriate individuals or groups.

A third measure using self-reflection for affects of change and learning involves interview questions or conversations with peers and/or mentors. One such example is shown by Reardon (2002) in a study conducted with engineers who experienced reorganization after the company downsized. The interview questions were helpful in revealing specifics about how new workflows were learned, how engineering expertise continued to be developed in a somewhat “crippled” environment, and how processes are

learned. This process also revealed important details such as the negative impact on mentoring when there are too few employees to perform the job. The process of being interviewed requires the employee to think about what is being asked and how their reaction to certain situations impacts the outcome.

Regardless of which instrument is used, a well-planned professional development program is critical to strengthening and maintaining a robust workforce. A challenge in this development is securing management's commitment to help employees develop and sustain their plan. Along with this, a well-defined competency model has shown to be most effective for professionals in the technical field (Rothwell, 2011). Multiple models exist. One model captures both technical competencies and behaviors associated with defining what superior "looks like". One such example can be seen in the Worksheet for Brainstorming Session on Work Experiences to Develop Competencies and their Behavioral Indicators, cited by Rothwell (2011), which discusses best practices in developing this particular model. He provides useful resources such as: worksheets for brainstorming sessions used by managers to best define competencies, a self-reflection tool for aligning the organization's strategic objectives to professional development, and an interview guide for pinpointing technical competencies. And, (Bromley et al., 2007) discusses the outcomes of using The Development Needs Analysis (a similar model) that combines both a questionnaire and a self-assessment. In his research, he was able to link behavioral indicators to competency statements for use in defining strengths and weaknesses as well as giving insights into skill areas in need of further development. He includes the one used in his study for doctoral students in the Abbreviated Skill Behavioral Indicator (Bromley et al., 2007). Over all, research shows the best models for

career development use multiple data inputs from various sources (Tillema, 1998).

METHODOLOGY

Familiarity with the Project Life Cycle (PLC) typically occurs later in a NASA engineer or scientist's career, normally 15 years on average. The usual process is an employee is familiar with basic, small pieces of work associated with a much larger project or program where management asks for progress, the progress is reported-up the chain by management, and feedback is reported back to the employee. In an attempt to make this process more transparent and increase the speed of knowledge transfer, the Engineering Directorate created a series of four classes to teach less experienced employees about the Project Life Cycle and associated nuances not otherwise captured in traditional training. This series of classes was the beginning of multiple future classes in which the same training method will be used with growing steps of technical complexity, touching multiple disciplines; much like completing a course of study at a university. It is referred to as Engineering Directorate University (EDU). In this intervention, novel training approaches were used such as: senior leaders sharing personal insights into how they have been successful, a forum where discussion was encouraged among the group, the use of a leadership panel where participants could ask questions to seniors leaders not otherwise available to them, and tools and resources available but not often known to most employees.

This Engineering Directorate, in-house curriculum took place over five weeks during March and April of 2014. It consisted of four sessions broken-down by phases of the PLC as supported by: the roles and responsibilities of the Engineering Directorate as an organization, department and laboratory contributions along with integration and using

relevant NASA examples including processes and procedures utilized to execute the operation. Some of the concepts introduced attempted to answer questions such as: what does successfully executing a project from start to finish require, who is involved, what are the critical pieces, how do organizations integrate, what is needed to execute each phase, and where answers can be found to questions. It gave participants an “up and out” view of how work is done. It also afforded time and thought around what employees know, what they do not know, and what they might need to know in order to be successful and grow professionally. The curriculum was developed by NASA managers, taught by NASA technical and project experts and facilitated by me. The number of employees who attended these sessions was targeted to be 28, though only 26 participants completed the series. The attendees had five years or less experience at Marshall Space Flight Center and were selected among approximately 1,400 engineers from a variety of departments and laboratories across engineering. I chose this series of classes to apply my intervention because of the group’s diversity and its potential to receive knowledge not otherwise available to less experienced employees.

Using this intervention, which included opportunities for crucial conversations with more experienced employees, I created and utilized two tools to measure the impact of knowledge transfer. Questions addressed by the tools included: can this type of training help employees determine where their products fit into the overall work being done at the Center, can they apply this knowledge to better understand their work, are they thinking about what their career choices may be, and how can they get from where they are to where they want to be? These tools included a Self-Rating Survey (SRS) and a Portfolio.

The Self-Rating Survey/Questionnaires, were administered electronically pre and post intervention to gather information related to: the roles and responsibilities of the organizations tied to the work of the Center as well as the employee's own personal roles and responsibilities, understanding who to ask for assistance along with comfort level in asking, defining a successful product and ability to apply information gained in the intervention to career-pathing and growth. It served to initiate the self-reflection process, which should have continued throughout all of the sessions (Appendix A).

The Portfolio was completed post intervention by the participants. Its purpose was to capture knowledge gained and an employee's ability to apply the knowledge. It consisted of nine application questions aligned with the goals of the training. It measured: participants' understanding of where products and services fit in relation to their work, the impact of the training on understanding customer need and products delivered, ability to apply concepts to career development growth and application and a participant's motivation to use processes in place to assist them in developing their career (Appendix B).

One-on-one interviews consisted of three questions and were administered by me. These interviews were conducted with a randomly selected sub-group of 13 of the 26 training participants. The interviews served as an opportunity to ask questions about assumptions drawn from the SRS and the Portfolio tools. Another goal of the interviews was to give employees opportunities to seek-out more information related to what processes are essential in the Project Life Cycle, related key roles, and how can this information help them steer career development. The target questions helped motivate employees to ask questions about roles they may be interested in assuming. These

questions were utilized post treatment and after initial data analysis.

The end goal of creating these two instruments, as well as interviews, was to assist the employee in self-reflection to determine if what they learned in EDU can be tied to: applying this knowledge to their work, self-reflection and steering career development (Table 1).

Table 1
Data Triangulation Matrix

Focus Questions	Data Source 1	Data Source 2	Data Source 3	Data Source 4
<i>Primary Question:</i>				
1. In what ways will a novel approach to knowledge transfer assist less experienced employees in applying this knowledge to their work?	Employee Portfolio	Employee Self-Rating Survey/ Questionnaire	Interview Questions/ Interaction and observations during class and in one-on-one interviews	Literary Review
<i>Secondary Questions:</i>				
1. In what ways can novel approaches to knowledge transfer impact an employee's ability to self-reflect?	Employee Portfolio	Employee Self-Rating Survey/ Questionnaire	Interview Questions/ Interaction with Peers and Mentors	Literary Review
2. How can knowledge gathered by these experiences help guide employees in steering their own development?		Employee Self-Rating Survey/ Questionnaire	Interview Questions/ Interaction with Peers and Mentors	Literary Review

DATA ANALYSIS

The data collection and measurement focused on knowledge traditionally gained over long periods of time through hands-on experiences, successes and failures. Analysis of the data included the use of two instruments, interviews, comments and questions

among 26 less experienced employees who were taught by 33 managers with numerous years of experience. Both instruments used a Likert Scale. For data analysis purposes for both instruments, responses of “almost always”, “always”, “agree” or “strongly agree” were considered a positive response, responses of “rarely”, “never”, “disagree” or “strongly disagree” were considered negative and “sometimes” or “neutral” were considered neutral responses. The data was collected from four training sessions spread across six weeks in both written and oral forms. Nineteen of 26 participants elected to provide feedback through the use of the SRS and the Portfolio instrument ($N=19$).

Impact of Intervention on Expertise Transfer

Using this method of analysis, evidence showed this type of training can effectively transfer expertise gained from years of practice and assist employees in applying it to the work scientists and engineers do. Data provided by the SRS from employees who participated in the EDU training showed increased knowledge and ability to apply the content to their work in two areas: how their organization and products integrate into MSFC’s engineering projects (Q1-3, Q8) and ways to meet customer needs (Q10, Q15).

The greatest awareness shift in participant knowledge occurred around their understanding of where and how their organization and/or products fit into the project they support. The SRS showed a positive shift in this knowledge, with the category of “always” jumping from 13% (pre-EDU) to 40% (post-EDU) (Figure 1). The Portfolio instrument supported this finding by showing an 84% positive response from participants in understanding where and how products fit into their project. In addition, follow-up interviews showed that once employees better understood roles and responsibilities, as

well as working relationships, they began to connect pieces related to their complex, organizational structured environments. For example, this was evidenced in a statement made by a participant, “It (EDU training) has begun to answer many black holes in my mind about how things work at the Center and the Agency in general.”

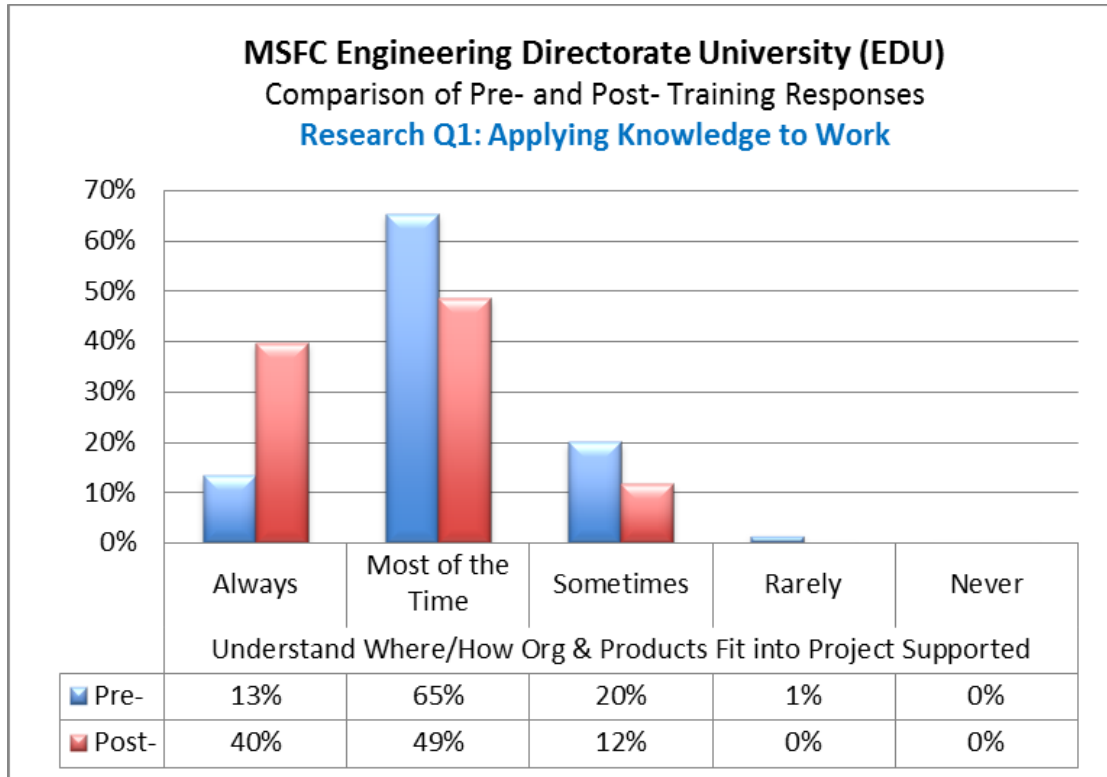


Figure 1. Understand Where/How Orgs & Products Fit Into Project Supported, (N=19).

The instruments also revealed a large positive shift in the ability of employees to identify and understand ways to meet customer needs. In this category, the SRS data showed that student responses of “always” shifted from 18% (pre-EDU survey) to 37% after completing EDU (Figure 2). The Portfolio instrument confirmed this shift with an 80% positive response from employees in better understanding this category (Q4). However, student interviews revealed individual sessions of EDU may or may not help; it depends on the specific work being performed. In other words, different kinds of work

require different kinds of details in order to apply it to their customer needs. In complex organizations there may be thousands of details that can be transferred, some of them applicable to one person but not another. For example, one student expressed a high interest in the second session claiming it was very beneficial to her understanding of her customer and wanted to know more. She explained this by stating, “For Pre-Phase A and Phase A, the Advanced Concepts Office needs more time to present the information.” But within the same session another stated, “Next time you might avoid some highly detailed aspects of the Advanced Concepts Office.” Revealing this particular employee felt the information was too much. Overall, evidence suggests that as a whole EDU hit its target of increasing identification and understanding of customer need, though more investigation may need to be done in the area of the advantages of one-on-one individual knowledge transfer verses large group.

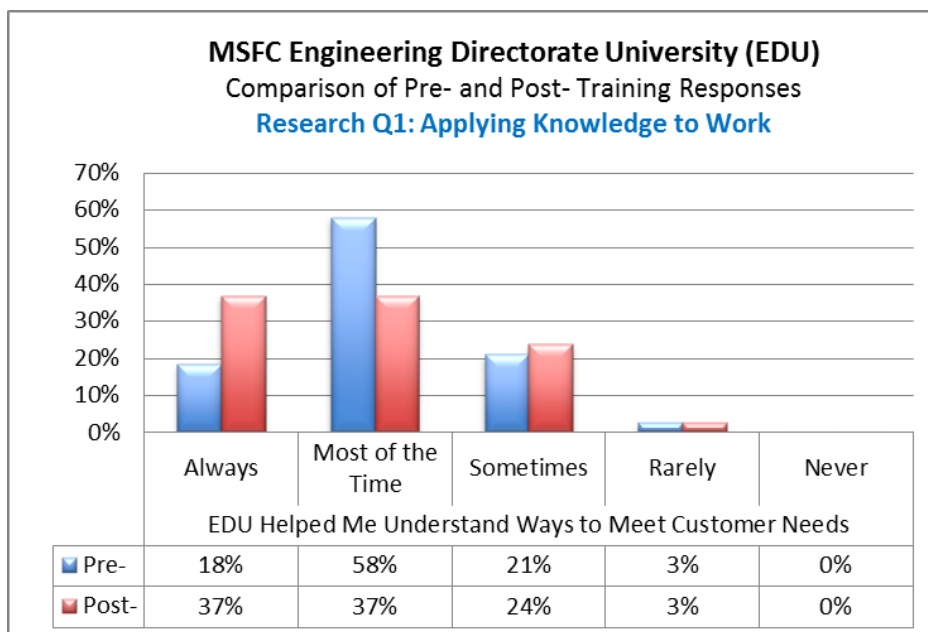


Figure 2. Understanding Customer Needs, (N=19).

Though the SRS data (Q9, Q11) showed only a slight positive shift in the category of “always” related to an employee’s ability to improve products/services (Figure 3), the Portfolio instrument (Q1) showed that employees do understand how to improve their products and services as reflected in a 90% positive response for that question. Given this data discrepancy, this area of employee knowledge warrants investigation and additional data to clarify if any real shift in knowledge resulted from participating in the EDU training program.

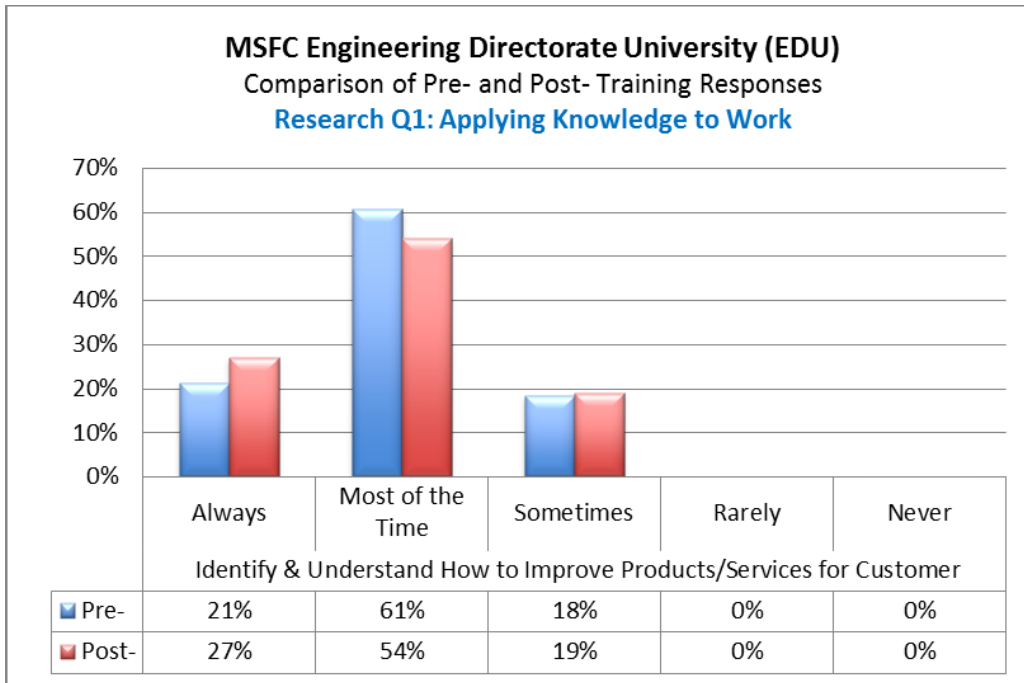


Figure 3. Identifying & Understanding How to Improve Products/Services, (N=19).

Impact of EDU Training on Employee Self-Reflection and Career Decision Making

Novel approaches to training, shown through the use of EDU, also impact an employee’s ability to self-reflect and modify approaches to decisions regarding their career. Data from the SRS evidenced only a slight positive shift in an employee’s ability to self-reflect and take action (Q10-13, Q15) (Figure 4). However, data from the Portfolio (Q5-6) suggested this type of training enhanced the participants’ ability to think critically

and seek improvements needed in their products, services and skillsets. This data indicated that 95%-100% of participants made gains in these two areas as a result of EDU. In almost every interview, participants indicated that EDU had enhanced their knowledge of what they could or might do in approaching career decisions. Evidence is found in post EDU student interviews and feedback form comments. Two different students stated: “Learning about Technology Readiness Levels and different funding avenues, gave me the guidance needed to know where to put my efforts and the best way to go about finding the funding.” and “Knowing what you face and what others have done, helps you plan and increases your likelihood of being successful.” Overall, evidence shows EDU training impacted self-reflection in a positive way and assisted participants with work decisions. In order to discover the discrepancies between the two instruments’ data more research could be done.

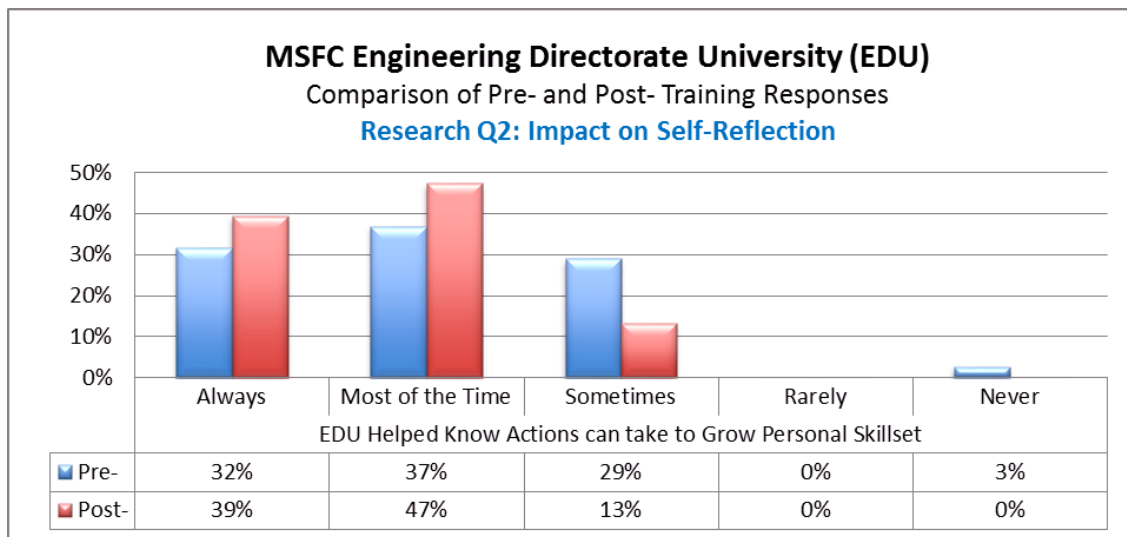


Figure 4. Impact on Self-Reflection, (N=19).

According to SRS data, there was a positive shift from 42% (pre-EDU) to 79% (post-EDU) in knowledge of personal development resources. Yet, there was a much

smaller positive shift in employee motivation (63%-74%) to take initiative and assert self-directed development (Q6, Q7, Q14, Q16). The Portfolio data highlights the difference between gaining or having knowledge verses applying it for personal career planning and growth. In response to two questions (Q3, Q7) in the Portfolio, 94% of EDU participants stated that they understood the critical relationship between their knowledge level and career goals while a whole 100% stated that they knew what tools were available to self-direct their personal development. However, when asked about their motivation or follow-through actions in using this knowledge (Q8-9), the data showed that only 47% of employees discuss career goals with a supervisor and/or mentor and only 32% of employees maintain an updated Individual Development Plan (IDP). This data indicates that employees can use training opportunities, such as EDU, to steer their development but brings to question will they.

INTERPRETATION AND CONCLUSION

Evidence from this study shows the use SRS and Portfolios can be used to determine how well a learning model can measure the understanding of work to be performed and to some extent steer career development. And, if an effective self-assessment tool is used, it can help Human Resources better understand where and when learning bridges are formed and where gaps still exist, also evidenced in a study performed by Straka & Schaefer (2002). Moreover, this research, as well as a study conducted by Gordon & Wong (2011) shows these types of experiences can also increase an employee's reflective thinking, building of career goals and seeking opportunities not otherwise known to exist.

Surprisingly, a variety of opportunities within various work areas are often

available for employees to explore throughout their career – especially in a complex engineering workplace such as MSFC. When more experienced employees transfer their knowledge to less experienced employees, it can help broaden knowledge related to career development choices. Evidence in this research shows these experiences can help employees move to areas of work that align more closely with their strengths and interests. However, actions toward aligning work with professional growth may be very different among employees. For example, three EDU participants were so excited about the work being done in other departments, they actually had discussions with management and moved to those departments; better aligning their career goals and interests. Others may take different approaches, or no approach at all, in their initiative. Evidence from the SRS and Portfolio indicated most EDU participants need to take more initiative in their development. For NASA and other professions, traditionally this includes the use of Individual Development Plans and conversations with peers and supervisors. Both these methods have been shown to work successfully in career and professional development (Tillema, 1998).

So, why do employees not pursue these conversations and create thoughtful development plans? Studies show employees do not use development plans because they find them too time consuming and not useful for short term goals (Smith & Harm 2001). This perception can be a limiting factor for employees. For example evidence shows, the lack of creating an Individual Development Plan where there is limited supervisor engagement can adversely impact an employee's development (Beausaert & Segers, 2011). Because this is critical to employee growth as well as sustainment of corporate knowledge, this is an area that should be further researched by Human Resources in order

to encourage engagement of these types of conversations among employees.

A positive impact of having conversations and engagement can be found in one of the most interesting findings in this research, which was non-intentional. Studies show age and experience tend to influence individual engagement in personal development. Generally, more experienced or older workers tend to be less engaged and are offered limited opportunities to learn and develop at work, with fewer opportunities for these workers to capitalize on their competence (Tones, Pillary, & Kelly, 2010). However, because EDU utilized senior employees to teach the sessions with the intention of transferring knowledge learned over years of experience, these more experienced employees actually developed in new areas themselves. They invested hours of time in preparing for their sessions and working closely with each other so as to create meaningful content without redundancy. They engaged in conversations and answered questions about their work. So, coincidentally, EDU became a developmental opportunity for them as well. Moreover, many instructors discussed with me their excitement about questions the younger workers asked, alluding to their amazement of the ability of less experienced workers to critically correlate EDU content to their own work. These instructors came to understand the younger generation is extremely engaged and capable of applying concepts through social exchanges, such as EDU.

VALUE

This Capstone Project has influenced my own professional growth in multiple ways, two of which are quite substantial. First, I learned how to implement self-reflection in my own career development as an outcome of making it a goal for the participants of EDU. It has caused me to contemplate areas where I can grow and

additional career paths I might consider. Secondly, I found quantifying goals and how they are related to work are very impactful in: delivering quality instruction, transferring applicable knowledge and supporting Center strategy. At MSFC we understand good training is essential to the health of our Center; however, I am not convinced we always take the time to reflect upon and quantify training requests connected to the workforce as a whole and how that relates to Center strategy. Because of this project, I have learned how to develop meaningful goals for training requests, create self-developed tools for measuring the goals and make connections between multiple data points in analyzing outcomes. This means, future applications of what I have learned can be very impactful to final outcomes of employee training and development. Ultimately, these improvements are not only professionally self-serving but also benefit taxpayers in delivering a higher return on investment.

Additionally, there were several notes of interest uncovered in this Capstone. One was discovering a large skill gap among senior leaders in efficiently teaching what they know to other employees, at least in large group settings. Because work at NASA is most often communicated through power point presentations and regular meetings, most of the presenters in EDU created long, extensive power point presentations. Research for this project supported the idea of conversations and dialogue with participants as the most impactful way to transfer experienced knowledge. This method was also validated by my experience as a former educator that told me instinctively more dialogue and less presentation would be most effective. However, when I had conversations about expectations for EDU with presenters they agreed they would present informally but when they presented, most of them, brought slides and read through them. One exception

was a leader who actually brought hardware to pass around and talked about the work they were performing with each piece. His discussion included what worked, why and how. He received the highest ratings on the feedback forms and the most questions from the participants. If we continue to create and host in-house, knowledge transfer training, it appears we need to better equip our more experienced employees on how to most effectively prepare and deliver what they have to say.

Another amazing discovery was how engaged participants became when they were told their feedback was very important to the delivery of the product. Even though only 19 out of 26 participants chose to give feedback those nineteen gave extensive, thorough details on what worked best and how they would apply the information. They took the time to include their perspective and inputs on the back of the data instruments and when answering questions during the interviews. Just as my research suggested, apparently one of the most engaging things you can do when implementing this type of employee training is to make sure the participants understand the goal is to ultimately serve their development. It should be emphasized that if they find something not valuable they should communicate that so it can be changed. Likewise, if something adds value they should be encouraged to communicate that as well, in order to keep and build upon what works.

Overall, the benefits to having done this project are almost too many to list. In addition to what I have learned during this particular study, I have utilized numerous tools and methods cultivated in this Capstone project. For example, I implemented formative assessments with teams learning how to perform new work, learned the value of performing research prior to executing new ideas and generated meaningful, new

solutions related to employee development. This has made me a better training consultant and I have seen this experience lend more credibility to my work, especially in the areas of respect and trust.

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APPENDICES

APPENDIX A
EMPLOYEE SELF SURVEY

Employee Self Survey

Name:

Date:

Please choose the answer that best fits your personal viewpoint for each question.

1. I understand the role of Engineering as an organization at Marshall Space Flight Center.

- Never
- Rarely
- Sometimes
- Most of the Time
- Always

2. I understand if and how my work is linked to other organizations within Engineering.

- Never
- Rarely
- Sometimes
- Most of the Time
- Always

3. I understand the role of Engineering in supporting the projects at the Center.

- Never
- Rarely
- Sometimes
- Most of the Time
- Always

4. I feel confident explaining to someone else my role in the project(s) I support.

- Never
- Rarely
- Sometimes
- Most of the Time

Always

5. I feel confident creating a technical memo on the work I perform.

- Never
 Rarely
 Sometimes
 Most of the Time
 Always

6. I know who the experts are at Marshall Space Flight Center related to the work I do.

- Never
 Rarely
 Sometimes
 Most of the Time
 Always

7. I feel comfortable asking for help or seeking advice on the work I perform.

- Never
 Rarely
 Sometimes
 Most of the Time
 Always

8. I understand how my works fits into the project(s) I support

- Never
 Rarely
 Sometimes
 Most of the Time
 Always

9. I understand what products I am to deliver.

- Never
 Rarely
 Sometimes
 Most of the Time

Always

10. I understand when my products are due.

Never

Rarely

Sometimes

Most of the Time

Always

11. I understand what a successful product looks like.

Never

Rarely

Sometimes

Most of the Time

Always

12. When I run into difficulty understanding or completing my duties, I seek assistance.

Never

Rarely

Sometimes

Most of the Time

Always

13. I understand the areas where I need to grow related to my future career goals.

Never

Rarely

Sometimes

Most of the Time

Always

14. I take action to improve in the areas where I need to grow

Never

Rarely

Sometimes

Most of the Time

Always

15. I understand the level of effort needed in order to do my job thoroughly as defined by the project.

Never

Rarely

Sometimes

Most of the Time

Always

16. I know where to find previous lessons learned that relate to the work I do.

Never

Rarely

Sometimes

Most of the Time

Always

*Participation in this evaluation is designed to enhance your ability to self-reflect in order to better develop and strengthen your career goals. It is strictly voluntary.

APPENDIX B

PORTFOLIO

WORK ASSOCIATIONS TIED TO PRODUCTS

Work Associations Tied to Your Products



Think about the above associations and complete the following questions:

1. In considering the relationships above, I understand how to improve my products and services for my customer(s).

- Strongly Disagree
 Disagree
 Neutral
 Agree
 Strongly Agree

2. In considering the relationships above, I understand where my product(s) fit for the project(s) I support.

- Strongly Disagree
 Disagree
 Neutral
 Agree
 Strongly Agree

3. Understanding the relationships above are critical to identifying my career goals.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

4. Recent learning experiences have equipped me to better understand ways to meet customer needs.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

5. Recent learning experiences have increased my understanding of my peers' roles and responsibilities related to my product(s).

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

6. Recent learning experiences have helped me better understand actions I can take to grow my skills.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

7. I am aware of multiple tools available for my use to help self-direct my development.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

8. I have discussed these ideas and my career goals with my supervisor or mentor within the last 6 months.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

9. I have an updated Individual Development Plan that accurately reflects my career goals

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

*Participation in this assessment is designed to enhance your ability to self-reflect in order to better develop and strengthen your career goals. It is strictly voluntary and may be used to assess the usefulness of this training tool and/or need for improvement, and/or for further research and assessment at the highest levels.