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The Blaeser Training Taxonomy

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A Dissertation

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Abstract

This research was undertaken to determine the efficacy of using andragogy, assessment, and quality control for training in a modern industrial workplace, with findings indicating that these modern training techniques can be implemented with success in this context. While andragogy, pioneered by Knowles, has been used in many areas of adult education, it has not been found to be commonly used in the industrial workplace. The study focused on Finnish trainers using the Blaeser Training Taxonomy – a training program utilizing elements of andragogy and assessment wrapped into quality control. Using a mixed methods questionnaire, trainers reported their training results, which indicated the value of the adult training approach rooted in andragogical principles.

Keywords: Andragogy, Assessment, Quality Control, Modern Industrial workplace, Mixed Methodology

Table of Contents

Acknowledgments and Dedications 2

Abstract 5

Chapter One 9

Who will this help? 9

What will this help? 10

The Product 10

The Format 11

Definitions and Conventions 11

Hypotheses 12

Chapter 2 13

Three-legged stool 13

Andragogy Defined 13

A Brief History of Andragogy 15

Examples of Andragogy in Various Industries 19

Assessment 20

Andragogy and Assessment 21

Quality and Training 24

Concluding points: 25

Conclusion 26

Chapter Three 27

Expectations 27

Teaching 31

Instructions 33

Blaeser's Taxonomy of Class Development, Delivery, and Assessment 37

Assessment 39

Assignment Scoring: 39

Bloom's Taxonomy 41

Chapter 4 42

Process 43

Question 1 43

Question 2 45

Question 3. 46

Question 4 48

Question 5 49

Question 6 50

Question 7 52

Question 8 53

Question 9. 54

Question 10 56

Question 11 58

Question 12 58

Question 13 60

Question 14 62

Question 15 64

In Summary 66

Chapter 5 69

Introduction 69

Summary and analysis of the data 71

Assessment 80

Implications for Practice 84

Where could this study go? 85

Conclusion 88

Appendix A 90

Appendix B 91

Appendix C 92

References 94

Chapter One

I am a trainer, a coach, a leader. Often a leader's job is to fix things when they are not quite right. As a training leader, I wanted to make training better in an industrial environment. In this environment, training people how to use their new products, which are full of electric motors, computers, controllers, and software seemed daunting. During my doctorate program, I was introduced to andragogy, or what might be referred to as Adult Learning Theory (ALT). While ALT in some ways is an outline for making training better. Andragogy was like a breath of fresh air for me as it seemed in many ways similar in structure, word choice, and purpose to what I do when I deliver training. While andragogy, in its entirety, is much too broad a topic to take on in this investigation, I wanted to try to introduce a process which uses elements of various parts of andragogy as well as other educational techniques in a codified plan or process, to deliver technical training or seminars in short, three-to-five-day classes for system operators, machinists, and milling machine center programmers. Making industrial process control training better is what I will try to do.

Who will this help?

Trainers need to meet the expectations of the companies for which they are performing training. Industrial control engineers and project managers (PMs) run the companies that are needing training. Engineers require measurable events; PMs require calculable and repeatable procedures, Quality Managers not only require quantifiable but repeatable, proven techniques and processes. This will help trainers deliver a better product — higher quality, properly focused on the curricula as well as the students' needs.

What will this help?

Andragogy, assessment processes, and quality control can make a class, course, or program more successful as these elements have been shown to be a measure of a mature and thought-out educational process. I have been involved with industrial controls, motors, and drives for over thirty years and have attended various training classes that may have had an assessment or attempted some quality, but they never applied all three elements together. This is what I intended to research: A) What is needed to be taught, not from the company's standpoint, but the student's point of view (andragogy); B) How can the training class fit both what the student's (customer) supervisor requires and what the student needs; and C) How can this all happen in a quality-controlled training environment? Learning about andragogy was an especially important and central part of this investigation and my research into the work of Knowles (Knowles, 1984) (Knowles, Holton III, & Swanson, 2015) and Cekada (2010) and the work associated with assessment seemed like they would be excellent to try in a modern industrial environment. Finally, I add the Quality Management System (QMS) manager at an international manufacturing company whom I interviewed with questions about quality and training as well as the renewed focus of a valid QMS. These are the three main parts of this investigation which helped me form the nucleus of my research of what seems to be lacking in the modern industrial automation-focused classroom.

The Product

The projected product of this work is to develop a better method of training. Training in such a way as to not simply use adult learning theory and assessment, but to use andragogy and

assessment in a quality-addressed fashion to make the training package easier to deliver while being more effective. I will evaluate if the value (money spent) on training equates to a higher output, this is known as return on investment. Are the workers making more parts or creating less waste (Campbell & Campbell, 1988)? Research (Campbell & Campbell, 1988) has shown consistently that performance increases when the process of understanding the system is better as well (Campbell & Campbell, 1988). The summarization of my research is in chapter 2 which includes the various articles and books on andragogy, assessment, and my interview of the previously mentioned QMS manager.

The Format

Chapter 2 shows the research performed. Chapter 3 describes what my teammates emulated when delivering a training session. Chapter 4 lists and ranks their responses to a questionnaire. This feedback helped me adjust the contents of chapter 4. Moreover, chapter 5 shows where I think this topic can go, and if this training process can be used elsewhere, to make other training endeavors better.

Definitions and Conventions

Andragogy will be synonymous with adult education. Andragogy has many elements, to investigate and exploring all the elements would be almost impossible and certainly impracticable. As this is a degree of practice, I investigated the element of "need to know / want to know" (Knowles et al., 2015). This helped me stay focused and helped the process to be more precise. "Quality" and "Quality Management System" is as used and defined by the previously

mention, interviewed company, headquartered in Finland, that manufactures industrial automated controlled equipment specifically for the machine shop industry and distributed worldwide.

Hypotheses

There has not been a training situation where elements of andragogy or adult learning theory, assessment, and quality have all come together in one package, this is especially true in the industrial machining industry. Moreover, I suggest that the training process outlined will result in a more complete training session which will be more effective for the student. This hypothesis was tested by my teammates, all in Finland, who used my plan and reported back with their findings.

Chapter 2

Three-legged stool

This chapter will delve into the new subject of andragogy in technical training and investigate how assessment can aid in the learning process. It will begin with an exploration of the development of "adult learning" as an educational concept, as well as a discussion on ways that assessment can gauge the accomplishment of the objectives. Lastly, there will be a short discussion of quality and training. This makes up the three-legged stool: parts of andragogy, assessment, and quality — all in an industrial training environment.

On top of this, the chapter will discuss the advances occurring in andragogy, with a special focus on technology in the industrial and automated classroom. With the advent of new, hand-held technologies, such as mobile phones and tablets, there is an increasing need to consider how these technologically based learning devices fit within successful, accessible andragogy. Innovation and technology have more meaning in today's world than simple gadgets used for amusement. However, this raises the question of whether we should rely so heavily on new technologies in the classroom. For example, Koskinen (2018, p. 22) described the difference between innovation and education:

> Education has always been slow to evolve to meet with the ever-changing landscape of the world and society. Innovations, trends, and technology move at a tremendously fast pace in which education struggles to keep up. In the past few decades, disruptive technologies have infiltrated the higher education classroom space. This has created a new marketplace for colleges and has also created new opportunities for instruction.

Andragogy Defined

Andragogy is defined as: "the method and practice of teaching adult learners; adult education" ("Andragogy," n.d., para. 1). Knowles' theory of andragogy emphasizes that adults

are self-directed and expect to take responsibility for decisions and that adult learning programs must accommodate this fundamental aspect (InstructionalDesign.org; "Andragogy," 2020).

Adult learning and assessment are the cornerstones of a properly led and run training experience (Swanson, 2007). Many companies pride themselves on being leading-edge and technologically forward, though the training delivered to their adult employees did not reflect the same forward-thinking. For example, companies in the machine tool industry that can cut or move an actuator within a few 10,000s of an inch, automate a building, and control thousands of inputs and outputs per nanosecond, should have training deliverables that are as up to date as the products they sell to consumers. Using cutting edge training delivery techniques, the company should be able to match the training deliverables to the vintage of the product, as well as keep the training standards at par with the latest technologies. If the company uses appropriate training techniques, results from the training should be measurable, quantifiable, and repeatable (Knowles, 1984; Campbell & Campbell, 1988; Swanson, 2007; Cekada, 2010; Knowles et al., 2015).

This chapter will examine the literature that deals with how industrial training programs for adult students are designed and offered. Three main topics are explored in the literature: andragogy, assessment, and quality in training. Analyzing the literature based on these themes will provide an overview that ultimately suggests that, at the moment, industrial classrooms and the instruction provided therein are not adequately addressing the needs of the adult learner. This literature review will explore the topics of andragogy and assessment of class objectives and what quality means to the training process and department, to describe how the ingenuity of technology can run parallel with improved instructional practices. This will lead to an improved

system of teaching and learning in the machine tool industry and ultimately to increased revenue, business quality, and customer satisfaction.

Before examining how andragogy can lead to effective improvements in knowledge transmission in quickly evolving industries, it must first be defined. After a brief history of andragogy, it will then be linked with assessment in learning, which will shape the importance of these learning modalities to learn standard industrial practices and machine tool use. Although andragogy is an important aspect of successful adult training practices, to date, little research has been performed on andragogy in the automated machine shop industry. I will first explore the research pertaining to the foundation of the andragogy, and then discuss styles of assessment and quality training that will be applied to automated deliveries and scheduling processes in the industrial machine tool industry training arena.

A Brief History of Andragogy

In the 1970s, Dr. Knowles' noted that andragogy was beginning to take shape when:

> Shortly after the end of World War I, in both the United States and in Europe, a growing body of notions about the unique characteristics of adult learners began emerging. But only in more recent decades have these notions evolved into an integrated framework of adult learning. It is fascinating to trace this evolutionary process in the United States. (Knowles et al., 2015, p. 19)

Throughout the 20th century various educators from Europe and the United States began to recognize and catalog the differences between the needs of juvenile and adult learners and became increasingly aware that different needs require different teaching techniques. Specifically, adult learners generally require a more self-directed focus, which comes from maturity and life experience (Knowles et al., 2015). Prominent social science contributors, such as Sigmund Freud, Carl Jung, Abraham Maslow, and Carl Rogers, supported the movement to

make adult learning a formal concept in education and advocated for the further codification of andragogy. As the mid-1900s approached, professors and other educators started to write papers and books on adult learning. These works provided a running catalog of differences, concepts, and principles rather than a comprehensive, coherent, and integrated theoretical framework. Therefore, they lacked an integrative and differentiating concept for adult learning (Knowles et al., 2015). Knowles is known for allowing the adult student to direct his or her learning. In these cases, the main role of the teacher or trainer is to act as a facilitator to enable the students to lead classes. It is argued that adult students should learn from their own experiences, as this experience should direct the adult learner to the content they wish to learn (Knowles, 1984). Though the adult learner is independent and interest-driven, having a structured and directed outline of learning should still be in place to create a clear pathway to interpret, intercept, and understand the new knowledge being learned. This will not only help the students learn but also lead to improvements in the process itself.

Andragogy is formed "when the educators, psychologists, sociologists, and observers noticed in the earlier part of the 20th century that adults can learn" (Thorndike, 1928, p. 61). This claim was bolstered by Lindeman's *The Meaning of Adult Education*, "… the resource of the highest value in adult education is the learner's experience. If education is life, then life is also education" (Lindeman, 1926, p. 8-9). However, this active learning can only go so far, as the effectiveness of the teaching also depends on the instructor's attention to detail during the training. Which is to say, there must be challenging and rigorous content available.

It was this concept that motivated Knowles to develop the Andrological Model (Knowles et al., 2015, p. 45):

I. The Need to Know
II. The Learners Self Concept

III. The Role of the Learners Experiences
IV. Readiness to Learn
V. Orientation to Learning
VI. Motivation (to Learn)

The science of andragogy continues to develop and expand with the increasing advances in communicative technology. Some scholars have suggested that "technology" could be the: "(1) lone facilitator of learning, (2) Leading to the abolishment of traditional learning hierarchies, and (3) leading to self-directed expertise development and certification. These are radical but not improbable ideas" (Knowles et al., 2015, p. 216). Education will continue to adapt and evolve new teaching styles, making it important to revise and evolve andragogy and its processes in the technology age of learning. Knowles further expanded his construct of andragogy in 1980 by proposing five key assumptions for adult learning:

1. Self-Concept
2. Adult Learner Experience
3. Readiness to Learn
4. Orientation to Learning
5. Motivation to Learn
   ("Andragogy Assumptions and Principles," n.d., para. 3)

These assumptions support and partially overlap with several of Knowles' other codices, such as his Andrological model, which has all these same five assumptions as well as the *need to know* listed as the first assumption (Knowles, 1984, p. 55). This first assumption indicates that adult learners will learn more and be more motivated to learn when they understand what they will gain from their knowledge and how it will improve their lives, making the *learners' self-concept* so valuable (Knowles 1984).

The next assumption is the *adult learner's experience*, which states that adult students want to know they are making a sound decision when choosing an education (Knowles, 1984). The "role of the learners' experiences" (Knowles, 1984) changes the viewpoint of the adult learner. When adults' experiences are devalued or ignored, not only do they assume the experiences are worthless, but they also think that they, as individuals, are worthless. This is because people derive value and self-worth from experiences gathered throughout life (Knowles, 1984). It can also be a positive experience, as after a person has mastered a task or tasks, they may desire more responsibility in the workplace.

This leads to the third assumption, *readiness to learn.* This assumption states that a new task is undertaken only after the learner knows they have mastered a previous one and is ready for new challenges (Knowles, 1984). The fourth assumption is that adult learners are "life-centered in their orientation to learning," where life experiences make up a large part of their learning styles (Knowles, 1984, p. 59). This is quite different from children who are more subject-oriented to learning, where they learn from activities and teaching without needing life experience (Knowles, 1984, p. 59). Lastly, the adult has the *motivation to learn*, which can be both "external (higher pay, a better job, and so forth) and internal (self-esteem, quality of life)" (Knowles, 1984, p. 61). Knowles' assumptions of adult learners provide a basis for what can be built upon with further examination of assessment and quality.

In 1984, Knowles wrote four principles of andragogy to help the adult educator build a learning experience tailored to the adult learner:

1. Adults need to be involved in the planning and evaluation of their instruction.
2. Experience (including mistakes) provides the basis for the learning activities.
3. Adults are most interested in learning subjects that have immediate relevance and impact on their job or personal life.
4. Adult learning is problem-centered rather than content-oriented.

("Andragogy Assumptions and Principles," n.d., p. 2)

There is a clear difference between teaching children and teaching adults. Children, for example, do not have as many life experiences to draw upon during lessons. Therefore, children generally learn better in a classical classroom environment, while adults have life experience and expectations of what they want to learn, and specific ideas in mind. This leads to the andrological premise of "need to know" as one of the main foci in this dissertation. Koskinen (2018) offers another view of the structure of andragogy:

> The creator of andragogy, Knowles, argued that adults learn differently. This work constitutes the creation of adult learning theory.
> Knowles' theory of andragogy is based on two concepts:
> - Adult learners are self-directed, and
> - The teacher is a facilitator rather than a presenter of content.
>
> Knowles (1984) also labeled four main principles of adult learning:
> 1. Adults should be involved in the planning of their learning.
> 2. Adult experience provides a basis for learning.
> 3. Adults are most interested when the content is related to their life.
> 4. Adult learning is focused on problem-solving rather than content. (p. 31)

This shows consistency in the definition of andragogy, heralded by Knowles originally in the 1970s and then codified by himself and others in many publications thereafter. The main andrological principle that will be explored in this work was developed and promoted by Knowles et al. (2015) who delineated six main principles of adult learning:

> … new perspectives on andragogy that have emerged from research and theory in a variety of disciplines. The chapter is organized by the core andrological principles and examines new thinking that refines and elaborates on each principle. These core principles are (1) the learners need to know, (2) self-directed learning (SDL), (3) prior experience of the learner, (4) readiness to learn, (5) orientation to learning and problem solving, and (6) motivation to learn. (p. 169)

Examples of Andragogy in Various Industries

When an educator uses andragogy in the classroom, this allows the student to experience many resources of knowledge and insight (Knowles, 2015). Andragogy can also exist outside of the classroom. For example, in the tourism industry, tour guides are taught to ascertain if their

clients (tourists) are only visiting the area or if they are instead trying to find their ancestral homes (Martain & Woodside, 2009). When the tour guide ascertains the motive, the guide can make a much richer experience. Another example is evident in the construction industry, which shows some use of andragogy in its training design by showing that when various other tradesmen were retrained, they then become better and longer-tenured employees (Sparks et al., 2009). In this instance, the trainers were able to employ andragogy to see if students who were trained in related topics became better employees.

Whether andragogy was specifically considered or not, there are many examples of andragogy-like instruction, in many different industries, that can be analyzed. The benefits of which I propose can be applied to the modern, industrial, automated machine shop industry where, to my knowledge, andragogy has not yet been used.

Assessment

When a task is finished, there needs to be a way to determine if it was done correctly. Professionals can self-assess, but students must be graded according to a standard or some sort of guide. As such, assessments can take many forms. An assessment can be as simple as asking, "Was the task completed? Select Yes /No," but since this does not provide much information, other questions may also be needed, such as: What else must be measured? Was the task done promptly? What are the conditions of an acceptable "done task"?

Are we assessing the work performed after training or are we assessing the training itself (Campbell & Campbell, 1988)? While the purpose of training is to educate, the purpose of a training assessment is to determine what needs to be taught (Cekada, 2010). Bringing this back to the subject of andragogy and the idea that adults learn based on their interests, one can see

how proper assessment can strengthen the style of teaching for adult learners. Knowles noted, “when adults undertake to learn something on their own, they will invest considerable energy in probing into the benefits they will gain from learning it and the negative consequences of not learning it” (Knowles et al., 2015, p. 43).

When evaluating a completed task, some researchers believe specific steps should be followed. This has been called “Training for Specific Skills or Knowledge” (Campbell & Campbell, 1988, p. 184). These systems of evaluation focus on management development or skills training, among other topics (Campbell & Campbell, 1988). In this way, one can map out the required steps to complete a task, as analysis will allow the educators to understand and make the best possible presentation of the educational material.

Various training assessments are currently used in classrooms. For example, assessment can be undertaken via evaluation forms (see Appendix B). Such a form is distributed to students to efficiently evaluate the quality of the training received, the course presentation by the instructor, and the accessibility of the course objectives. This style of form typifies those currently used when evaluating a class or educational experience ("Evaluation Templates," 2020, p. 1).

Andragogy and Assessment

Modern industrial control processes have a feedback loop included to monitor the quality of the objects brings created. This feedback loop monitors the process to ensure that the target position, speed, or temperature, among other measurable phenomena, are reached. For example, a thermostat monitors the temperature of the room, while the speed of a car is monitored and maintained by the accelerator and the driver. This is equivalent to a servo loop process, which

has three signals, “Command,” “Error,” and “Feedback.” Notice in the drawing presented in Figure C2 (Appendix C), the output can be anything, including an electric motor, a heating system, or a positioner. This is a definition of feedback in the industrial control world which is measurable and assists the device in knowing what is happening and at what stage the process is in. In the industrial training world, a “servo loop” should be required to let educators know if they are hitting the mark. With this in mind, one must inquire if introducing assessments to the learning environment would be useful.

In the military, especially while training, there is as a matter of policy that requires an after-action review (AAR) in which all personnel attend and discuss the various topics related to the most recent training event. As educators, one can evaluate the AAR format and replicate it for learners. The AAR provides leaders and troops an opportunity to discuss the training event. Everyone is encouraged to speak, as all comments are respected and properly discussed between troops and leaders alike. The sense of respect is important in this format, as it opens space for questions to be answered and further discussed. See Appendix C (Figure C3), to see how the objective, the reality of what was learned, the goals, and how the learning or mission was attempted (experiment).

The AAR offers a form of feedback, which allows the trainer(s) to make corrections in content, delivery, and execution. The United States Army follows this outline:

- What did we set out to do?
- What really happened?
- Why did it happen?
- What are we going to do next time? (Gavin, 2000, p. 106)

There are many reasons why such an assessment is helpful, and it can be used after training or running simple tasks that may be mundane (Gavin, 2000). One key element of the assessment is that no task is too intricate nor too simple to be formally assessed, such as the

United States Army's tradition of training to a time standard as estimated by TRADOC ("TRADOC," 2020). The military is now moving past training to a strict time standard, "This iteration should take 2.3 hours…" as it is possible to learn as much without it taking as long, though learning may take longer for some individuals. The first two points of the AAR assessment has a specific amount of time allocated to them. These questions are, "What did we set out to do?" and "What happened?" "According to Army guidelines, roughly 25% of the time should be devoted to the first two questions, 25% to the third, and 50% to the fourth" (Gavin, 2000, p. 106). This AAR process started in the 1970s when larger units, brigades, and regiments, would train at the National Training Center (NTC) (Gagne', 1962). This process has been used as recently as the Iraq and Afghanistan wars where the soldiers, airmen, and U.S. Marines would discuss the recent movement to contact and what went well, what did not, and what to do next time (Gavin, 2000). For example, an officer will lead the larger meetings, while the troops are encouraged to direct the discussions. It is suggested that "75% of the time is allocated and must be filled by discussion from the participants" (Gavin, 2000, p. 110). With this regimented practice of assessment, one can point, with needle precision, at an issue and troubleshoot for a resolution, making future education all the clearer and more precise.

The beverage industry also undertakes a version of this assessment as they evaluate the company's performance with an annual review of performance in various phases. These phases are delineated by time, department, line performance, mechanical, electrical maintenance as well as management (Koss, 2000). They use a Master Action Plan, (MAP), and the various elements can assist in writing their goals and record what happens throughout the year (Koss, 2000). In this way, they can collect data throughout multiple production cycles, compare variations, and improve business with each evaluation.

Quality and Training

To determine the importance of quality in training, I interviewed the Quality Management Service (QMS) manager at a large international company. In the following summary, "quality" is defined as a repeatable and adequate delivery of training which is verifiable and measurable.

The QMS manager notes that within the company, due to the hiring practice of hiring from all over the word and from different business backgrounds, quality was suffering. Previously there was not a formal training program, so each time a new person was hired they brought in using a all new process. She stated that there were "as many processes as people." This was the situation which she entered two years ago when she was hired to reorganize and put a quality system in place.

The QMS manager went on to say that quality in training is an agreement to do certain things in a certain way, and employees need to be trained to follow one process in order to continue to a single goal. This is not to say that if a worker has a better process that it should not be considered, but the QMS system should be implemented in order to assess if the newly proposed process meets the quality standards of the system. She feels that the quality program implemented has created a sense of quality for its customers through its systematic method of training. From a more philosophical point of view, although training is not necessary to inspire the employee's need for learning, because of the quality of the training provided, employees seem to be benefitting professionally.

The QMS manager also notes the importance of an employee not being simply trained to push a button, but to understand the why behind the process. She seeks to make sure that each employee comprehends the importance of the process, not to just receive some training.

She views her responsibility as ensuring that there is a clear, simple, and consistent method of working so that the strategies being followed and lived are ensuring the safety of the employees and the success of the company.

In summary, she understands the limitations of the role of a QMS manager but continues to strive to work with department company leaders to ensure that quality measures are in place. She sees that the role of the Trainer is key to the success of the QMS mission, and therefore the success of the company.

Concluding points:

- The training process should be made more regular and predictable
- Training must follow a plan of delivery, so all trainers can be successful
- There is room for individuality of training delivery, as long as all topics (TLOs) are examined
- The training process must be communicated to everyone and with some kind of evaluation to ensure that it is understood
- Training must be more than an attempt to deposit information, but to help the student/customer understand what they are to do

Conclusion

This chapter explored andragogy, its development, and what it means as a theory, along with a discussion of assessment in industrial training areas and professional environments. This metasearch has shown the importance of these styles of adult education and educational construction. This can be agreed upon, because different places have been identified, from the military to construction, and even the tourism industry, where andragogy was used as a teaching technique. The assessment was discussed using the example of the military's AAR process. Also, assessment as a tool to improve training based on feedback information gleaned from tests and questionnaires or projects was explained using the servo loop theory.

Based on this literature review, it is clear that the modern industrial machine shop has been left behind in this regard, as there is no central resource for training in this particular industry. The machine industry is an essential global business that has been left with a gap where fruitful education could be harnessed and strengthened to lead to a more successful business structure. This is a major issue because various companies are providing extremely high-speed process machines but are not taking advantage of these modern systems of education.

In the next chapter, I will explain why modern industrial businesses must take advantage of modern learning systems to stay competitive and successful in an evolving society where adult learners are striving to effectively communicate and understand their learning process. A focus on andragogy and assessment is where the modern automated machining industry should focus to deliver training that is as impressive as the systems they market.

Chapter Three

The process of learning how to be a better trainer can be a humbling one. We all have egos and throughout my career, I have found that all trainers, like all software and controls engineers, are *artists*, because they all know the best way to do the task. As a trainer myself, I base the ways that I train on the best practices reported in the current literature of andragogy and assessment, as well as my 30 years of training-delivery experience.

This chapter's purpose is to codify my process of training. This process will be shared with my teammates, and I will ask them to perform these tasks and gather feedback from them and their students. The process is thought out and deliberate and is based on experience mixed with current adult learning theory. Primarily, Knowles proffers the theory of andragogy, along with Swanson and a few others. Knowles and Swanson both have said training should not take too long (Swanson, 2007) (Knowles et al., 2015). The classes and training segments should not be too long, but long enough to get the message across. The training process and presentation must be organized for two different groups of people — the students or learners present and the trainer delivering the material. The students need a scheme or process so that they can follow the presentation.

Expectations

My expectations for the trainers who read this entire thesis are to understand and question what is presented, as well as compare and contrast what I do during the training with what they do in the classroom or shop floor. When finished, the training team should exhibit a higher understanding of adult learning theory and the need for training assessment, in some form. As

such, this thesis could be a Standard Operating Procedure (SOP) required in many different industries.

A complete and objective assessment of my teammates' efforts should include but are not limited to, their assessment of the training work, their students' assessments, and all comments from the students and my teammates. This assessment must go beyond "what I liked / didn't like," and instead, it should assess effectiveness and adaptability and maybe a bit of cognitive dissonance or even disruption in the process they are currently employing. All this information will assist in making a better training manual. Furthermore, as technology increases in speed and scope, so too should the training technology. *Technology* in the training and education arena does not necessarily mean computers, but process and thinking. The evolution of processing and thinking must move beyond the "we don't do it like that here," as tradition or comfort cannot be a reason for using the old ways. As the system changes, we need to change how the operation and maintenance of these systems are presented and taught. This is described by Christensen et al. (2017):

> This change in the direction of causality occurs in every successful organization, When the task simply to improve individual components (trained workers), the organizational structure facilitates these improvements, but when the company's product needs to be fundamentally reconfigured to escape the trap described above, the organization's structure itself must be reconfigured to facilitate new patterns of groups working together (Christensen et al., 2017, p. 212).

However, because something is new and different does not mean it will work for everyone in every situation. The purpose of this chapter is to see if the techniques I use can be used by the whole team. If the whole team can use my techniques, this will move us closer to a more uniform approach, higher quality of training, and a more easily regulated product, which in our case is training-class delivery.

Class expectations are related to terminal learning objectives (TLOs), which are the main points of the current block of learning, the takeaway, and the point of the lesson. The learning objectives are listed first, this helps the student see the target and know where they are going. This is especially important — how can you get anywhere if you do not know where you are going? The TLOs, along with the Rubrics, must be shown upfront and clearly understood by all. This can be expressed easily — *Here is your target, this is how I know you hit the target.*

Examples of well thought out learning objectives must include both an action verb and a performance standard. The action verb shows clear measures of "mastery of demonstrable learning outcomes" (*Writing Successful Learning Objectives*, n.d., para. 3). An example of a well-written learning object is: "By the end of this class, students will be able to demonstrate the dynamic route process of part making and demonstrate the same with or without their manual" (*Writing Successful Learning Objectives*, n.d.). As there are multiple TLOs, there should be many supporting parts to the rubric. The adult student approaches learning as an exercise in problem-solving, or "what do I need to know to get my job done" and they are unlikely to learn until they are ready to learn and are motivated to learn. Rubrics are an important list of standards, used to assess a student's performance (Bolton, 2006). Rubrics should look like the following (Bolton, 2006, p. 5):

Configure System, traditional NC programmers job			
Configure the system to prepare an order to be delivered to the Control Panel			
	Proficient *25 Points*	**Emerging** *19 Points*	**Beginning** *13 Points*
Step one- In 'Master Data' Add a fixture	Is done without the manual and correctly chooses the fixture for this job	Finds the Master Data in the Data Manager	Finds the Data manager
Step two- Import or choose the NC program for this job	Succesfully imports or selecets the corrct NC Program for the job at hand	Finds NC Programs, can not select the correct program but can see where it should go	Cannot find the porgram to import or select,cannot find the Import area in the data manager
Step three- Create Part Master Data	Complete task successfully and has all the operations filled out correctly	Completed the task but did not have all the opeartions filled out correctly	Could not find where to put the data.
Create a Production Order	Correctly Chosen the Order number, defined the start and due dates, order status, quantity and hit save	Forgot one of the following items "Correctly Chosen the Order number, defined the start and due dates, order status, quantity and hit save"	Forgot more than one of the following items "Correctly Chosen the Order number, defined the start and due dates, order status, quantity and hit save"

(*QuickRubric*, 2020, Table Configure System)

Ensuring the rubric follows and enforces the learning objective is critical, this adds the burden of needing to write well thought-out learning objectives and professionally written rubrics (Bolton, 2006). In the industrial environment, the work is generally task related. The power of industrial controls, Programmable Logic Controllers (PLCs), and microprocessor controlled motor variable frequency drives (VFDs), and artificial intelligence (AI) all are known on the modern industrial shop floor. In short, the rubrics and TLOs must be simple, precise, and complementary — "*this is what is taught, this is how I know you can do the tasks*." Rubrics must contain criteria and standards expected by the trainer. "Adult learners, which is all we teach, have a great appreciation for a well-defined rubric because they reduce uncertainty, there is a link between topic TLO and Rubric and expectations" (Bolton, 2006). Rubrics set the standard by which you, the trainer will easily gauge success or failure and are generally presented in a grid format.

Teaching

The main goal of teaching and training in industrial environments is to ensure proper operation of the equipment. As such, it is best to allow the students to engage directly in the activities and learn through experience. The computer-controlled equipment needs a skilled operator, and it is the trainer's job to transfer the knowledge of "how to…" and allow the student and the company to reach the increased production from their newly purchased system. Selecting and planning equipment and appropriate training make for a better product (Knowles et al., 2015).

It is also important to ensure that there is an abundance of time to discuss what the students want to learn, which keeps them focused. Practice and exercises must be the bulk of the lab or learning time with the student, and the time spent in a classroom lecture should be as short as possible.

Before the class starts, it is also beneficial to inquire if any students have special requests about a part of the lesson, something they heard, or an activity they are concerned about accomplishing. This shows that the students are concerned and attentive, as well as proves to the students that you care about their learning experience. One of Knowles' main principles of andragogy (Knowles et al., 2015) is learning and exploiting a student's "need to know." The need to know is not an abstract idea, but rather a specific skill, process, or construct that the student wants to know. Understanding what the students need is particularly important because it can indicate the amount of effort required to train your class. For example, if the students do not know what a computer is, they will not understand what it means to "click" on something. If the students in your class have been on the receiving end of six other systems over the last few years, the training class will be a review of the software and maybe a comparison of the systems

as they have progressed over the last few years. This is maybe time to apply the "Situational Leadership Model" (Hersey & Blanchard, 1988), in the following graphic. This graphic shows these scenarios, from the neophyte to the expert, (S1–S4). As trainers, we realize learning is fraught with blunders and students do make mistakes. We also know they may embellish their talents and skills. If they think they are in the S3 or S2 area, and after observation, we determine they are in S1, it is OK, we can always train from the beginning. This process allows us to be flexible and it ensures the student gets what they require when learning the system their company purchased.

(Blanchard, 2009, p. 189)

The areas listed by S1–4 can be briefly described as “orientation or directing stage (S1)” and “dissatisfaction and/or coaching stage (S2)” followed by “integration and supporting stage (S3),” and finally, “Production Stage and delegating (S4)” (Blanchard, 2009). These can be thought of as developmental stages of training intensity and leadership. In the training area, S1 is for the beginners, such as people who applied for a new job and need extra attention and a high degree of detail in the instructions. Next, S2 trainees have some idea of what is expected of them but still need guidance and coaching. They need encouragement to realize they are on the correct path and are going in the right direction. When the student arrives at the S3 distinction, they can integrate thoughts and actions, they have a keener sense of how things work, and can be left alone while the system is running. Once S4 is reached, the student can teach students of lesser abilities, can delegate the process, and can fully integrate the solution to the problem (Blanchard, 2009).

Many different methods of training can be chosen when teaching a class. One such method that I have found to work well is to organize the learning objectives into smaller steps that allow for the easy digestion of the whole system. A system drawing follows the written description.

Instructions

I have adapted a step-by-step process of my training methods and protocols based on Sisson. The individual steps are outlined as follows: (Sisson, 2001).

I. This first step sets expectations. Weeks before class starts, you should contact the customer to inquire about any special ideas or thoughts that they would like you to address. It is best to learn about this ahead of time so that you can research

anything you may not completely understand. This also correlates to Knowles' principle of "need to know." This helps you understand what they need and what type of training style they may need, and this will also help build a professional rapport.

a. If you are given any special requests, include appropriate questions and answers in the training booklet that you will build for them.
b. If you received special questions, include them in your TLOs and rubric. This will help build both your rapport and re-enforces the adult learning theory from Knowles.
c. If there are no special requests, carry on as planned but be open to requests from the students during class.

II. Explain how the class will work. This lays out the ground rules and the expected flow of the class.

a. Clearly explain the topics that you will cover and make it clear that you are open to questions anytime.
b. Hand out the training materials.

III. Explain that most of the class sessions will use the following pattern:

a. Explain the objective and goals — tie this into the TLOs and rubric discussion from the classroom portion.
b. Introduce the subject.
c. Present the required information.
d. Demonstrate the actions, where possible.
e. Practice skills and procedures.

f. Evaluate and coach the students through the processes.

IV. Explain that most of the training will be in the work area.

a. Use the correct terms for the various features as they are explained.

b. This process enforces the standards we hold for ourselves and helps the student know what the various things are called (nomenclature) because we, as trainers, will be calling them by their correct names throughout.

V. Explain to the students that you expect lots of questions and it is OK to make mistakes. It is better to do that now than to do it on the job.

VI. Explain how the students will be evaluated, either at the end of each block of instruction or all at once at the end of the session.

VII. Always and frequently ask if they have questions

VIII. Choose your prepared slide deck for the topic at hand.

a. Write the TLOs from discussions with the customers and lacking this, be sure to refer to the topic points provided from the training team repository.

b. TLOs should be written properly and shown in the classroom before you make your way to the system.

c. The rubric should be shown immediately following the TLOs. The rubric should follow the TLOs in structure and type, this should also be shown and discussed with the students in the classroom. These are two examples of rubrics:

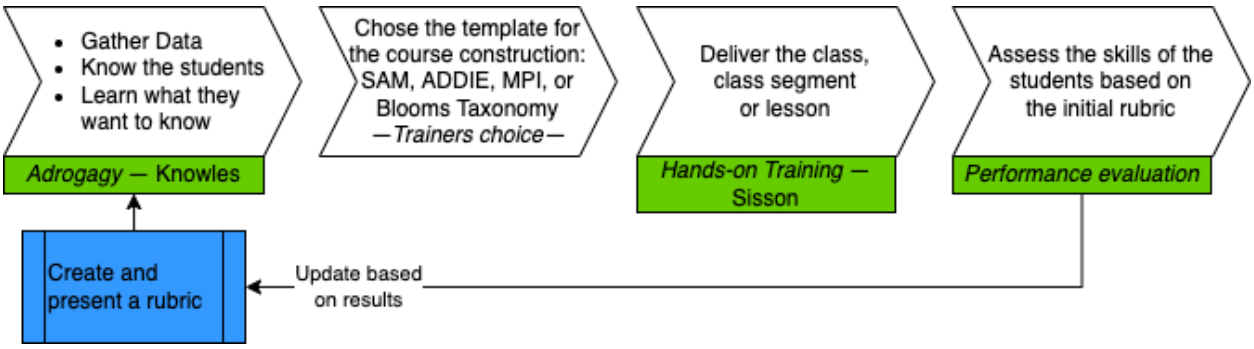
i. With or without your training guide, you will demonstrate the seven steps and make a part by yourself.

ii. *In an emergency (fault) situation, you will successfully move the stacker crane to its next known position using either the Station Commander in the case of an FPC or pendant in the case of an FMS system.*

IX. Show the slide deck, at least the parts germane to the main topics at hand, such as "the seven steps and their sub-steps" (Taxonomy) and other main topics of interest. Remember, this is mostly a hands-on training class, so try to stay out of the conference room as much as possible. Go in the conference room if you need to clear up a point or need to revisit something. It is easier to speak in the conference room as the noise level is much lower.

X. When you and the class are near the system, walk around it and explain the larger parts of the system — the cage, the crane or robot, the pallets, the fixtures, etc. Explain the main purpose of the larger items; for example, "CC1 cabinet does…," "the Station Commander's purpose is…." Always stop for questions and point out the finer points as well. Let the students speak and question. If one of the questions asked previously can be answered now on the shop floor because you happened to be near the focus of the question, make use of the time.

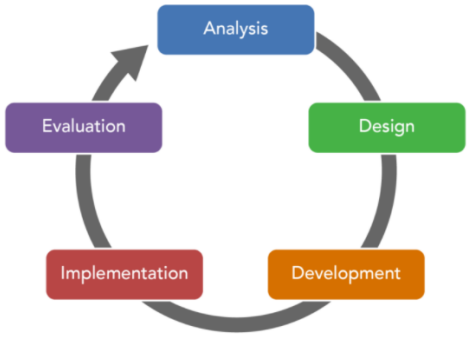
XI. Re-demonstrate the software, show how the system works, then coach each student through the same process. Do this for all students present. Explain to them how and why the various processes are explored. Individually, coach each student and ensure that all students get the same experience.



Blaeser's Taxonomy of Class Development, Delivery, and Assessment

I have created my taxonomy by incorporating a combination of parts of andragogy (Knowles), assessment, and quality control and when expanded and exploited, the class that is delivered is powerful, personal, and effective. The students are engaged and entertained. It is up to the instructor to keep the students' attention. These are not college courses or University lectures; the purpose of this educational work is to impart the knowledge needed to run their new pieces of equipment and answer their questions.

Preparing the presentation is up to the individual instructor. There are different templates or tools one might use, including tasks, conditions, and standards. In this process, a task is identified, rehearsed, and explained and then the students are given tools or information required to perform the task. The task is to be performed in a particular way, sometimes with a time constant or other standard limitation. As an example, the student is given a car with a flat tire with instruction to change the tire in thirty minutes or less. The task is to "change the tire," the condition is "a flat tire, a replacement tire, and the required tools," while the standard is to "complete the task in thirty minutes or less." Another popular template for the presentation of a learning chunk or class is the ADDIE process. See the following figure:



In ADDIE, each letter stands for a part of the lesson or class development. A is for analysis, D is for Design, the next D is for development, the I is for Implementation, and the E is for evaluation. Some training managers treat the A and E as managerial tools and the DDI as parts for the trainers to perform, but this technique is not required.

The last example of a training construction process is SAM (Successive Approximation Model) as follows:

Like ADDIE, SAM has analysis, design, and development, but these happen at a faster pace and the cycle between these three elements never stops. I have seen where "SAM is a cyclical process that includes three iterations: Analyze → Design → Develop. Due to its simplicity, SAM moves easily from prototype to full project" (*Instructional Design Objectives*, 2018). This is such a simple process that the steps can be adjusted on the fly.

Incorporating Bloom's taxonomy (Bloom et al., 1956) into adult learning in the classroom was performed by Dr. Williams of Georgia State University. This study and subsequent exercises show the central values of Dr. Knowles work and Bloom's Taxonomy, and that they are flexible enough to be used where time may be limited or the instructor does not have a high level of expertise yet is still called to train on a secondary topic (Williams, 2017). Assessment and mastery are two takeaways of Dr. Williams' work. As the trainer moves the student from novice to a more expert level of competency, the student's skills may be evaluated using one of the three listed evaluation tools. As the student moves from Knowledge to Evaluation, this process is more thoughtful for the adult learner because the lessons can be applied to the reasons for the class in the first place. Trainers should strive to move students from the first level to and through the final level, but having only three to five days may make this difficult. Bloom (Bloom et al., 1956) may have designed his pyramid to show just this. Knowledge is broad and easier to get whereas the level of Evaluation is smaller and more pointed (Williams, 2017).

The assessment of the training is as important as the training itself. When this assessment is based on the rubric as it is presented in the first part of the class, the feedback loop is closed, much like the servo loop discussed.

Williams (2017) found the following:

Assessment

Assignment Scoring:

The assignment can be graded in a variety of ways.

1. Based on an instructor's goals and objectives, points can be assigned in a weighted fashion that reflects the course's

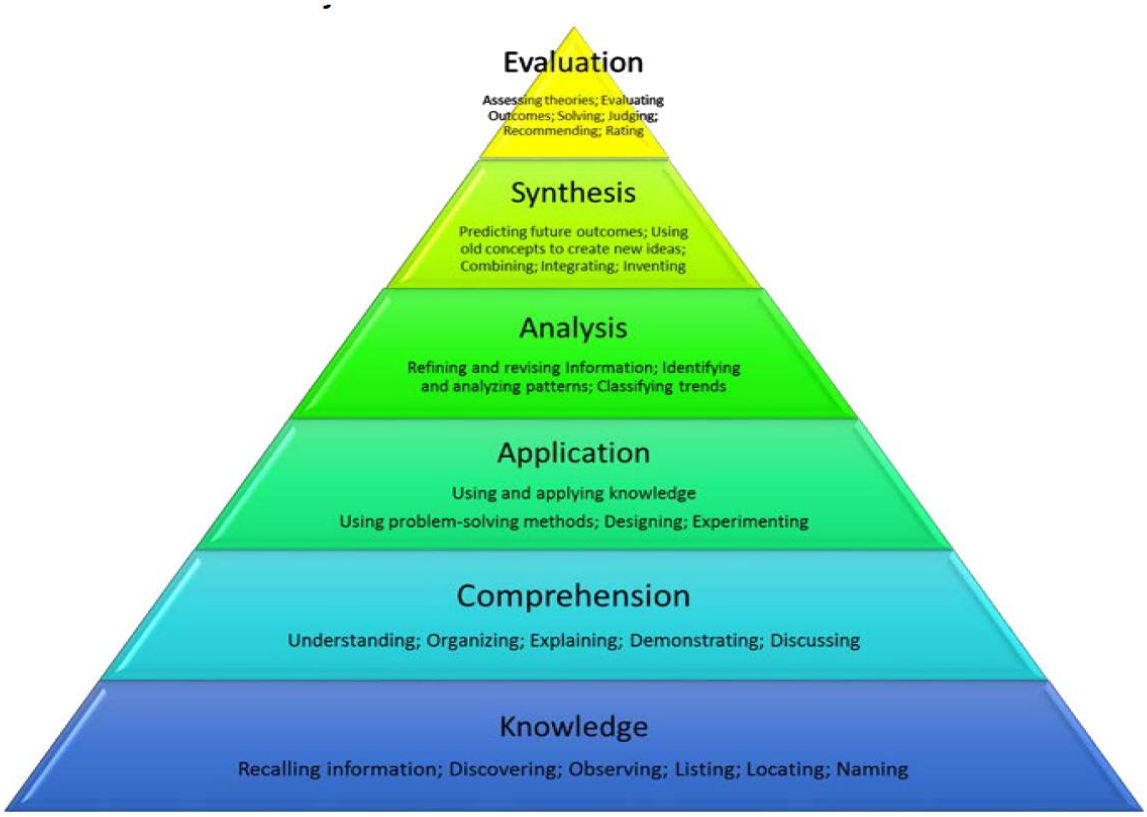
emphasis. For example, if mastery of vocabulary is deemed of great value the instructor may choose to assign more points for question 2. If the course is designed to produce a research project, question 7 might receive more points. If the tool is used multiple times and over different readings or lectures in the course, the weighting of questions can be changed to fit the goals of each implementation.

2. Alternatively, the instructor may grade the entire assignment as pass or fail based on the completion of the assignment. This simple dichotomy allows for speed in grading without diminishing the writing (or working) experience.

3. The instructor may decide to employ the C.A.S.T system, by which point(s) are awarded on parallel scales across each of three primary dimensions: a) **C**ompletion (i.e., the level of completion, inclusion of supporting details, and/or thoroughness demonstrated in the response), b) **A**ccuracy (i.e., the extent to which the response provides correct information and evidence), and c) **S**ynthesis of **T**hought (i.e., the strength of critical thinking, integration, and/or innovation demonstrated in the response). The scales can be dichotomized or assessed as 5-point ratings. Note: Synthesis of Thought as used in the CAST system should not be confused with the synthesis dimension of the exercise.

There are many different ways that one could teach a class and many models that could be used. I found andragogy or adult learning, coupled with an educated choice of model, in this case, ADDIE, SAM, Bloom's Taxonomy or even Millers Pyramid, all show promise in assisting the trainer to develop a class that makes the best use of both the students' and their own time. These models show the effective use of resources and allow for one's style to come through. Add expert delivery modeled after Sisson and thoughtful attention to the rubric when assessing the student's new skills, and a complete and valid course can be created without too much extra work or stress. This is the way I train, and I have found that it successfully trains adults in an industrial setting.

Bloom's Taxonomy



Chapter 4

The participants of the international industrial manufacturing company, introduced in chapter 2, who answered my questionnaire plus took the time to read and comment on my taxonomy are in Finland and America, and they are my teammates at work. All participants are in the training department of a large Finnish company that has an American branch office. I have eighteen completed questionnaires. All respondents are male except for one, with time as trainers ranging from three years to over twenty. Age range is dramatic, from the late twenties to sixties. Demographics were not recorded, to maintain anonymity.

The purpose of this chapter is to present the data collected as well as interpret its meaning. All respondents are my colleagues, all like a plan and a structure to follow. The population queried have all stated they prefer training in a structured environment with clearly defined lessons and goals.

Lastly, expectations showed three sides of itself. What is expected by the student, what is expected by the trainer, and what is expected by management. The first principle of andragogy is "the learners need to know: why, what, how" (Holton III, Swanson, & Naquin, 2001, figure 1) (Holton, Swanson, & Naquin, 2001, figure 1). The students expect to have their needs sated and questions answered. The trainers expect the students to try to learn and participate in the class. Management of a company that just spent millions of dollars on a system expects their employees to get trained and then use this system to make the parts they need to make.

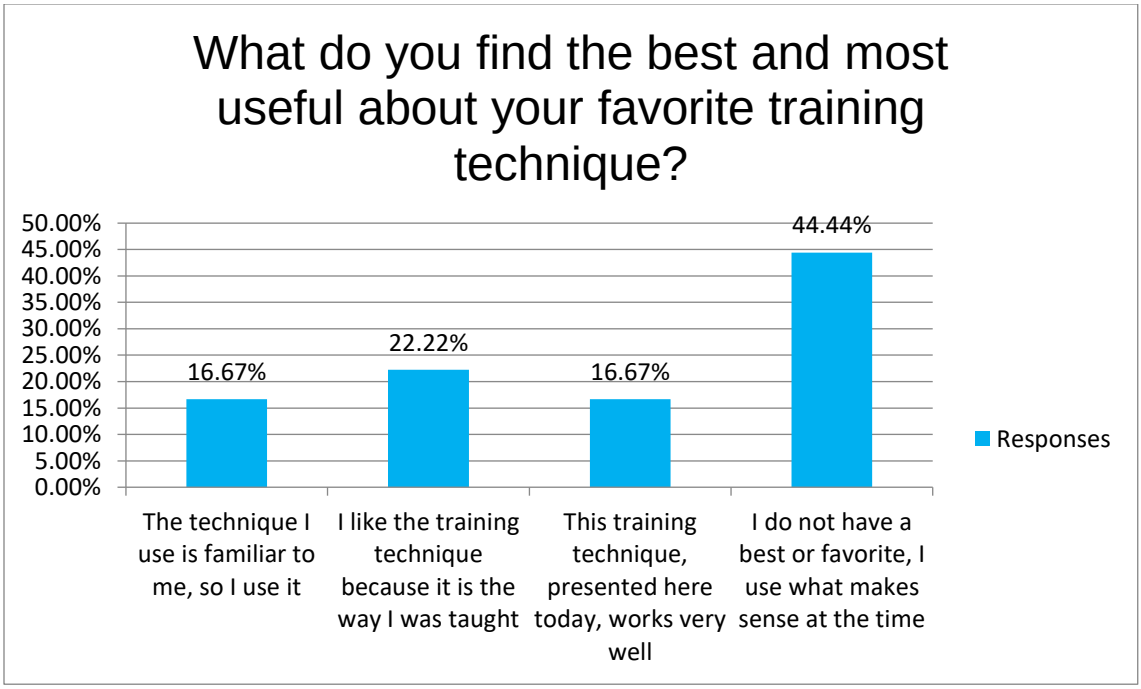
It is clear that this group of trainers are looking for structure and process. This chapter will show what parts of this process they found useful and acceptable to lead a class.

Process

Each question will be examined and exposed. All findings, discoveries, themes, and trends, along with any anomaly or epiphany moments, will also be disclosed as these too are valuable. Chapter four aims to discover the survey results and use that information to write a better training manual.

Question 1

What do you find best and most useful about your favorite training technique?

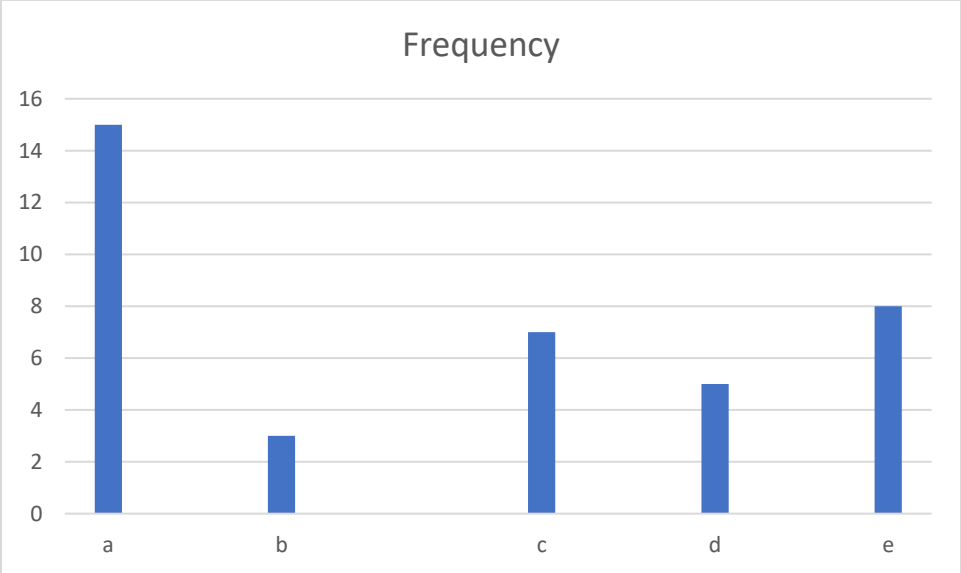


Approximately 39% of the respondents thought the Blaeser Training Taxonomy was a clear and concise, as well as useful, process for developing and organizing training.

This question has a second part in which the respondents were asked to explain which model they use and why they choose it. Plus, a follow-up question: What do you find best and most useful about your favorite training technique?

The answers fell into three main groups. The first group of seven states they liked or would use or have used a process like the one presented. It is the opinion of this group of seven that the trainer should be a subject matter expert (SME). Four of the seven respondents said they used a process like the one presented and can modify their approach to a particular assignment based on the needs and abilities of the students as well as goals of management. The ability to alter one's approach is a subset of adult learning theory (Holton III, Swanson, & Naquin, 2001), (Holton et al., 2001). Andragogy is not so rigid that the trainer cannot stop and pivot and move to a more pedological approach. This is useful when the students are new to the overall process (Holton III et al., 2001).

Another group thought training should not be planned and stuck to one planning process. One group member said they do not use any of the preformed materials, and they simply train without a plan. Another stated, "different scenarios require different planning processes" and still another "one size does not fit all." There were eight in this group. This group is more independent and relies on their abilities as well as system knowledge. These groups leaned on ADDIE as well as Bloom's taxonomy for any structure they might require.



Response key

a. They liked or would use or have used a process like the one presented, and the trainer should be an SME

b. Four of the seven respondents said they used a process like the one presented and can modify their approach to a particular assignment based on the needs and abilities of the students as well as goals of management

c. Another group thought training should not be planned and stuck to one planning process. One group member said they do not use any of the preformed materials, and they simply train without a plan.

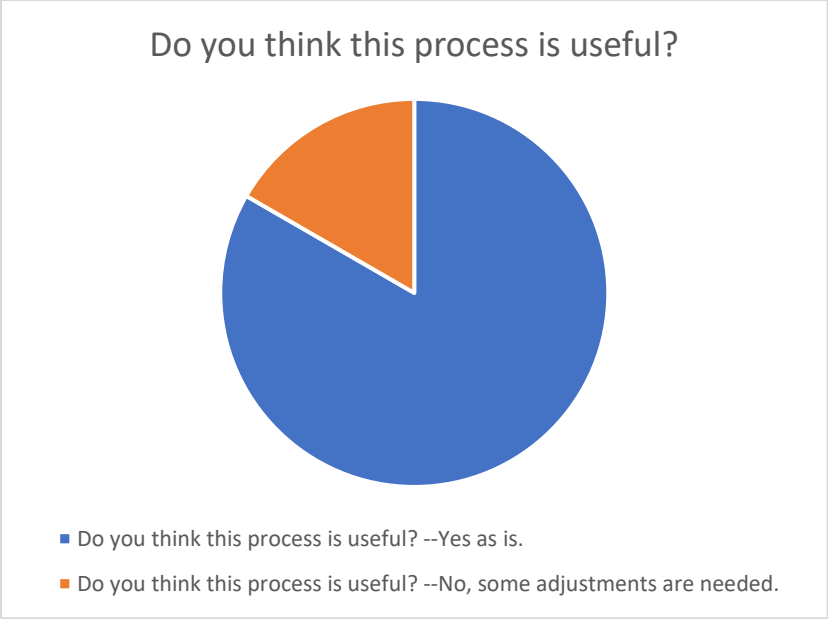
d. Different scenarios require different planning processes

e. One size does not fit all

Question 2

Do you think this process is useful?

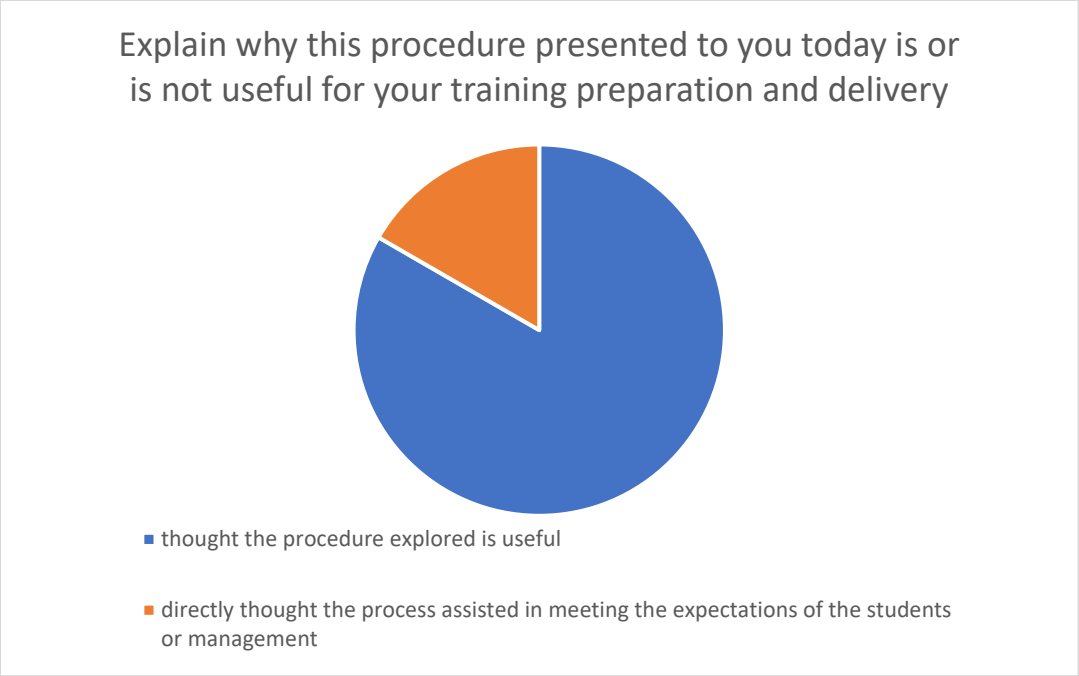
The answers to this are much clearer: fifteen out of 18 said, "yes" or answered in the affirmative. This question drew little discussion; there were no dissenting opinions given. Some wanted to confirm individual skills, and one objected to forcing all to use one way of training development. Two suggested they liked structure better than a free-flow style of teaching. These two said they like a more "systematic approach to training and training planning; otherwise, it's just a bunch of dudes showing people how things work." One respondent noted the process is something like they use in class already but added more to the process. Another said it was too academic for the audience at hand. A vast majority found this a good plan. At least 88% thought this process was useful or helpful and should be used in class development.



Question 3.

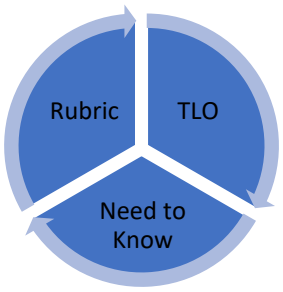
Explain why this procedure presented to you today is or is not useful for your training preparation and delivery.

In this question, 15 of 18 thought the procedure explored is useful; 88%. Three of 18, almost 20%, directly thought the process assisted in meeting the expectations of the students or management. All responded positively to the practical use of the process delivered to them. Some thought this process could be used as a training device for new trainers and to be used for general training. Most complimented as it brought structure to the nebulous process of "reading slides" and "showing them how the systems operate," which is the process employed by many respondents in their daily activities.



Five respondents relayed the following ideas, all in favor of the Blaeser Taxonomy: "stress more on delivering the right things rather than standard trainings delivered mechanically." Some respondents wondered how the customer/student can know what to ask before the system is delivered? Two students advocated for a more significant presence of the training team involved in the sales or the kick-off meetings, to let the customer know we are available for questions, and to show our willingness to work with them on an individual basis.

The "need or want to know" (Knowles, Holton, & Swanson, 2015) is a stated principle of adult learning theory. This very principle is the portion of andragogy explored in this study. When a specific topic listed on a rubric can become a terminal learning objective (TLO), trainers and students discuss these TLOs, and these expectations can become their "need to know." This may appear to be circular logic; one feeds the next. As the situational Subject Matter Expert (SME), the trainer can direct the conversation and show the importance of the topic discussed.



Question 4

Explain what you would do to make this procedure more useful.

There was no discernable theme to the responses. Some of the answers varied from "it was pretty inclusive" to "be sure to add more feedback" and even "adding suggestive sales pitches to the class to bolster revenue." There were many more responses as well. Because the respondents are used to using checklists, four of 17 responses brought up the use of a checklist or more structure. As disjointed as they were, all these comments tell me they did not read my process thoroughly or did not understand it as English is not their first language by and large or forgot what they read in the process which includes the quality process explanation as well as evaluation and course construction. The structure is evident and intended. Is the design obvious to the reader?

One respondent suggested my process may work in the United States of America, but the rest of the world would require a more pedagogical approach. Although relevant in adult education at large, I am not exploring cultural differences in technical training, which is out of scope for this work.

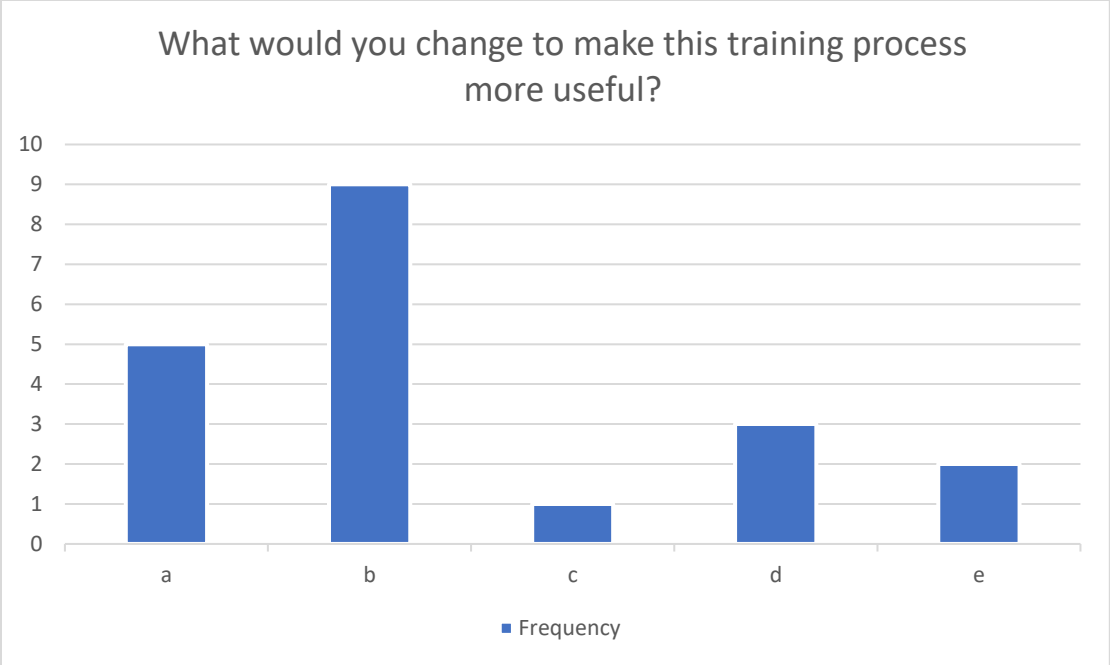
Three respondents suggest more opportunities for feedback and practical exercises. These suggestions tell me my taxonomy must be more explicit. This lesson, one of being more specific, is something I must do to get my process to be understood.

Maybe the process was idiosyncratic and thus had a wide variety of responses that yielded no discernable theme.

Question 5

What would you change to make this training process more useful?

The themes which arose from the respondent's answers to this question are varied but much more cohesive than the last. Transferability, five of 18 respondents said this style of teaching might or could be used in other courses, not just training in the modern automated industrial machine shop. It is good to see there are other places a technique could be used. One-half of the population (nine people) said they either would not change anything or had no comment or simply said "nothing" as an answer to the question. This indicates the process is worthwhile or worth attempting to use it more than a few times. One respondent out of the sub-group of nine suggested they would take their poll, over several different classes to see how their students responded to such a training technique. Setting classroom or student expectations was mentioned three times. Two of 18 respondents mentioned that when training brand new customer-students who have never seen a system, they do not know what they do not know. Some participants elaborated so much their answers counted as two different answers. The two largest themes in this chapter are Transferability and acceptability/useability.



Response Key

a. This style of teaching might or could be used in other courses, not just training in the modern automated industrial machine shop
b. Do not change anything or had no comment or simply said, "nothing" as an answer to the question
c. Take their poll over several different classes to see how their students responded to such a training technique
d. Setting classroom or student expectations was mentioned three times
e. Training to brand new customer-students who have never seen a system do not know what they do not know

Question 6

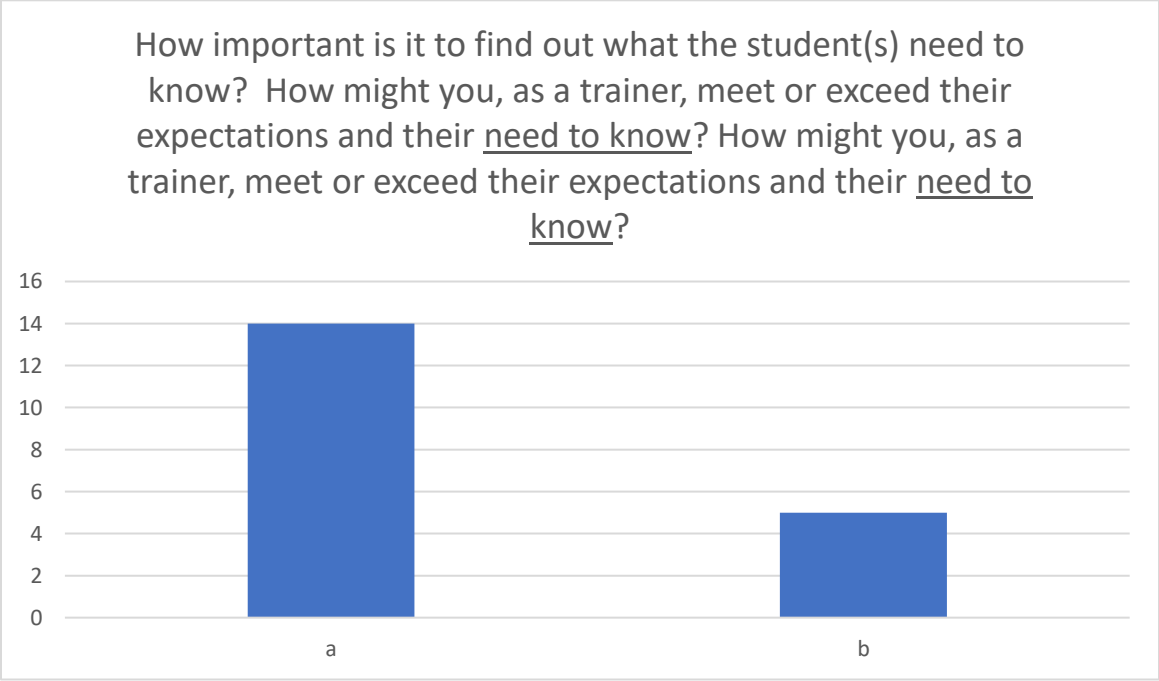
How important is it to find out what the student(s) need to know? How might you, as a trainer, meet or exceed their expectations and their need to know? How might you, as a trainer, meet or exceed their expectations and their need to know?

Fourteen out of 18 respondents suggested learning or knowing what the students need to know is critical, important, crucial, very important or essential as well as other adjectives.

Respondent number 10 checked out of the questionnaire. This respondent decided to answer the rest of the questions with the following statement in part, "I do not understand the

purpose of this questionnaire is also educating the the trainers to think more of what is a good training" [sic] this respondent decided to simply copy-paste this answer for most of the questions. This is where the total number of respondents changes from 18 to 17.

The need to know, this dominating and percussive answer reinforces my thoughts, as well as one of Knowles's main points which is the need to know is paramount (Knowles et al., 2015). Setting expectations was mentioned five times and all five of these respondents were part of the larger subgroup of 14 mentioned above. Is setting expectations and meeting expectations part of the need to know? This group's response shows me it is important to meet the expectations of the students. The special moment in this question was when the respondents emphatically exclaimed the expectations should be written and met. These same respondents gave some interesting suggestions on how to do this. One suggested the trainer separate the students into groups with various, similar expectations and then join the small groups back into larger ones once the smaller groups had their expectations met. The recombining is designed so the subgroups could share what they learned so all could learn everything with the larger groups.



Response Key

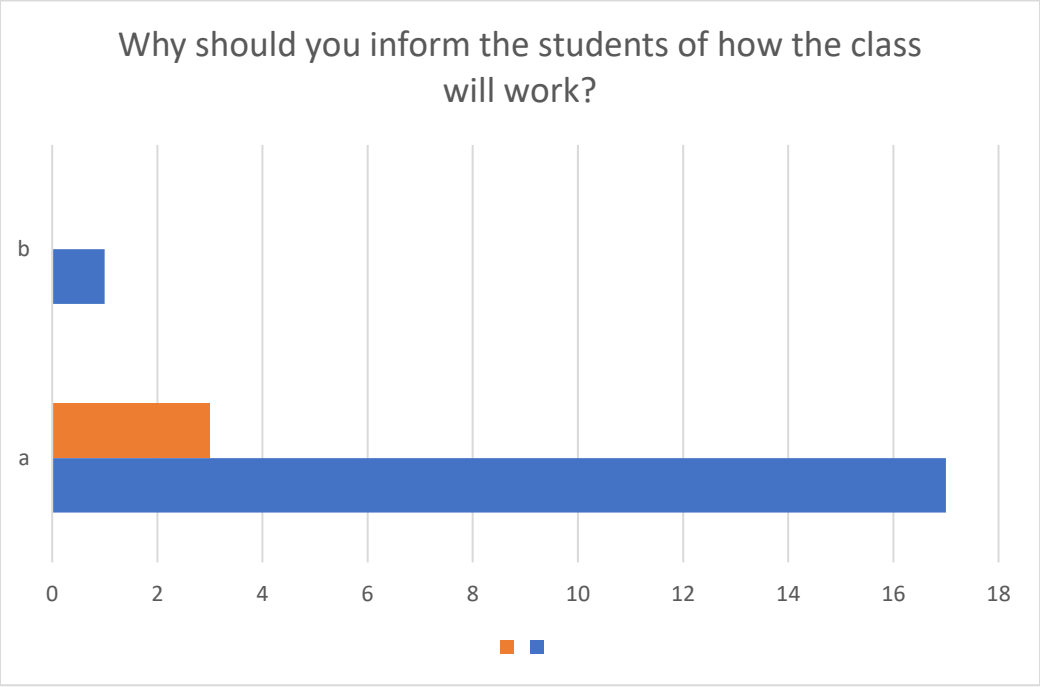
a. Learning or knowing what the students need to know is critical, important, crucial, very important or essential

b. Setting expectations

Question 7

Why should you inform the students of how the class will work?

The pool of respondent resources is effectively only 17 for the rest of this project. Every one of the respondents answered this question by mentioning how to inform the students of the trainers' expectations as well as to assist them in knowing how the class will operate. Three respondents went further and stated this practice of informing the student how the class will operate will lessen anxiety and reinforce some adult learning ideas that show "the adult learner does not like to be treated like a child." These are basic principles, albeit reworded, of andragogy. Building trust between student and trainer as well as setting a rhythm allows the student to learn the best time and place to ask questions. These points were brought up by three of the respondents as well.



Response Key

a. Respondents answered this question by mentioning how to inform the students of the trainers' expectations as well as to assist them in knowing how the class will operate

b. Building trust between student and trainer as well as setting a rhythm allows the student to learn the best time and place to ask questions

a. Practice of informing the student how the class will operate will lessen anxiety

Question 8

Why do we explain the objectives and goals of the class? How do we use a rubric? Where and when do you think this information should be given to the students?

All seventeen of the respondents showed they understood why goals and objectives were explained. In this question, expectations came up again, though in most of the responses this time expectations took on a different meaning. Rather than being a student-centric term "the student expects they will be able to…," which is a good goal, but in this case, expectations was more course-centric, especially when discussing the rubric. Expectations gave us objectives; objectives on the industrial shop floor generally are built around behaviors; these behaviors are measured by reduced waste and an increase in the number of units over time. Objectives are codified not a rubric that shows the standard. All 17 answers to these questions hit on these ideas together or at least partially. Phrases like "to get a great buy-in from the students," and "to give a clear vision of the goals and the training point," another stated the andrological idea of "*what's in it for me*?"

The use of a rubric was accepted and acceptable by all respondents; however, some stated it should be sent ahead of time, others at the beginning of class, and others only at the end. This was interesting; this indicated that the respondents seemed to think the rubric was a sort of secret weapon to be used by the trainer to get the students. This portion told me they all knew what the rubric was used for, but in practice, I have not seen anyone use a rubric. Nine of the respondents

suggested the rubric should be given and discussed the first day, right after the discussion about the objectives. An unexpected response, from two respondents, said the information of the class, even its objectives, should be given in small chunks rather than all at once. This argument does have merit if the course was semester-long. However, our classes are at most five-days long. Occasionally, and based on what the customer purchased; the course could be two-weeks long.

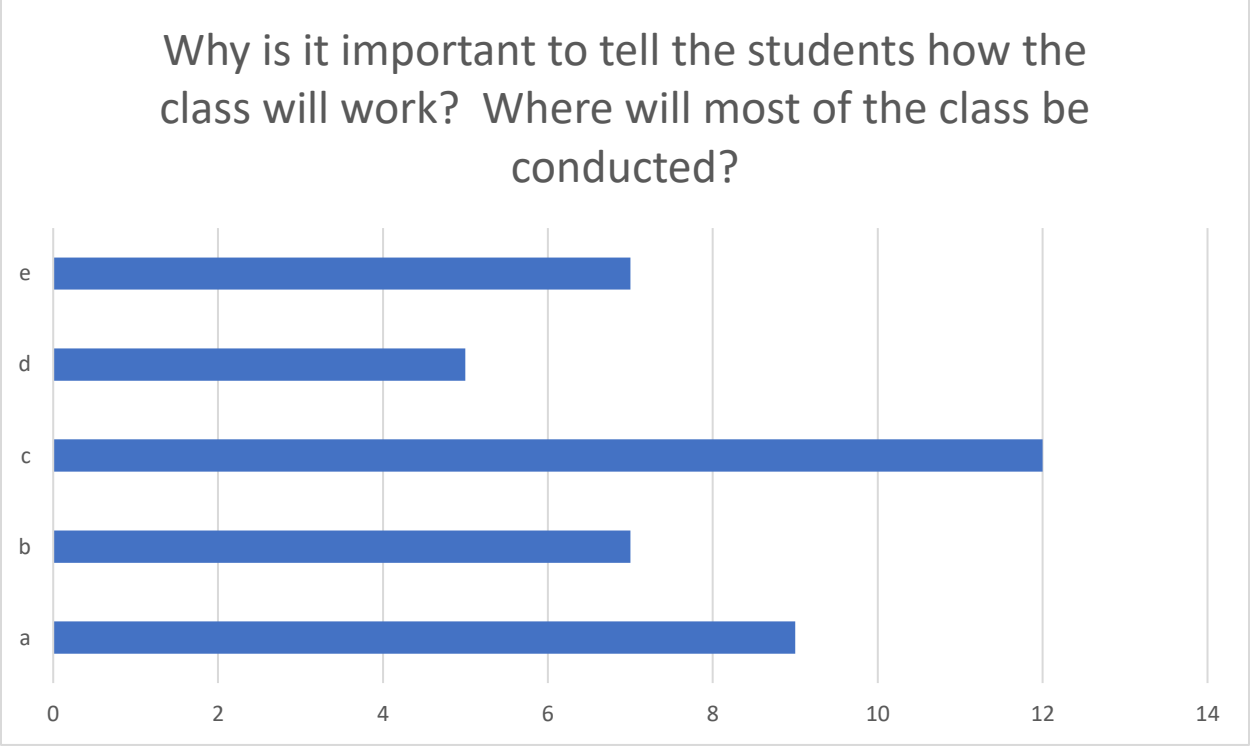
Question 9.

Why is it important to tell the students how the class will work? Where will most of the class be conducted?

The most prevalent themes this question invoked are awareness, expectations, and choice of venue — hands-on (equipment/system) or classroom. Six out of 17 respondents mentioned awareness to tell students how the class will work and where it will be conducted. Because these classes are generally built around industrial equipment, it makes sense to have the course taught on the shop floor. My classes have a limited time in the classroom. Classroom time is for introductions, essential software discussions, and familiarity with me and how I do things. These ideas are reflected in what the respondents have suggested by where they think the class should be conducted, for similar reasons. Fourteen of the 17 respondents said the course or most of the course should be held in and around the equipment. This answer makes sense as the shop floor is where their job occurs, and the system is installed. The familiar answer of expectations is mentioned here as well. The respondents said “expectations” or “to expect” 10 out of 17 times. The “expectation” is a popular theme I see as the study continues to unfold. It makes sense to discuss and teach a system at the system if available; this is expected and assumed from what the

respondents said in their answers. It is not much of an epiphany, but it does make a lot of sense. Why talk about something when you can show it?

Awareness is the last theme made relevant by the proffered responses. Seven out of 17 respondents mentioned "awareness." Awareness in the context of this question and our classes is one of spatial awareness and awareness of the needs of the students and what is being taught. There is safety awareness; there can be welding and the flames or sparks accompanying them, and industrial environments usually have fork-trucks. The simple awareness that the students are used to activities means that the students should do something in these industrial courses; they are to learn how to use this new piece of equipment. One respondent said, students should do something as they are most likely manual learners.



Response Key

a. Mentioned awareness to tell students how the class will work and where it will be conducted
b. The course should be held in and around the equipment
c. The respondents said "expectations" or "to expect"

d. Respondents mentioned “awareness”
e. Students should do something as they are most likely manual learners

Because the class is conducted largely on an active industrial shop floor, there are inherent dangers. The trainer must be aware of safety on the shop floor and enforce the use of all required Personal Protective Equipment (PPE). PPE includes, but is not limited to, hearing protection, eye protection, helmets, steel-toed shoes or boots, static-grounding straps, fire retardant smocks or clothes, heavy leather gloves/gauntlets, and face shields. The trainer must still train while wearing all this and not get killed while doing it. The trainer must be effective as well.

This question brought out these themes: awareness, expectations, and hands-on/classroom training (delivery venue).

Question 10

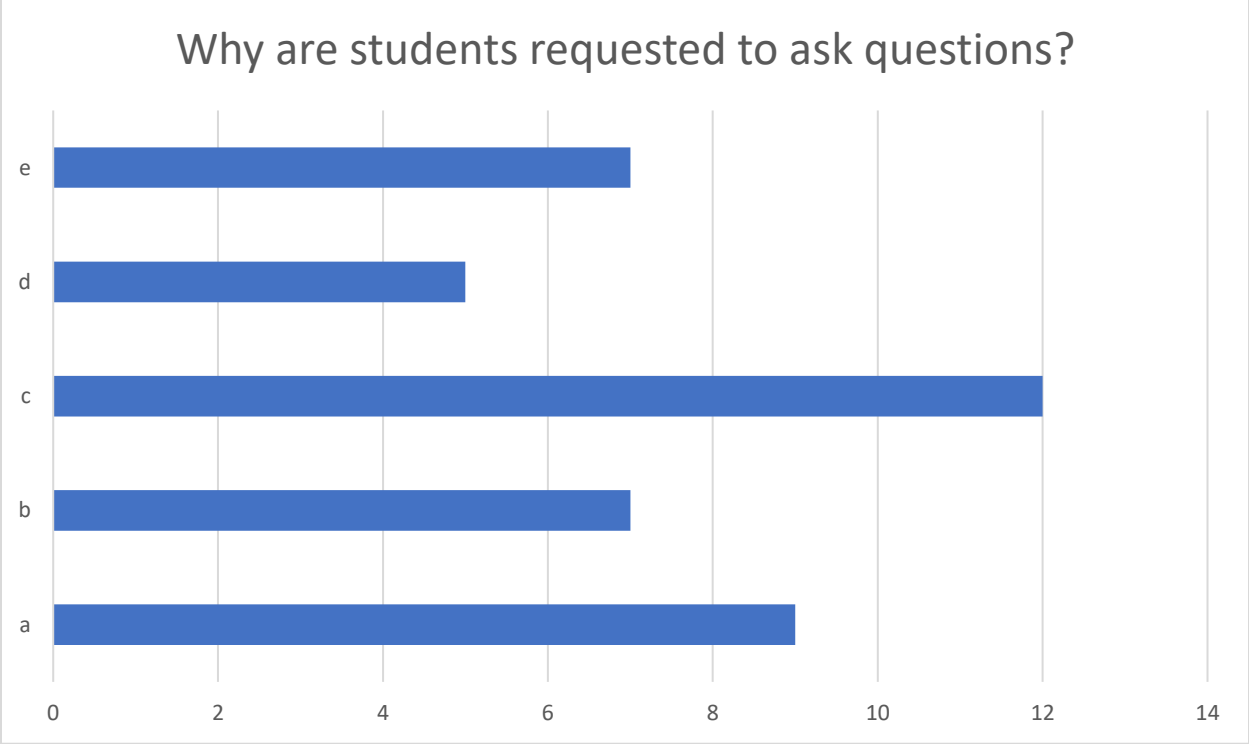
Why are students requested to ask questions?

The previous question, Question 9, when analyzed, brought up the theme of expectations often. Expectations are not discussed in question 10 nearly as much as a new theme — feedback. Feedback, as a theme, is mentioned explicitly or implicitly eight out of 17 times. Prompting students to answer questions is expected. Questions are the venue students and trainers can use to bring to the fore ideas not yet covered or ideas covered and not clearly understood, or to go over the concept or idea — one more time. Feedback from the student to the trainer helps the trainer know if the student knows the material. Feedback, in the form of questions from the trainer to the student solidifies understanding of the concepts, which may have been hard to understand in previous classes. Using evaluations should have two purposes, “Formative

evaluation is seen as feedback and feed-forward between the various phases of learning" (Knowles et al., 2015, p. 163). This statement brings credence to using questions as both evaluations for a student's knowledge and evaluation of the trainer's intent.

Another familiar theme is expectations. Students' and trainers' expectations were discussed — expectations from both sides. Four of 17 respondents brought this theme up in response to this question.

Two respondents shared that those questions from students can help the trainer learn how they are thinking. The discussion on this question led to more discussion. Discussion about behavior versus cognitive thinking and long versus short term storage of the information presented. These were the special or unusual ideas which are different from feedback and expectations.



Response Key

a. Feedback, as a theme, is mentioned explicitly or implicitly
b. Students' and trainers' expectations were discussed

c. Questions from students can help the trainer learn how they are thinking
d. Behavior versus cognitive thinking (learning)

Question 11

What happens during the first tour of the system with the class?

What should happen during a tour of the system/machine/workstation or job site with the students at hand? In my attempt to make my questions easier to understand, I think I went too simple, and the point of this question is lost.

The purpose of the course is to train students on how to successfully use and profit from the new machine center control system. This system is software-reliant but mechanically based. In short, the system runs the machine centers and controls in which parts are loaded and run — based on delivery requirements. Because the mechanical portion of the machine takes up space and moves and wears, explanations are in order. The whole system is there to be seen, touched, and experienced. Exploring the system and all the features it has must be done in a safe process. This idea is supported by 14 out of the 17 participants in this survey. The epiphany moment came out of some of the participants' expressions of confusion. I should write in a more precise way. Some of the various verbs used in this question were as follows: to explain, describe, show all, acquaint, introduce, and present.

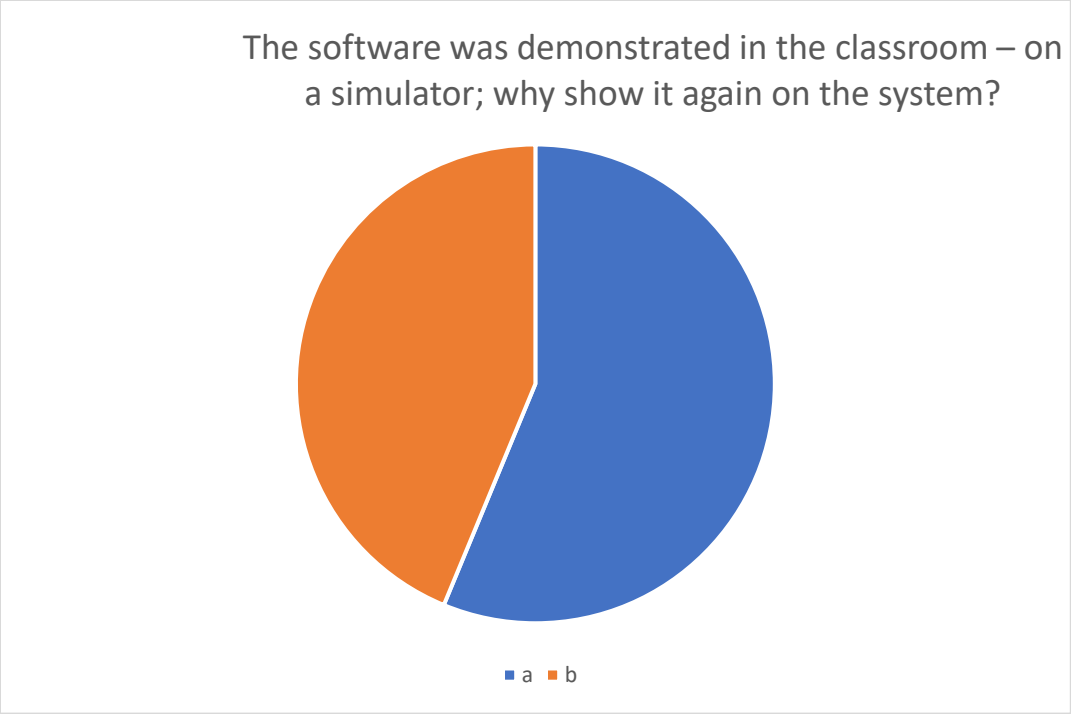
Question 12

The software was demonstrated in the classroom — on a simulator; why show it again on the system?

One answer which keeps coming up in this question's list of responses is one of realism. Sixteen out of 17 participants mentioned realism or something similar. The respondents said

several times, the simulator is the system without any moving parts. It is safe and stress-free because nothing is moving, and nothing can crash. However, the keystrokes are the same on the simulator and the actual system. The system has a robot or a transport mechanism driving around a rail, like a train. Parts and pallets with a combined weight of 50 to over 4,000 pounds are moving around the system. The dynamics of this precise motion are difficult to fathom when one is only pushing buttons on a computer. However, if one can imagine and understand the process, on the simulator, making air parts, one can take the same skills and make solid parts.

Four respondents brought up safety as a reason to start in the classroom and use a simulator. Two of these four members mentioned brand new students/workers who have never been in a machine shop or industrial environment before. Although there is a first time for everything, I have not met anyone in this industry who has never seen or been around systems and industrial settings. Andragogy shows this flexibility; it is not so rigid, the trainer may use a conventional pedological process if warranted “It seems clear that Knowles always knew, and then confirmed through use, that andragogy could be utilized in many different ways and would have to be adapted to fit individual situations” (Holton III et al., 2001, p. 128). The system is their station and where they will work. It makes sense to have the students learn their system — at their system. It seems to follow and makes sense to understand the systems software in a safe, non-threatening way.



Response Key

a. Participants mentioned realism or something similar — 16
b. Safety as a reason to start in the classroom — 4

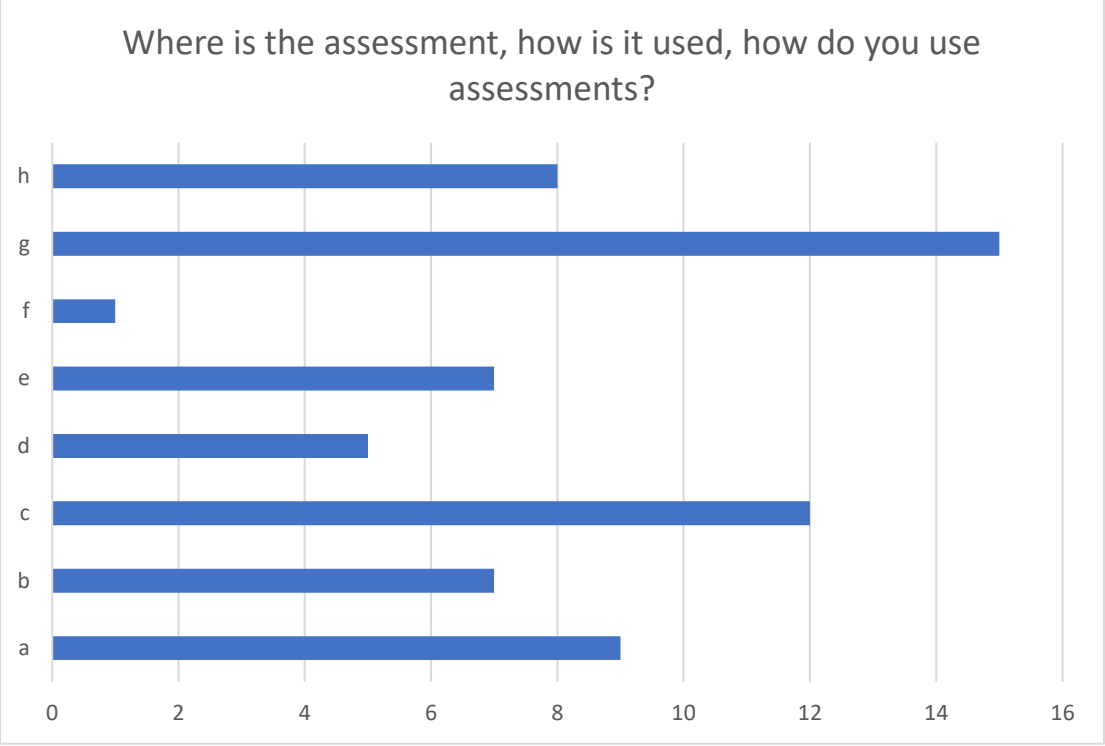
Question 13

Where is the assessment, how is it used, how do you use assessments?

The question of the evaluation has varied answers. Few if any of the respondents answered all parts of this question. Three people did not answer this at all; the one respondent I discounted after question six, another left their answer space blank, and yet another stated, "I do not use." Fifteen respondents attempted to answer it. The trainer should administer the assessment at the end of the training course wrote nine of 15 respondents. Seven of 15 thought the review might be best served in smaller chunks, at the end of a section or topic or the end of each day. Twelve of 15 respondents discussed the assessment style. Another five of 15 thought a simple "pass-fail." In contrast, seven of 15 thought a more in-depth evaluation is in order,

suggesting each student take their turn and complete and discuss various TLOs. One told of a progressive process; after each instruction block, each student will perform the topic discussed.

The purpose for assessment ranged from "to provide feedback/mastery/skill level to the student or their supervisors" to "feedback to assist the trainer for their next training assignment." All who supplied an answer to the question of "how are assessments used" said they must be practical in nature. Written tests carry little weight with the machine and system operators and, for now, have little validity. The student must learn how to run the system as well as the machine. Eight of 15 survey takers thought a student is expected to explain what is happening in the system due to their actions at the control panel. Example questions a student should be able to answer: Why does it do this? What does that color light mean? Why are there no parts manufactured now? Should the machining center be cutting parts now? A student's answers should be able to be defended by the student.



Response Key

a. Administer the assessment at the end of the training
b. Review might be best served in smaller chunks
c. Assessment style
d. Simple “pass-fail”
e. A more in-depth evaluation is in order
f. Performance — after each block of instruction
g. Suggest practical vs remembered facts
h. Ability to explain what is happening in the system

Question 14

How do you consider training to be successful?

Successful training, whatever this means, is the brass ring or golden ticket of education. How can we know if the training works? In the industrial world, companies want production. How many parts are made? If a student who is an employee of a company that bought a new system can use the new system to make their company more productive, training is successful. If the training does not address one or both of the following questions, why bother? Are the students more productive? Can the students fix/maintain or adjust the system? This is the goal of training in the industrial world. In this question, respondent number 10 decided to make a more meaningful contribution. However, respondent number one chose not to participate in this question actively. The number of active/useable answers is 17 for this question.

Some answers focused on the intrinsic side of education, how it made the trainer, or the trainee feel. Some of the other responses were more extrinsic, measurable, and quantifiable; increased productivity, fewer accidents, or incidents that hurt an operator. Looking at all the answers, I broke them down into intrinsic and extrinsic responses. I found 16 of 17 respondents to be extrinsic. I also found six respondents to be intrinsic. Some had both intrinsic and extrinsic properties, and there were five in this category.

The extrinsic respondents said things like, increased efficiency, higher part count, fewer reportable accidents. The innate or intrinsic responses were more on the unmeasurable side; understanding, comfortable, light bulb effect, the students grew to like the system, positive feedback. The few answers that had both intrinsic and extrinsic listed or quantifiable and qualitative were few and did not have detail.

A few responses stated that if the students cannot show increased part throughput or higher efficiencies, the training was unsuccessful. This kind of thought is listed three times. How can a trainer know the students have retained the training imparted by simply being comfortable or understanding? Because this is industrial in nature, there must be a product with manufacturing at the core of purpose.

Nobody mentioned assessment scores to measure successful training. Two people said fewer calls to technical support or fewer accidents as an indication of success. This seems to be a relatively low bar to cross over. Expectations, as they have shown up in nearly every question so far. Meeting or failing expectations was not mentioned ever in this question as an answer from the respondents. Successful training seems to be labeled or described as a class where it went well, and the participants had fun.

Response Key

a. Extrinsic responses — increased efficiency, higher part count, fewer reportable accidents.
b. Intrinsic responses — understanding, comfortable, light bulb effect, the students grew to like the system, positive feedback
c. Both intrinsic and extrinsic responses
d. If the students cannot show increased part throughput or higher efficiencies, the training was unsuccessful
e. Fewer calls to technical support or fewer accidents as an indication of success

Question 15

What does effective training mean to you?

Training effectiveness seems elusive and varied, like the definition of successful training in the previous question. One definition of the effectiveness of training came from the Kirkpatrick model, there are four elements; they are "Reaction, Learning, Behavior and Results" (Bates, 2004). Some of these qualities listed are part of some answers from the population chosen. However, as I discuss a process for learning in an industrial environment, the overall goal is to increase the flow of parts through an industrial process. To learn to use their systems and procedures in a better way to assist them in doing their jobs.

If effectivity, by itself, can be measured, the participants of my survey seem to indicate this by whether or not a particular topic was taught or even just mentioned. This is to say, could a third party sit in the back of the room and observe or even count if a particular idea (TLO) was mentioned or discussed. If it was, then success is achieved on that topic. This survey question garnered 18 responses. This is the breakdown of the questions. Eight out of 18 mentioned checklists of objectives discussed or lists of topics scheduled mean the class was effective. Five out of 15 took this idea a bit further and wrote about achieving production goals or the ability to demonstrate a new skill on a new piece of equipment. Two of 18 responses suggest leaving the students with good training materials — for their own reference in the future. Mastery as a concept or an implied idea was evident in five of 15 survey results. In these five survey results, they said things like, "By the end of training, the student can perform the basic tasks with the equipment" and "Few calls to technical support are required after class has been completed." If the topics have been mentioned or demonstrated, a box can get checked off on a list, then the class was effective.

A few poignant remarks were made, these remarks show shades of andragogy shining through. Some students, with a little previous mastery of similar products, ask deeper questions. Another response showed this, "Effective training means a customer can do business; we can do business." These seem to show an andragogical bent, as does this remark. "When the training is efficient, adaptive, and modified as needed, by the end of class, the student can perform their job."

Effective training is, as expressed by the participants of this study, different than successful training. This population shows effective training as training that has "met the

standard" or "hit the various/requested topics." Both phrases have similar weight and definition. The respondents gave minimal regard is given to mastery of the required skills.

In Summary

I think expectations can be linked to a student's need to know which is the point in andragogy driving this study. ("Andragogy," 2020) If a student or a student's manager made a topic known, a topic that could be turned into a lesson or an entry in the rubric, they expect it to be taught or discussed at the very least. When the rubric is sent to the class, they know what is happening, expectations as well as who, when, why, and where of the training. Rubrics set the standards and can be discussed in the introduction to the class.

Customers expect to be taught the skills they need to make their system run as it should, producing what it should in the quantity and rate it was sold to do. If this standard is met, training can be listed as effective. Many study participants stated their support for structure and expectations. This told me a few things. The product introduced is known to the group. They did not know an effective way to teach their class. The reasoning for their ideas on their ability to train may be because they do not have the required knowledge, training, and teacher skills a trainer should possess, or they have these attributes, however, they are missing a plan or direction and this taxonomy is filling that gap. Some survey participants explained this training process presented would be good for a beginner or as a pretraining guide — I agree. Some respondents suggested this taxonomy should be adopted to train as it allows flexibility of delivery. No place in the taxonomy was it stated, "you must do this…," however, it did suggest the operator should, based on pre-delivery fact-finding, develop a class best suited for the current

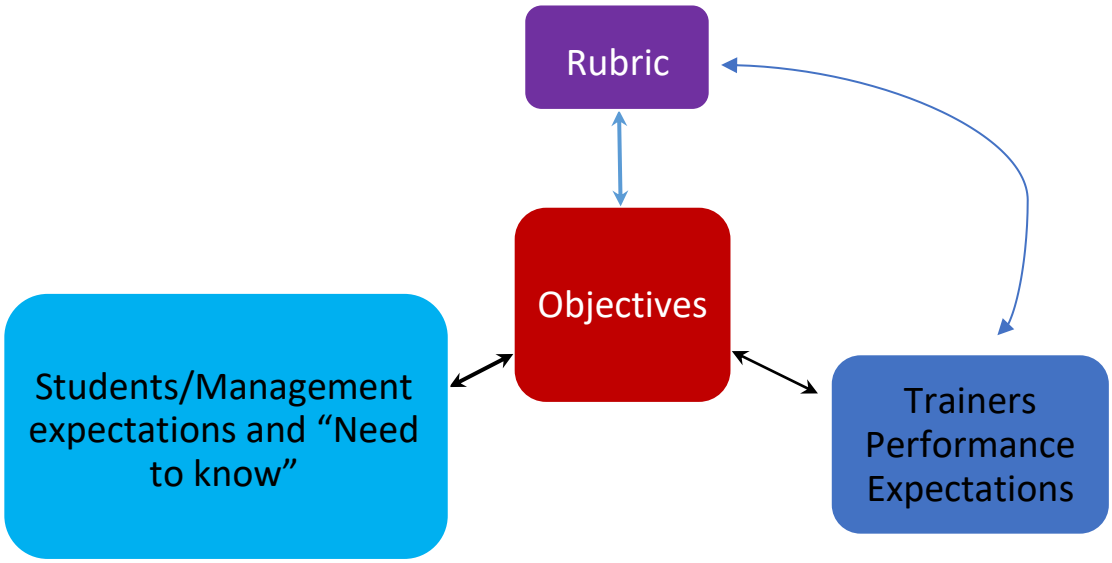
assignments needs. All to fill the expectations of the students, customers as well as professional supervisors, and themselves.

Expectations as an answer and as a theme continued to show when discussing the development and use of the rubric as well. The introduction and use of a rubric brought about a common answer — expectations, again. A clear majority of responses support the use of a rubric. Some thought the rubric is only a teacher's guide for grading — to see if standards are met. One interesting idea from some teammates was that the rubric should be sent to the students a short time before class so they can familiarize themselves with the terms as well as the expectations and to allow adding their own "need to know" comments. Some responses showed a rubric could be used as a performance grading mechanism. They explained, if the objective of the training is to educate the operators of the system to produce parts, and the trained user did all the necessary steps to operate the system safely and effectively but forgot one of the many steps, did the trainee learn how to make parts? The user did almost everything the user was supposed to do but did not produce anything for the efforts. E.g., raw materials weren't loaded into the system to be processed or machined; a finished part was not made. If the student was graded on a percentage scale, even though 90% of all the steps were accomplished correctly — with no parts, did they / should they pass?

Conversely, I had some special moments where a thought or an answer was confounding. Some teammates thought the rubric is of no use to the students at all and should not be used except as a checklist to ensure required training tasks are accomplished. Another respondent suggested this taxonomy is a closed-loop more than an open-loop system. If this is the case it should run more efficiently and should have a higher degree of positively accomplishing the expectations and performance of the lessons at hand. They also said advanced skills cannot be

expected until the more fundamental tasks are performed correctly and adequately. I did notice there may have been a language barrier. My teammates are all conversant in English, however, English reading and comprehension skills may be a challenge. This may have caused a few answers to go in a way I did not intend it to go but it is written as such: to open a channel to the trainer of their own needs and expectations.

The following graphic shows the relationship between the different expectations, through the various lenses of Student and Trainer as well as Rubric and Objectives.



These are the results of the analysis of questionnaire. The first response came in on 2 February 2021 and the last came in on 15 April 2021. The average time it took to complete the questionnaire was fifty-five minutes. All but one respondent answered all the questions, with one respondent who chose to answer most of the questions with a simple cut and paste answer as previously discussed.

Chapter 5

Introduction

This dissertation is an application of elements of andragogy, assessment, and quality control in training students in the operation of a system for manufacturing parts equipment. The training is delivered using the Blaeser Training Taxonomy (BTT) to students who are employees of the company that bought the system. The setting for this training is an industrial manufacturing plant. Reviews of the literature as well as industry knowledge suggest that the BTT, or similar training process has not been done before, in a modern, automated, industrial workplace; this finding is reviewed in detail previously in chapter 2

This dissertation explores the effectiveness of the BTT in the industrially automated focused classroom and the assessment of student skills. A part of this exploration involves understanding if the BTT is "disruptive" (Christensen, Horn, & Johnson, 2017), and ascertaining whether this will make a difference in the training of customers who expect a better product as well as a higher rate of part production.

Chapter 1 introduced that the learning process is based on sound educational procedure in a plan which delivers a training course for people in the automated machine shop industry (Blaeser, 2021). In chapter 1, it was investigated to see if elements of andragogy, assessment and quality can come together and become a system for training in the modern, automated machine shop. As Programmable Logical Controllers (PLCs) increase in speed and flexibility, customers are desiring a more logical and faster more effective way to train their employees.

In chapter 2, a working observation, based on a meta-search/review of the literature, suggests there is not a system used in the industrial training world which has andragogy, assessment and quality aspects built in. The BTT addresses these issues and seeks to fill the

voids that are left unfilled. The intention is to create a system which uses these elements to make industrial training better.

Chapter 3 describes the development of the BTT. This involved bringing elements of andragogy, assessment, and quality control (as described at a major machine shop component provider) together and to codify it. The following issues are discussed: (1) the way the BTT is deployed and illustrated in various scenarios. (2) the substance of discussion and testing by the respondents who volunteered and opted to use the BTT in their classroom. (3) when working with new and inexperienced students, should the employers' expectations supplant those of the students, and finally, (4) how will the training process discussed in this chapter improve training?

Chapter 4 describes the deployment of the survey used to gather information on the implementation of the BTT in a live scenario. This scenario required the respondents to read portions of chapter 3 which described the principles of the BTT and then apply them in one or more of their classes where they are the trainers. The respondents then were issued the questionnaire where they had mostly open-ended questions to answer about their experience with the application of the BTT. The data is disclosed, and the qualitative questions are quantified and displayed in various charts showing either percentages or raw numbers. Raw numbers were shown occasional as some respondents gave multiple answers to some questions. Comments from the respondents are analyzed to provide suggestions for improving the BTT which was largely accepted. The respondents wanted to be sure to honor and use the expectations of the students and plant management to help steer the course delivery. These same expectations are also to be used to assist in the rubric creation and solidify the "need to know" and, over time, help create a standard of quality and assessment.

This chapter provides the final analysis of the data and discusses the strengths, limitations, and implications of future research of this topic.

Summary and analysis of the data

Based on the questionnaire data, the BTT is a work in progress. The respondents identified several strengths/positives and suggested areas where the BTT could be improved. The BTT is a tool which can be used to develop, deliver, and assess quality training. How did the BTT deal with the three legs (andragogy, assessment, quality) on which it was built?

Fifteen of 18 of the respondents indicated the BTT is a useful and favorable tool to be used in the training planning, delivering, and assessing of quality training. The data which supports this is question 1b, first column in the following chart.

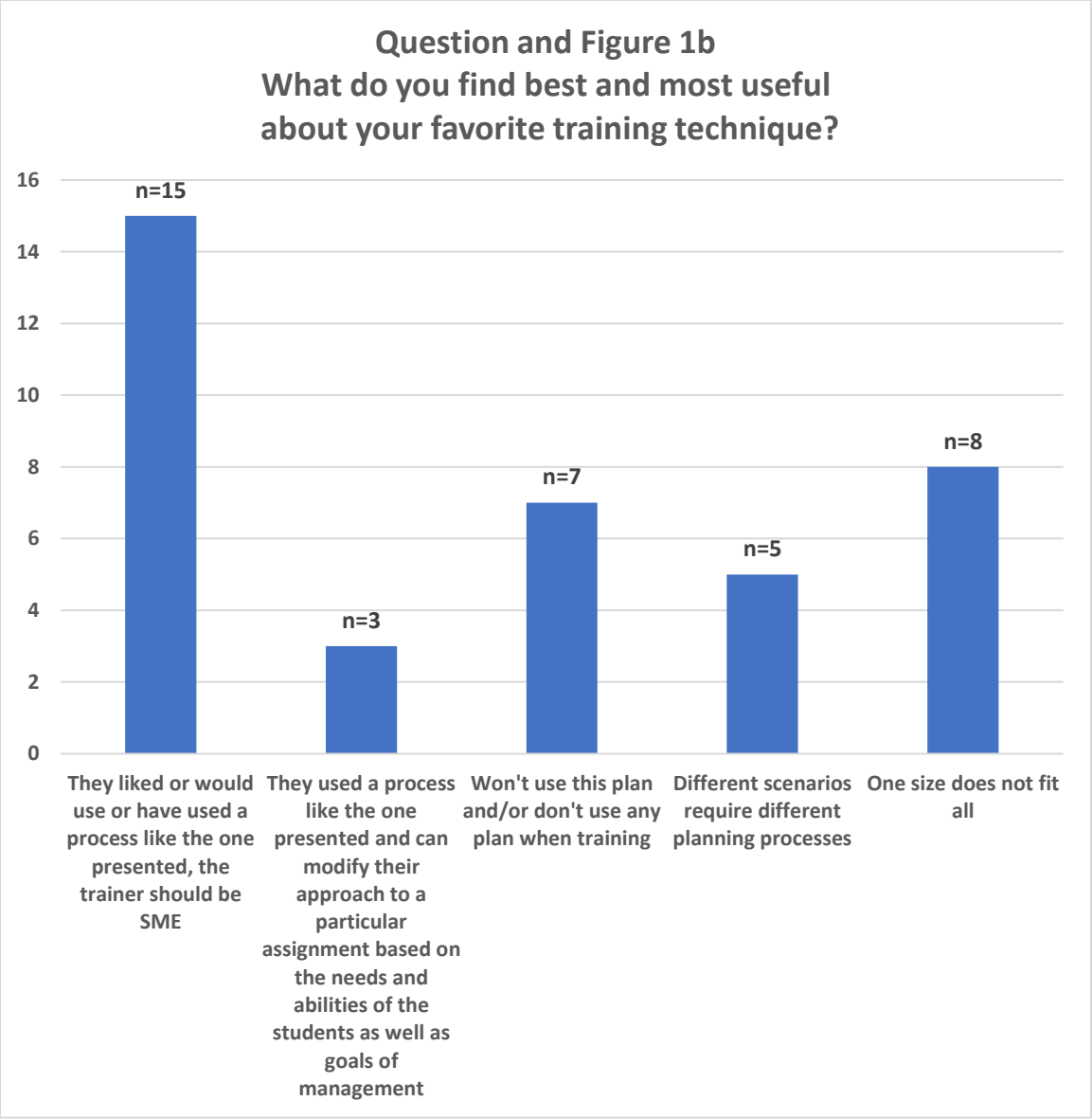
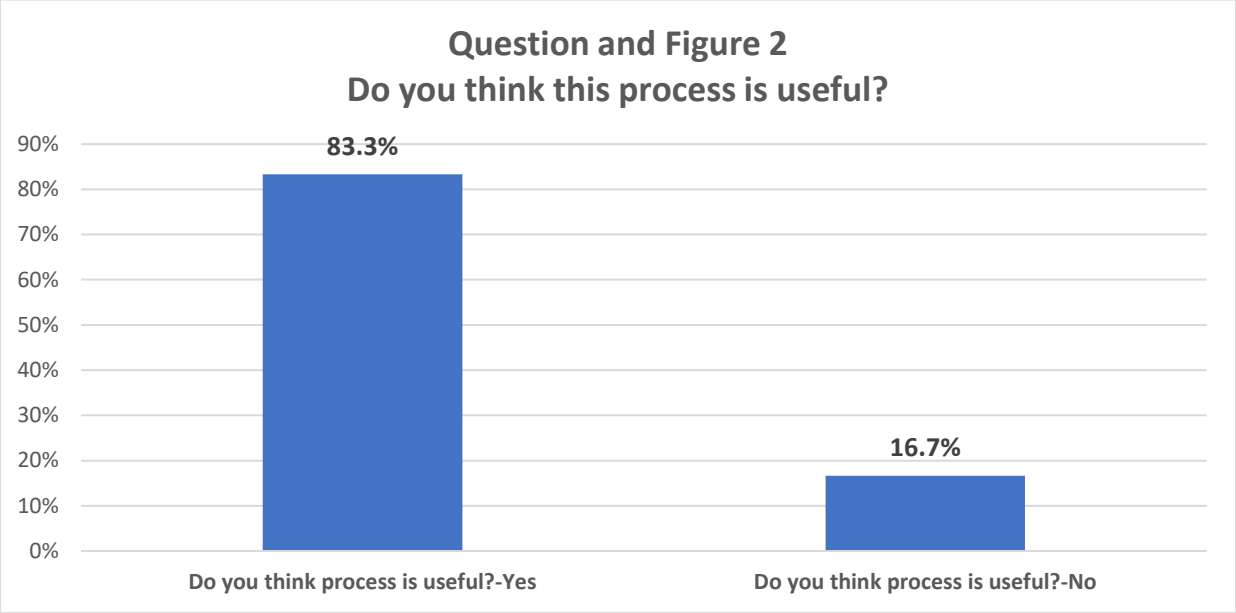
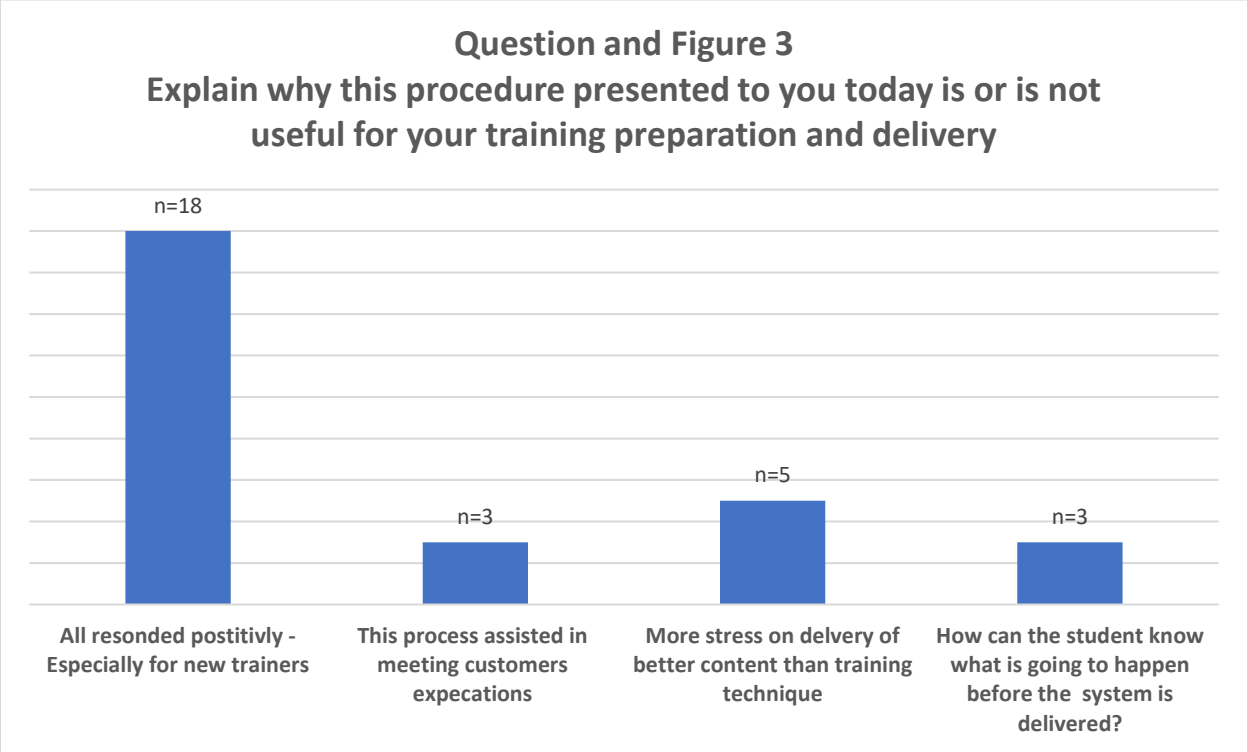

Question and Figure 1b
What do you find best and most useful about your favorite training technique?
16
14
12
10
8
6
4
2
0
n=15
n=3
n=7
n=5
n=8
They liked or would use or have used a process like the one presented, the trainer should be SME
They used a process like the one presented and can modify their approach to a particular assignment based on the needs and abilities of the students as well as goals of management
Won't use this plan and/or don't use any plan when training
Different scenarios require different planning processes
One size does not fit all

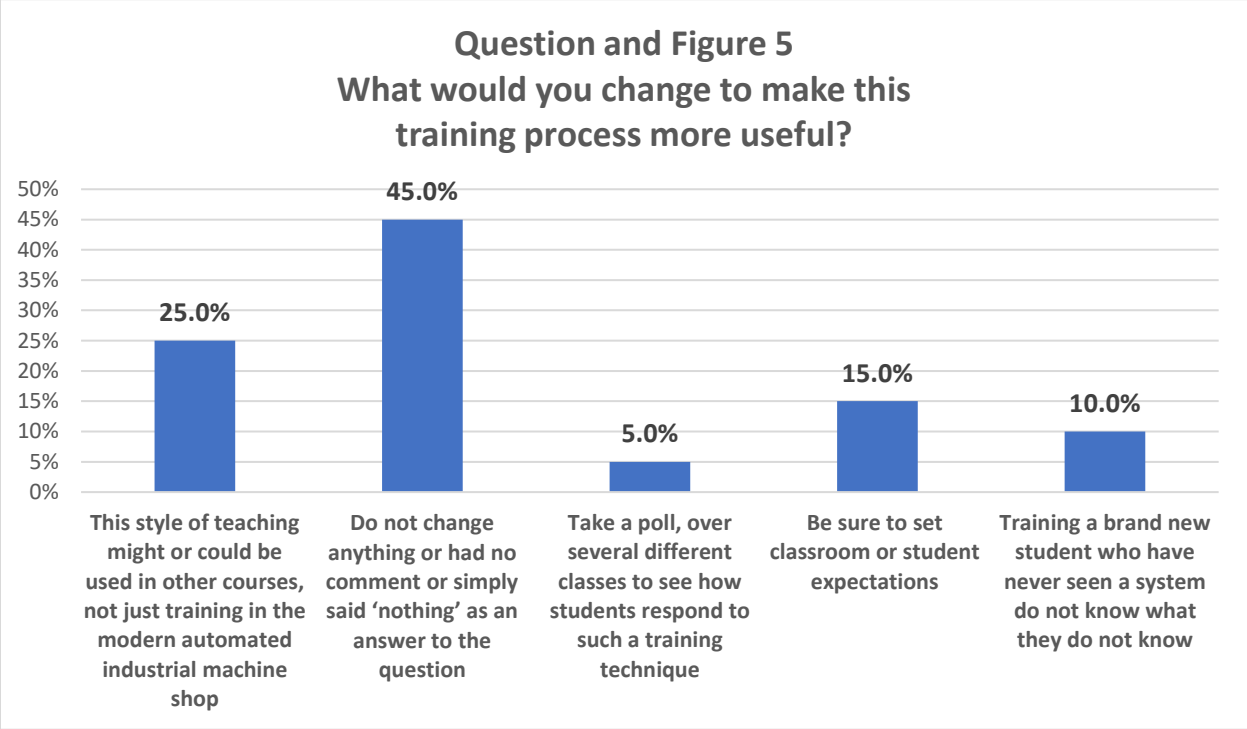
Figure 2, shows 83.3%, from just one group of answers, stating the BTT is useful.



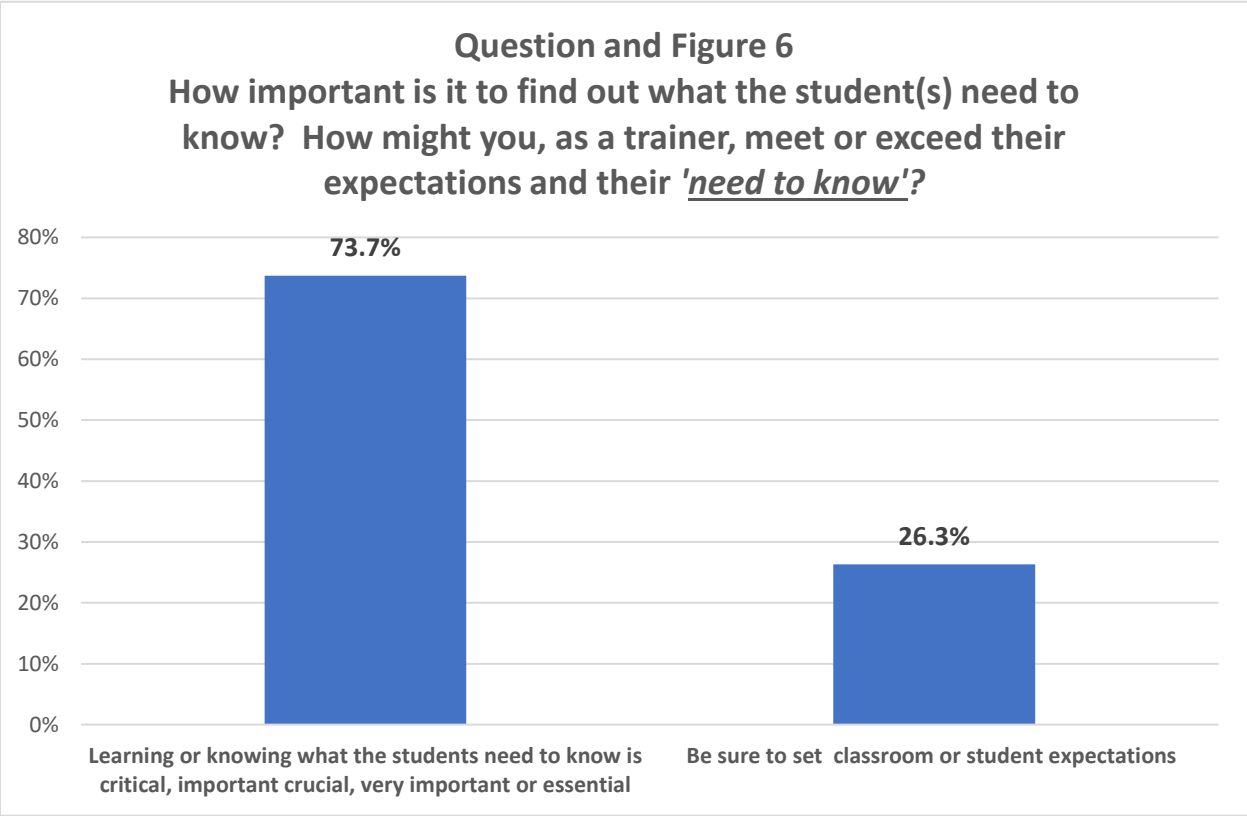
All respondents (100%) said that new trainers could successfully use this tool, as illustrated by question 3.



When asked what to change, figure 5 shows that 70% of the respondents said the BTT is useful as it is and could be used elsewhere.



The BTT is built on elements of andragogy, specifically the “need to know” which is the first element of andragogy. As shown in Figure 6, Almost 74% of the students thought the trainer must know what the students “need to know” and deliver it.



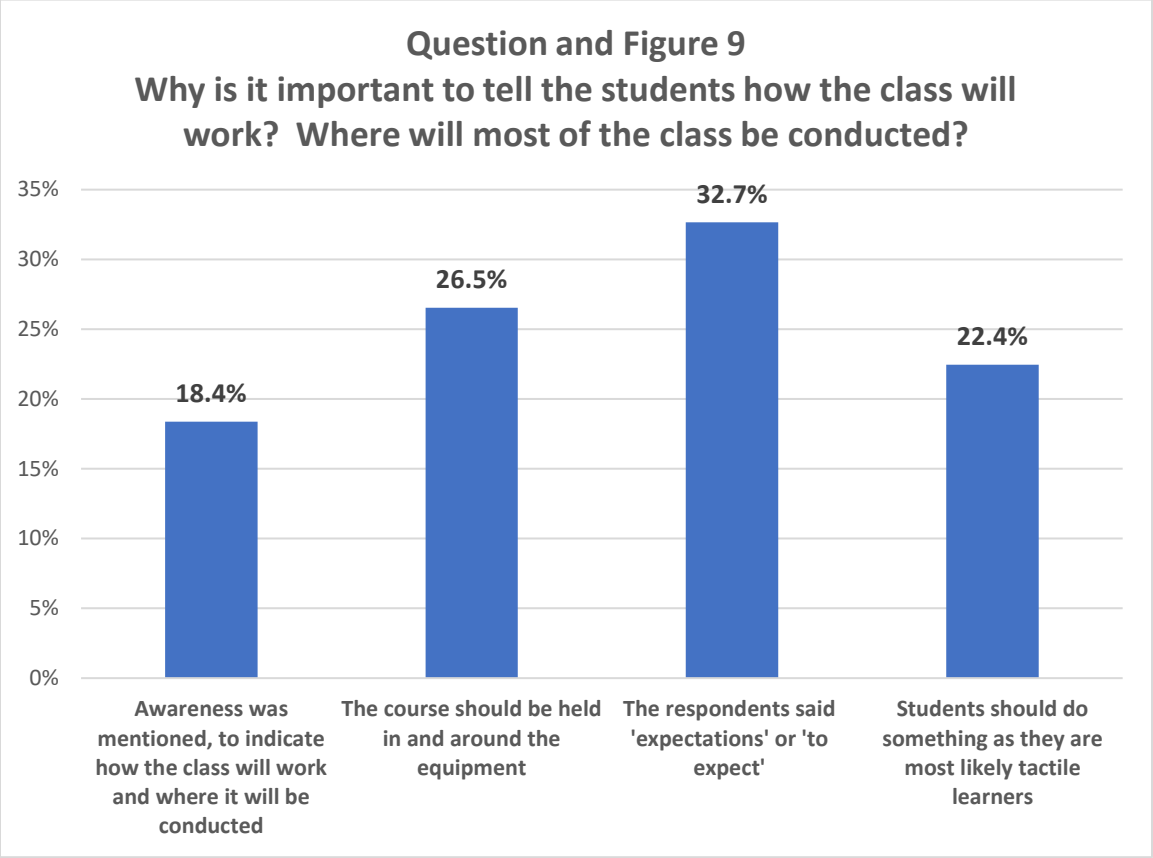
This review indicates that the respondents had a positive experience when applying the BTT to their training classes. Several respondents asked an interesting question: What if students are so new to the industry, “they don’t understand anything?” Knowles addresses this question by noting andragogy is not so rigid that it cannot turn to pedagogy or traditional Instructor Lead Training (ILT) if the situation requires (Knowles, Holton III, & Swanson, 2015).

The respondents reported that adults genuinely like to solve problems rather than be only lectured to, or read to, or ignored (see Chapter 4 on page 7, paragraph 2). This shows the BTT process of problem solving is appreciated by both the training staff and students (this supports the discussion of andragogy by Knowles et al., 2015).

There are the expectations of the plant management, student, and the trainer. The "need to know" can and should be discussed with management and the operators, if allowed. These preliminary discussions can help build rapport and give a sense of urgency to the training. The trainer understands the importance of learning what the customer needs to learn. If the trainer asks the customer, "What do they need to know?" and then the trainer tells the customer, "I will teach this," then the need becomes an expectation. Conversely, the trainer may have expectations as well, classroom practices, hours for class, process of instruction; these and others can be the trainers' expectations. These management, trainer, and student-centric expectations can be codified into a rubric. Expectations help create and are a major part of the rubric creation, in keeping with making training class-centric and topic-specific. Rubrics, if built correctly, are formed of a collection of expectations primarily from the students and students' managers as well as the training staff, for the curriculum.

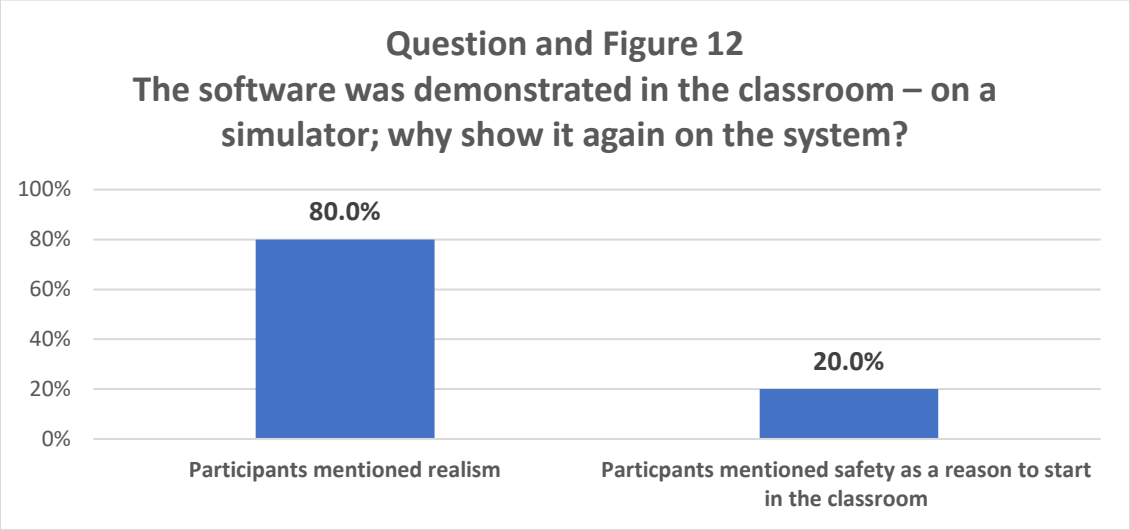
As indicated previously, part of the class is demonstration of the software system in the classroom on a computer. The classroom is a preparatory process in software demonstration because the actual operation of the machinery cannot be shown. After the classroom demonstration, the class goes to the actual, physical system. Figure 9 shows that when columns one, two, and three are added together the responses are almost 80%, the respondents thought this sequencing was important to show realism in the software when demonstrating it in the

classroom, then the students will see the software is “real” when they get to the physical system.



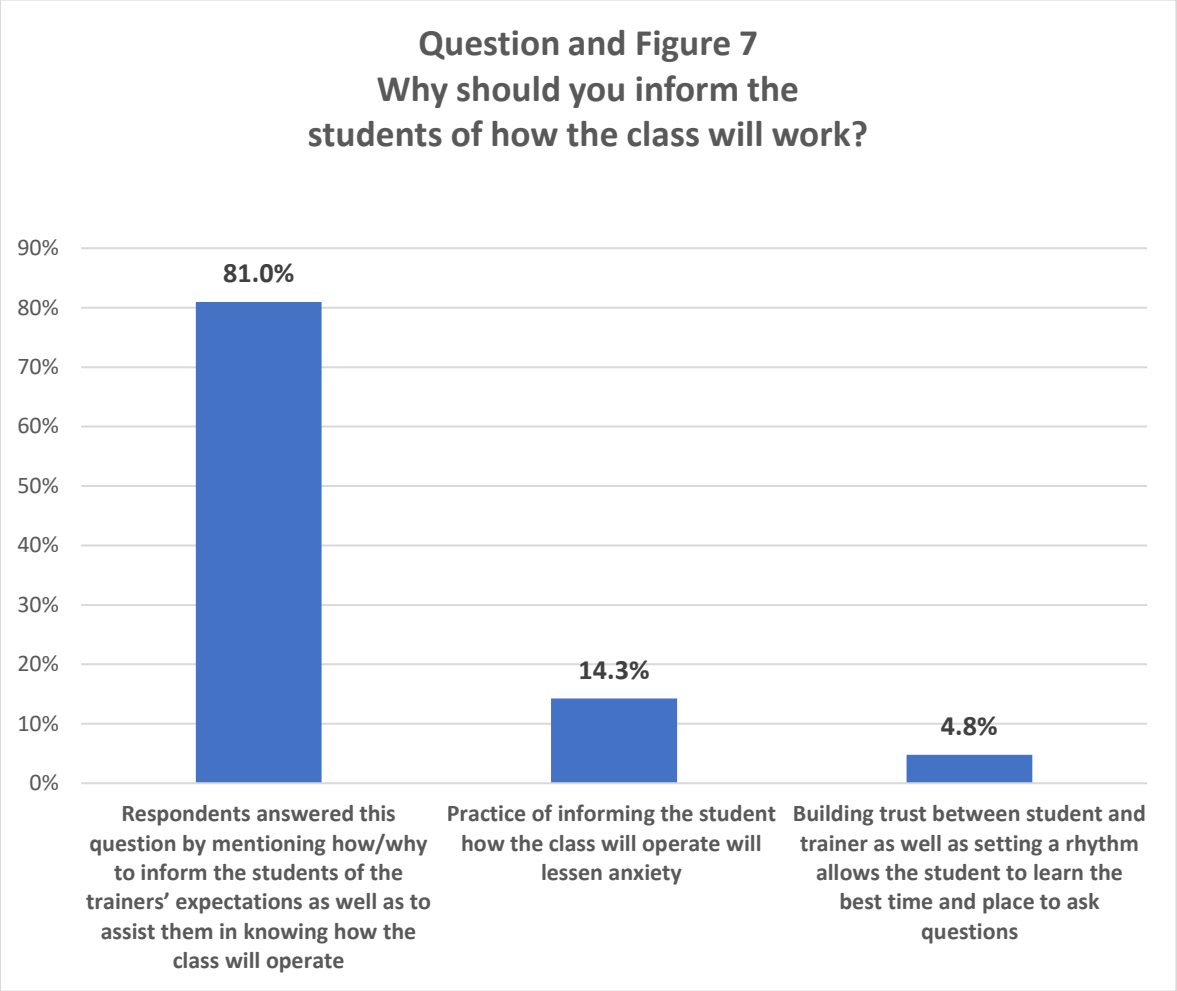
Again, in figure 12, the remaining 20% cited safety concerns for starting in the classroom. There are a few things which cannot be demonstrated in simulation in the classroom. Therefore, the class moves to their workstations on the production floor and begin to learn from

the real industrial system.



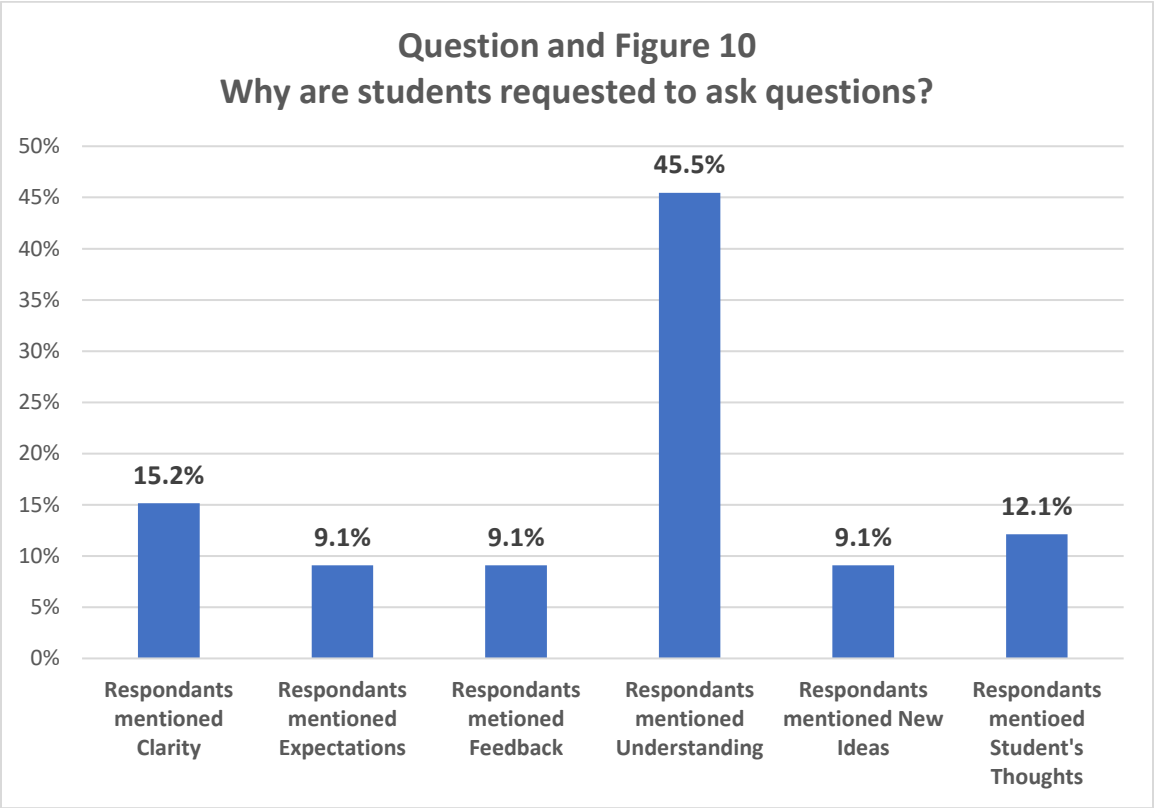
When delivering a block of instruction which is relatively short, lasting a few days to a week, it is important that the instructor introduces how the class will operate. The data shown in figure 7 is that 81% of the respondents thought it is a good idea to inform the students of the operation or “lay of the land” as well as some housekeeping rules and procedures. Some respondents’ data showed that, again in figure 7, 14.3% thought this practice would help lessen anxiety. Lastly, when explaining how the class will operate, its tempo and expectations, will

also act as a trust building exercise, almost 5% of the data showed this in Figure 7.



Verifying students understand a topic or newly presented idea will require discussion or demonstration. Part of discussion is questioning which helps answer the "need to know." In the questionnaire the respondents indicated a variety of reasons for questioning. The most common reason for questioning is for clarity and understanding as shown in Figure 10. If clarity and understanding are the same, then 60.7% of respondents would say students ask questions for clarity and understanding (columns one and four added together). When students ask questions, it can have different reasons. Most, 45.5%, of the respondents suggest if students ask questions, it indicates or assists in their understanding. One group, 15.2%, felt students should ask

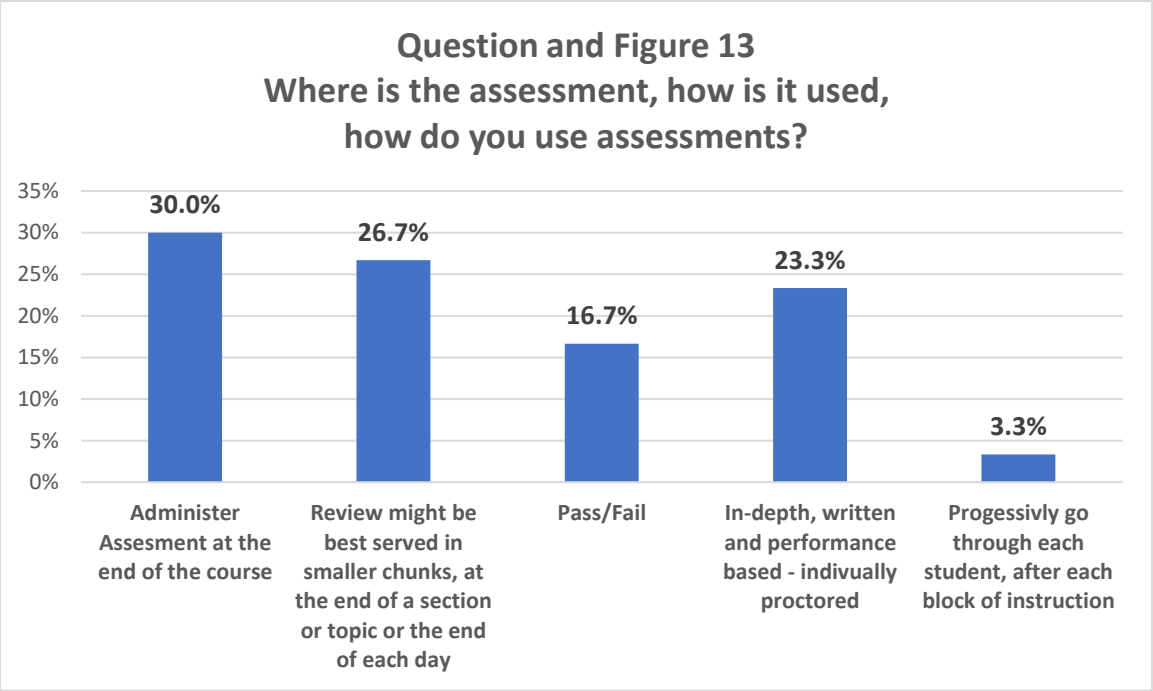
questions for clarity. Another group, 12.1%, felt it exposed the students' thought. The last three groups, 9.1% for each, felt the benefit of students asking questions was: meeting expectations, gathering feedback, or getting new ideas.



Assessment

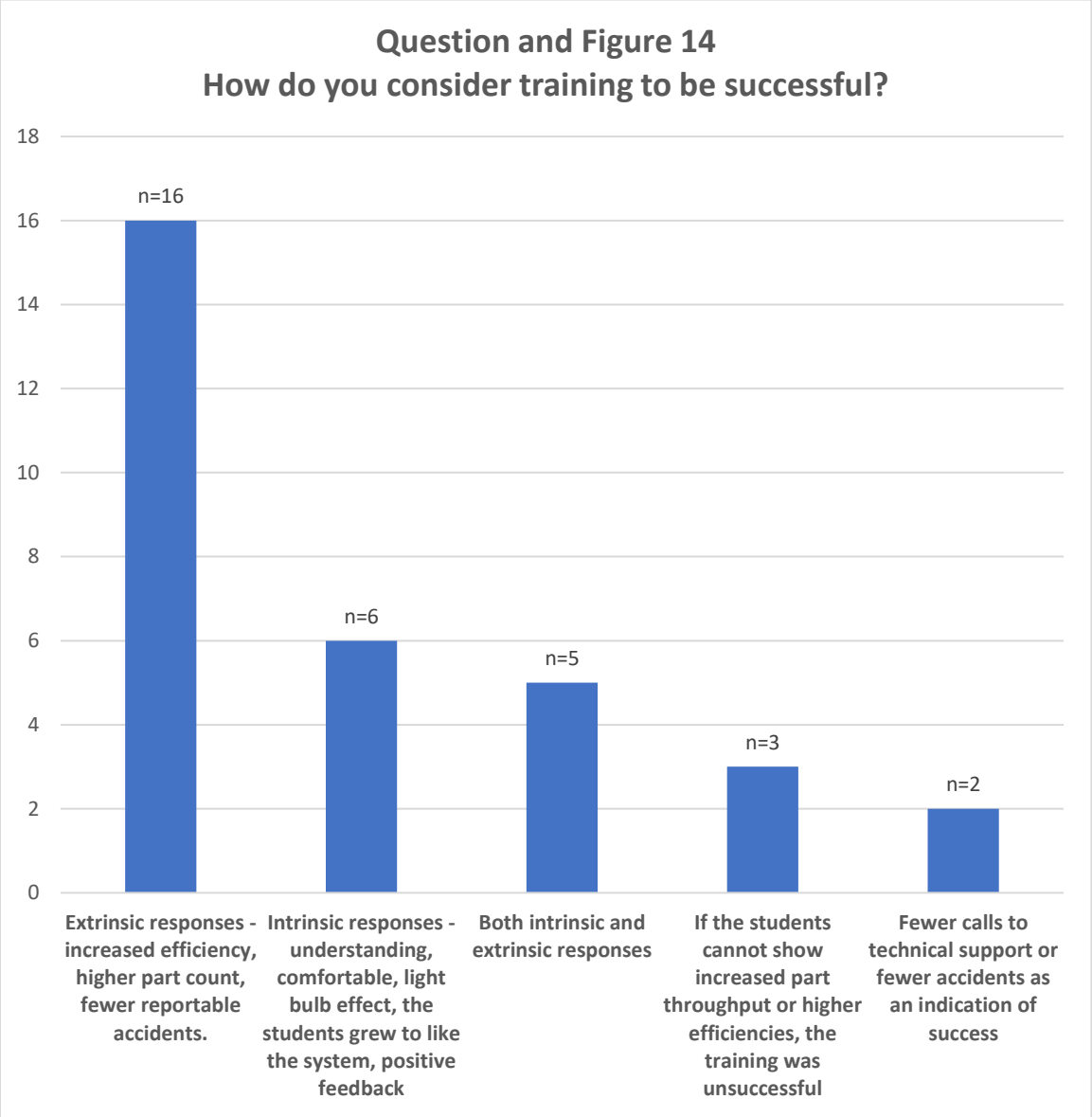
The presentation, content, and delivery of training materials are always important. How do trainers know if the training is useful and retainable? How is this learning phenomenon then measured and assessed? This was the question the respondents were asked: Where is the assessment, how it is used, how do you use assessments? When asked, 30% of respondents said; assessment of some sort should be administered at the end of the course Figure 13. Another group, only slightly smaller, 26.7%, said a review and an assessment should happen at the end of

each day or the end of major blocks of instruction. In-depth, written and performance-based, individually proctored assessment were suggested by 23.3% of the respondents. A simple Pass/Fail practical exam should be given, say 16.7%. Lastly, 3.3% of respondents suggest the instructor progressively go through each student, after each block of instruction. Verifying students understand a topic or newly presented idea will require discussion or demonstration.



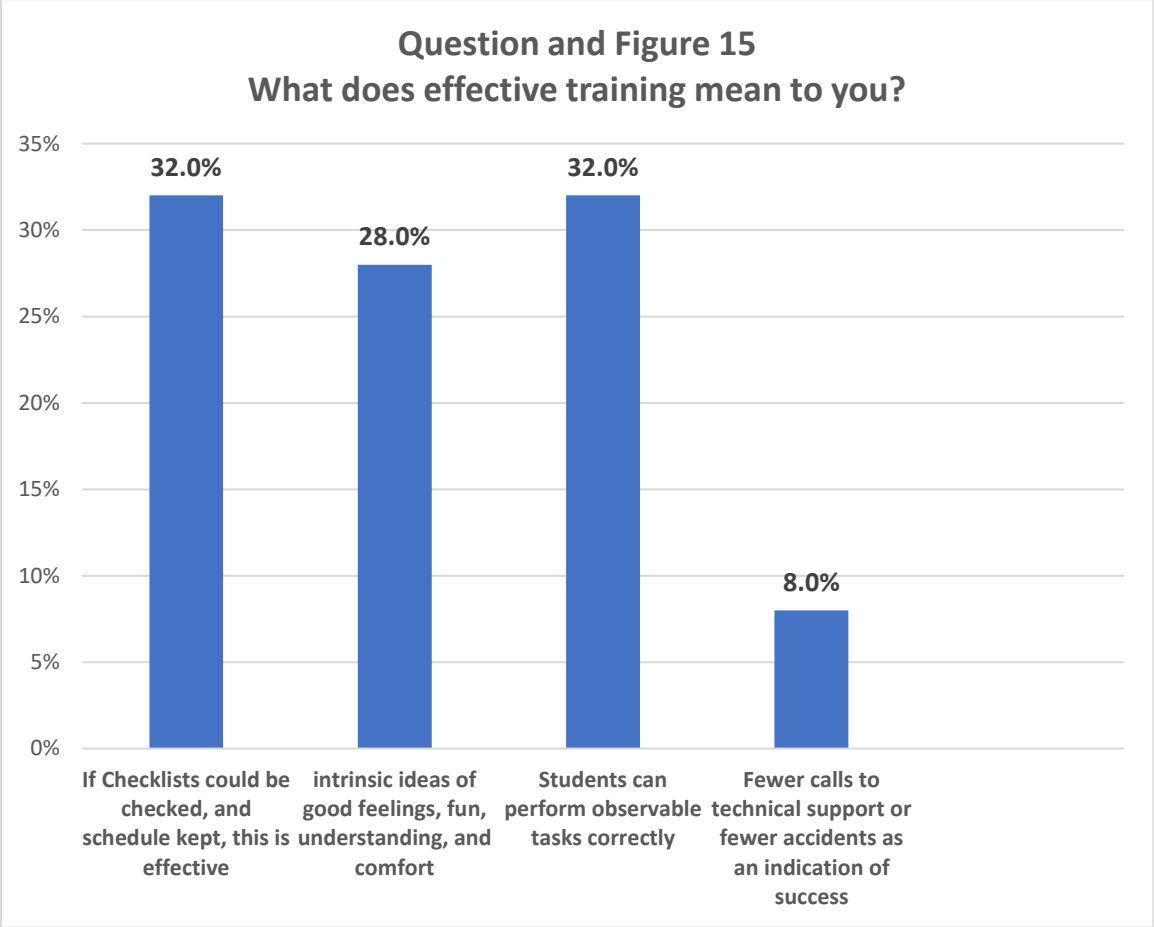
The respondents said in an overwhelming voice (16 of 18), as shown in Figure 14, the BTT is a successful training means towards increased efficiency, higher part count, and fewer reportable negative incidents. Then (six out 18) suggest a more intrinsic approach to success, such as greater understanding, comfort level with the system, greater insight, students grew to like the system, and positive feedback. Eighteen suggest both intrinsic and extrinsic measures should be used to show what successful training looks like — if students cannot show an increase of throughput and higher efficiencies, then the training was unsuccessful. Lastly, two respondents said a class is successful if there are fewer technical support calls after a class was trained. Does successful training mean quality? The quality manager implied, when training,

doing something that works and repeating it is an action of quality in training.



After discussing what "successful training" looks like, the idea of "effective training" was discussed. These answers seem to harken back to the checklist and project management mentality of our company's training process. Four groups, as shown in Figure 15, noted: checking a topic off a list once aired (32%), gauging the level of intangibles, like fun and comfort and good feeling (28%), and when the student can perform a task or tasks successfully,

then class was effective (32%). Additionally, 8.0% said fewer calls to technical support and fewer accidents are proof of effective training.



The manufacture of these systems is extremely safety conscious. Safety is part of all the various classes which are taught. The various safety procedures and fault recovery processes are explained, demonstrated and then all the students must be able to explain and demonstrate how to recover from the various faults and system errors which may occur. This is often a fun part of the class as the instructor can plant "bugs" in the software, cover sensors with tape and disable other parts of the system and have the students hunt down the issue. In question 11 ("What happens during the first tour of the system with the class?"), nearly 83% of the respondents said error correction is a very important part of the class.

Implications for Practice

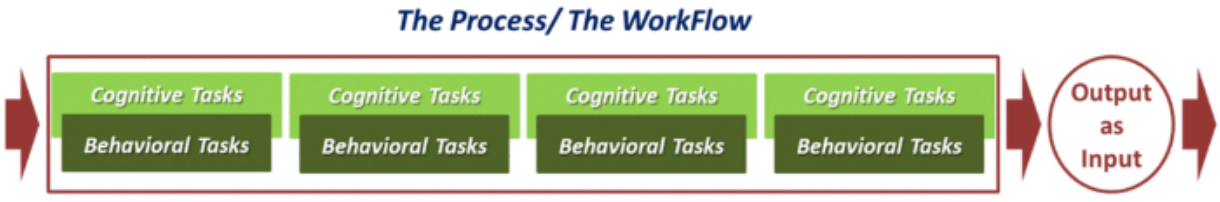
Setting expectations comes up often in this work. Based on this study, and the BTT, the following expectations are evident in the experience of delivering training. Due to the operational tempo and scheduling, time is a commodity of which trainers are in short supply. Scheduling time to speak with the customer and their students may not happen until the morning of the first day of scheduled training. Sometimes the answer to, “What would you like me to expose or train your employees to while in class?” is, “Just show them everything!” or “Give them what they need!” Then there are cultural differences, some parts of the United States of America have lots of Spanish or Hmong or Vietnamese speaking people, along with the language one must work within the culture as well. This tells me that expectations of the owner of the equipment, the students, and their managers must be queried to learn what exactly they “need to know.” This “need to know” is the first principle of andragogy ("What Are the Six Principles of Andragogy?," 2020). Further, this process of gathering and discussing expectations, requires additional blocks of time, added to the overall project of sales and installation of this systems. Time and space must be added for the training team to work and work properly and add value to the sales and production process. This could mean interviewing the various stakeholders, the plant owner, and team managers such as operations, maintenance, and supply, plus interviewing the students which can be from operations, engineering, and maintenance departments. Trainers should ask open ended questions, get feedback, come up with an initial plan and finally submit the topics which will fill the customer’s expectations of “need to know.” The respondents mentioned, if not extoled, the virtues of expectations in questions: 2, 5, 6, 7, 8, 9, and 10.

Where could this study go?

This study could develop into use in general skill classes. As the BTT is polished overtime, it could be used in academic, medical, dental, general industry, specific industry, military, even in psychotherapy types of training. Once a basic skill is taught, any new skills required could be condensed and taught using the BTT to accelerate and enhance training efforts.

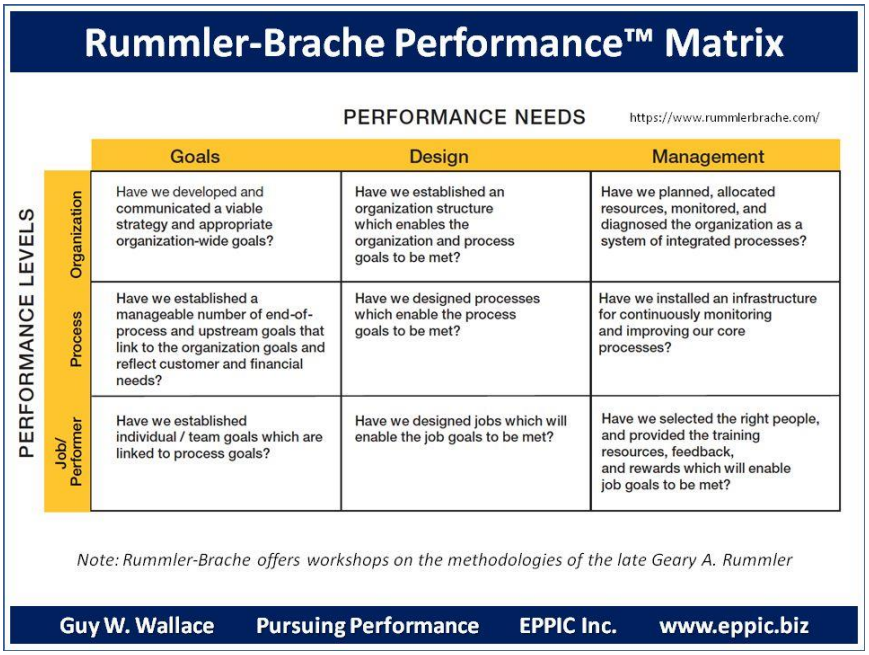
Another leg, a fourth leg, could be added to the three-legged stool included in this dissertation of andragogy, assessment, and quality in the automated industrial workplace: performance improvement. Adding the ability to teach a performance enhancement process seems to be very direct. Here are a few performance improvement training methods. One of the co-authors of *The Adult Learner*, Dr. Swanson is a huge proponent of *Analysis for Improving Performance* which is also the title of his book. Moving from merely training a skill or skills to training to do skills expertly and quickly.

Another performance enhancing proponent is the training company known as EPPIC Incorporated. Wallace's work is a re-do of ADDIE with a strong twist to performance. The Performance-based Modular Curriculum Development process maps out the ADDIE process, but it adds one more step. The steps in this process are broken down into six phases: phase 1, Project Planning and Kick-off; phase 2, Analysis; phase 3, Design; phase 4, development/acquisition; phase 5, pilot test; and phase 6, revision & release. Each one of these phases are to have a behavioral component as well as a cognitive component.



Notice how each output of the cognitive/behavioral task is an output and an input for a cognitive/behavioral task. Cognitive tasks are performed before, during and after the behavioral task (Wallace, 2021, expression 4). Wallace states, “When the desired behavior is analyzed and quantified, performance increases.” This is known as performance competence (Wallace, 2011).

Not only are tasks to be learned and performed, but they are to be done correctly, quickly, and thoroughly. This is another example of their training materials: there are lots of overlap shown here and to what we know as andragogy.



A newer, even more modern look at adult learning theory is one by Dr. Mezirow. Mezirow says that transformative learning theory (TLT) has two basic focuses:

> Mezirow says that transformative learning has two basic focuses—instrumental learning and communicative learning. Instrumental learning focuses on task-oriented problem solving, and evaluation of cause-and-effect relationships. Communicative learning focuses on how people communicate their feelings, needs, and desires. Both of these elements are important in transformative learning—students need to be able to focus on different types of their understanding and view new perspectives that are both logical and emotional in order to challenge their previous understanding.("New Adult Learning Theory," 2020, para. 5).

Clearly this has performance and cognitive as well as behavioral aspects to it. Transformative learning theory should be placed with or alongside andragogy to make a better more deliverable classes, mainly as it is experiential-based learning. When one looks at the four phases of Mezirow's work, it is apparent to me this process could merge well with andragogy: The four phases are: (a) having experiences; (b) making assumptions; (c) challenging perspectives; and (d) experiencing transformative learning.

When I was first exposed to andragogy, I was amazed at the parallels between it and Neuro-Linguistic-Programming (NLP). NLP and andragogy use the same terms and phrases — with the same meaning. Both are aware of the various learning modalities of visual, auditory, and kinesthetic learning modalities (VAK). In recent articles concerning andragogy and learning modern skills there are many examples of VAK and adult learning; "The convergence of learning techniques in question is a visual learning style, auditory learners, and kinesthetic learners that lead to the acceleration of knowledge supported by media and technology in utilizing data and communication" (Firmansyah, Siswanto, Roekhan, & Priyatni, 2020, p. 9539). Even in teaching dance using andragogy and respecting the visual and the kinesthetic learning modalities "She notes how mirrors influence the relationship between dancers' kinesthetic and visual narratives of their movement experiences. The complexity of this sensorial feedback loop provides an example of the dancers' multiple attentions" (Henley & Conrad, 2021, p. 2). Even during the COVID pandemic, andragogy and VAK skills were used to teach psychomotor skills in a virtual classroom; "The student had to think about and explain these steps to the instructor and participant, creating opportunities for kinesthetic, visual, and explicit learning" (Plummer, Smith, Cornforth, & Gore, 2021, p. 9). In NLP, VAK is an important learning modality as well. When applying various NLP techniques or while observing someone as they illicit a response to

a question, watching their eyes can give cues to which modality (VAK) they favor (Bandler & Grinder, 1979). I have seen that there are many examples of NLP that have been used in learning and change development. From Bandler and Grinder's seminal tome *Frogs to Princes* to later works like *NLP Essential for Teachers* by Becheral and *The NLP Tool Kit: For teachers, trainers and school leaders* by Terry and Churches, NLP along with the BTT or NLP with andragogy should be explored for the possible assistance it could give to bolster the BTT.

The focus of this research was done with trainers who trained people in the modern industrial automated machine shop. Might the BTT be used elsewhere and in other industrial environments requiring a dynamic training process? I think it could.

Can NLP and BTT be used together to make the BTT more effective? There are similarities in word choice and structure.

Conclusion

The data supports that the BTT is a viable and useful tool for training. The respondents and their data in this dissertation further showed, by adding and enforcing the "need to know" with more emphasis on the collection and codifying of the students and their management's expectations, the BTT could be an even better tool for trainers. If a trainer can know their product, know what is needed in the point of view of a student, then teach this in a uniform and reproducible way, training will be looked at as a major contributor, like engineering, marketing, and service is now.

In developing the BTT it seems to be that industrial training is a bit of an art and a science. Any competent trainer will have their go-to method. Often trainers have many roles to

fill including: an educator, a trainer, a counselor, a project manager, comedian, a bit of an electrical controls engineer, phone support, and confidant.

Assessment helps the learning process directly and indirectly and must be included. In assessment not only does the trainer learn how well the class did, but the trainer can also learn a lot about the teaching process. If the trainer employs a test analysis system, and adds data to the system regularly, the training can see where one should step up the game to be a better trainer.

With a bit of polish and adding the suggestions of the respondents (my peers) to the BTT, it can a great training tool. I recommend using the process in all industrial environments, not only machine shop applications. Once this is learned and used, I think training for adults will become clearer and simpler and more effective. Cosmetology, any industrial art class, carpentry, plumbing, electrician work can be supplemented or done completely using the BTT. Any skills-based, student-centric process which requires a certain behavior, in and at certain times would benefit from the BTT.

Appendix A

Assessment

TRAINING EVALUATION FORM

Course name:_____
Instructor: _____ *(Please fill out one for each instructor)*
Date: _____

Training Quality					
The overall quality of the training I received was high	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
This training will be beneficial to me in the performance of my job	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
Course Presentation					
The methods of content delivery (lectures, PowerPoints, etc.) were appropriate for this course.	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
The course material was easy to understand and helpful.	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
The topics were presented in a logical order.	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
The vocabulary used in the course was clear and easy to understand.	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
The instructor was knowledgeable and effective.	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
Course Objectives					
The course covered the material I expected.	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
The times scheduled for the agenda items were appropriate.	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
The course met the training objectives.	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
The course met my training needs.	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*

- The greatest strengths of the course are:

- This course could be improved by:

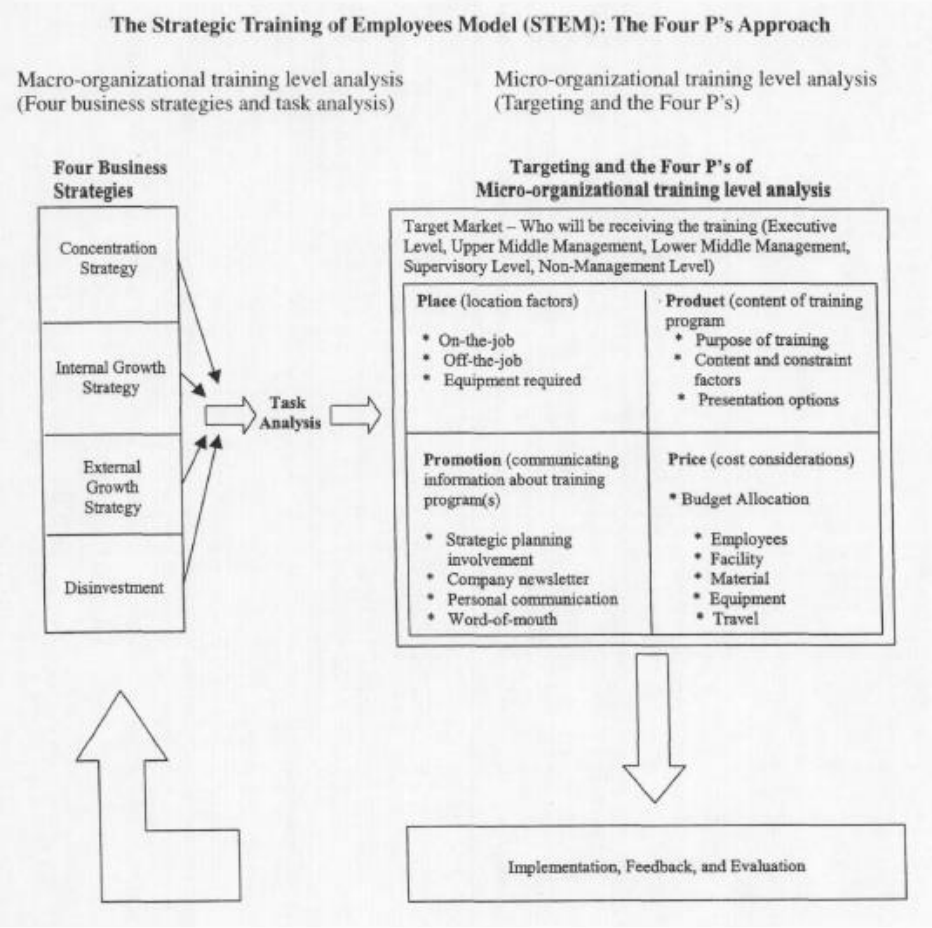
- Any other comments:

This is an example of a student-focused evaluation of a course.

Figure B1, Training evaluation form. From “Evaluation Templates,” 2020, p. 1

Appendix B

Andragogy, Quality, and Assessment

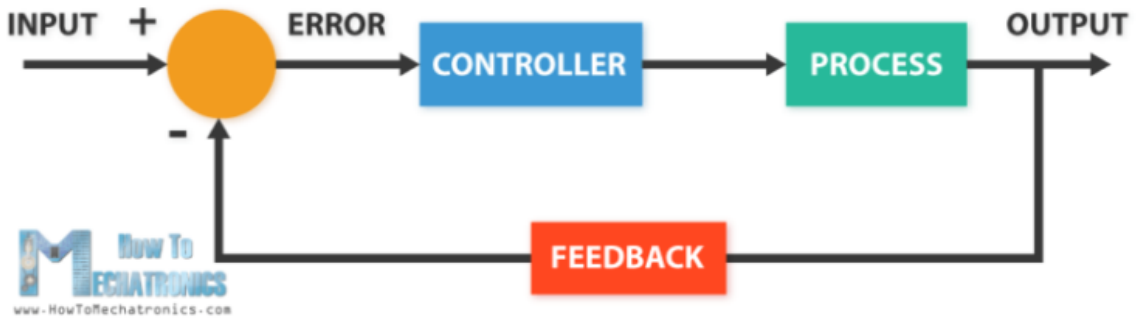


This is a training model, from the company level viewpoint to the student-level viewpoint.

Figure C1, The four Ps approach. From Wentland, 2003, p. 63

Appendix C

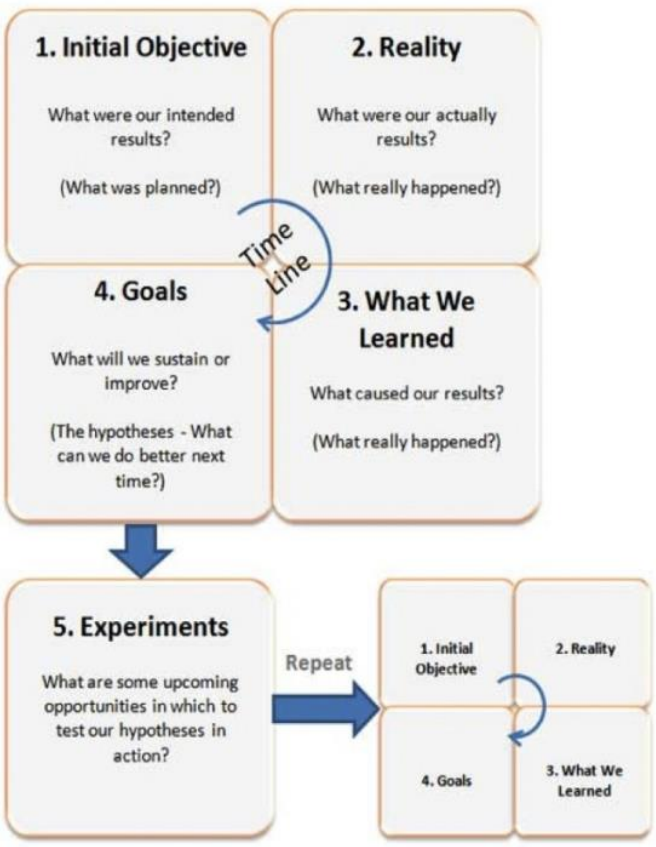
Andragogy, Quality, and Assessment



An example of a feedback loop, used in motion control or actuator control, is shown here to show how feedback is useful information used to correct and move the trainer, their delivery, and information onto the right course.

Figure C2, Servo loop process. From How to Mechatronics.com, 2019

Appendix C (cont.)
Andragogy, Analysis, and Assessment



The AAR process is explained graphically.

Figure C3, After-action review (AAR). From Foster, 2014

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