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Janet Z. Burns
Georgia State University

Karen Schaefer
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Jessie M. Hayden
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Trade and Industrial (T&I) teachers take on numerous roles in order to work effectively in their schools. Among their many roles they are program managers, instructional designers, facilitators of learning, and student advisors. To successfully perform these roles, they, like all teachers, master a myriad of complex skills, skills which fall into at least four categories. Danielson (1996) defines these categories as planning and preparation of instruction, creating a supportive learning environment, engaging the students in instruction, and taking on professional responsibilities outside of and in addition to those in the classroom.

Customarily, new teachers complete formal training programs through coursework, workshops, student teaching, and other structured events before they obtain certification or licensure. These formal training programs are designed to produce explicit knowledge (Knight, 2002). This knowledge, in turn, is intended to prepare the new teachers to take on all the roles required of them in their future classrooms and laboratories. Traditionally, teacher educators have assumed that teaching skills are learned through formal programs. However, research from corporate training settings suggests that many job skills are learned on the job through more informal methods (Enos, Kehrhan & Bell, 2003).

Burns is Associate Professor, Hayden is Clinical Instructor, and Schaefer is retired Clinical Instructor in the Department of Middle Secondary Education and Instructional Technology at Georgia State University in Atlanta, Georgia. Burns can be reached at jburns@gsu.edu.

Theoretical Development and Research

Formal versus Informal Learning

Formal learning is defined as learning based on direct instruction in which learners engage in lectures, discussions, simulations, role-plays and other structured activities. These activities are based on specific learning objectives and are designed to enable students to master predetermined outcomes. Typically this instruction is removed from the day to day work setting (Enos, Kehrhan & Bell, 2003). Prior to the student teaching experience, pre-service teachers enrolled in traditional teacher training programs spend the majority of their time engaged in these types of formal learning activities.

In contrast, informal learning has been defined as learning that is predominately unstructured and that takes place outside an institution of learning. Informal learning occurs spontaneously within the context of real work and is not focused on specific learning objectives nor does it lead to predetermined outcomes (Marsick & Volpe, 1999). Informal learning happens through trial and error, mentoring, networking, and other self-directed learning modes. It is learning composed of action and reflection (Watkins & Marsick, 1992) and is the result of individuals' making sense of experiences they encounter during their daily work lives (Marsick & Volpe, 1999).

In recent years, there has been growing criticism of traditional teacher education programs which some critics contend embraces a theoretical approach that leaves graduates ill prepared for the realities of the classroom (Hartocollis, 2005). Other critics point out that there is a lack of formal teacher training programs for in-demand content areas such as math, science, foreign language, and special education as well as a lack of graduate faculty to train teachers in these critical needs areas (Boehner, 2004). Still others note that current teacher training programs are simply not able to provide the number of teachers needed for American schools. According to Simon (2005), "In the last five years, 500,000 new teachers have taken jobs in the nation's elementary and secondary school classrooms. In the next five, a half million more will be needed as the student population

swells and aging boomers accelerate their march to retirement" (Simon, 2005, p 27).

The federal No Child Left Behind Act of 2001 calls for a qualified teacher in every classroom by the end of the 2005-2006 school year (*No Child Left Behind Act of 2001*, 107th Cong., 1st session, Public Law 107-110). Challenges such as these have led to a movement towards alternative methods of teacher certification. Currently, 47 states and the District of Columbia offer alternative routes to teacher certification with programs, such as Teach for America, that detour from the traditional and fast-track prospective teachers into the classroom (Hartocollis, 2005). In some states, new methods of teacher certification allow prospective teachers to obtain certification by passing a standardized content and pedagogy test, thus side-stepping traditional teacher training programs. These alternative teacher education models tend to be mentor based with learning taking place mostly at the school site and away from colleges of education (Georgia Professional Standards Commission, 2005).

With these innovations in teacher training, it seems likely that increasing numbers of teachers will earn their teacher certification outside of traditional, formal learning environments and possibly garner the necessary teaching skills through informal learning methods. While research focused on the impact of informal learning in the corporate workplace is on the rise (Marsick & Watkins, 1997; Marsick & Volpe, 1999; Watkins & Marsick, 2003), there is a lack of investigation of its impact in the school environment. Research in informal learning in the corporate environment began appearing in the literature in the 1980s (Edwards & Usher, 2001). Several studies have suggested that informal learning is pervasive in the workplace (Enos, Kehrhahn & Bell, 2003). Other research goes as far as to say that while some structured workplace learning occurs, informal learning comprises the majority of workplace learning (Fox, 1997; Leslie, Aring & Brand, 1998; Lohman, 2000). However, despite the recognition of the part played by informal learning in the corporate environment, little research has been conducted in the area of informal learning in teacher education programs, specifically in the area of trade and industrial (T&I) teacher education. A search of the literature revealed only one

exploratory study of T&I teachers enrolled in an alternative teacher certification program (Burns & Schaefer, 2003). This preliminary study concluded that T&I teachers learned informally at their school workplace while enrolled in formal university education coursework.

In the study of informal learning conducted by Burns and Schaefer (2003), provisionally certified T&I teachers reported that they had engaged in informal learning their first year on the job. The informal learning they reported ranged from practical "how to" techniques for classroom management to more subtle awarenesses of their particular school's culture. The teachers also reported learning skills informally that helped them maintain their own personal and emotional balance (2003). The informal learning in this study was categorized as instrumental, emotional and political (Brookfield, 1995). Instrumental learning covered topics pertaining to classroom management and instructional skills. Skills that aided in preserving personal and emotional balance fell in the category of emotional learning. Those skills that helped teachers develop an understanding of the underlying culture that forms a school's political agenda were categorized as political learning. Participants in the study indicated that in their first year of teaching some form of informal learning had occurred in each of the three categories. One of the findings of that initial study is that although informal learning occurs for new T&I teachers, it is stimulated and augmented through formal learning techniques. "While informal learning plays a role in the lives of new T&I teachers, informal learning is not a substitute for structured training or education. Often learning is much more productive if it is planned and facilitated" (Burns & Schaefer).

Proficiency

Proficiency can be defined as the ability to skillfully apply knowledge within a particular domain (Sheckley & Keeton, 1999). In order to measure proficiency, a set of competencies within the selected domain must be identified prior to testing. In the field of education, there are a variety of sets of competencies for the various content areas. A general set of competencies applicable for teachers of all disciplines and grade levels has been developed by the Interstate New Teacher Assessment and Support

Consortium (INTASC) (Campbell, Cignetti, Melenyzer, Nettles & Wyman, 2001). The competencies are organized in a set of ten standards. The ten standards are Standard 1, knowledge of subject matter; Standard 2, knowledge of human development and learning; Standard 3, adapting instruction for individual needs; Standard 4, multiple instructional strategies; Standard 5, classroom motivation and management skills; Standard 6, communication skills; Standard 7, instructional planning skills; Standard 8, assessment of student learning; Standard 9, professional commitment and responsibility; and Standard 10 partnerships (cited by Campbell, Cignetti, Melenyzer, Nettles & Wyman, 2001).

Purpose of the Study

Trade and industrial teachers enter the classroom as content level experts who may have acquired their content expertise through a combination of formal industry training and informal on-the-job experiences. When they make the career transition from industry to teaching, they must acquire professional teaching competencies. Like the content competencies, these teaching competencies may also involve both formal and informal learning experiences, particularly because the majority of T&I teachers are employed by schools and begin teaching while simultaneously attending alternative teacher preparation programs. For new T&I teachers, formal teacher training in the area of pedagogy before entering the school workplace is the exception rather than the norm (Crawford-Self, 2001).

The purpose of this study is two-fold. First, this study aims to add to the body of research in informal learning by focusing on the school workplace rather than the corporate workplace. Secondly, this study builds on an exploratory study which discovered that informal workplace learning takes place with novice T&I teachers (Burns & Schaefer, 2003). The current study was designed to learn more about which teaching competencies new T&I teachers learn formally versus which they learn informally, and the relationship of the learning method to the teachers' perceived proficiency in core teaching competencies. The following research questions were addressed by this study:

(1) To what extent did new T&I teachers enrolled in an alternative certification program learn the program's core teaching competencies through formal or informal learning?
(2) To what extent did new T&I teachers enrolled in an alternative certification program perceive their proficiency of the program's core teaching competencies?
(3) What is the relationship of perceived proficiency with the extent of informal learning or formal learning for new T&I teachers?

Methodology

Subjects

An "availability sampling" approach (Keppel, Saufley Jr., & Tokunaga, 1991) was used to represent the target population of this study. This approach permitted exploration of the perceptions of a group of T&I teachers who were all completers from two separate years of the same year-long alternative teacher training program conducted at a major university located in the southeastern United States. The alternative program enrolls T&I teachers who are provisionally certified but who have not yet fulfilled the state requirements for fully renewable teaching certification. All participants in the study were employed full time as T&I teachers while enrolled in an alternative certification program. The participants teaching experience in a T&I secondary education program ranged from one to three years. All subjects were adult learners who ranged in age from 28 to 54 years.

In the alternative certification program, the T&I teachers spend fifteen semester hours on a university campus in coursework structured through formal learning experiences. An additional nine semester hours consist of field practicum in the school where they are employed. The field practicum is designed to foster informal learning opportunities and reflective practice (Schon, 1996).

Table 1
Core teaching competencies for trade and industrial teachers

Item #	Competency
1.	Write instructional objectives at different levels of cognitive, affective and psychomotor domains of learning.
2.	Develop lesson plans based on vocational content, county curriculum, and state mandated QCC's.
3.	Analyze a learning task and include all prerequisite knowledge as well as all steps.
4.	Set up a grading system.
5.	Maintain records and paperwork.
6.	Develop evaluation techniques and measures.
7.	Implement a classroom and/or laboratory management plan that includes student participation.
8.	Use pro-active classroom/lab management strategies versus reactive strategies.
9.	Recognize ways to involve students through social, interactive, and active participation.
10.	Establish an environment conducive to learning in a vocational program.
11.	Handle discipline problems.
12.	Set up a variety of activities such as whole class discussion, small group discussions, panel discussions, brainstorming, buzz groups, task groups, cooperative learning groups, role-play, case study and laboratory experiences.
13.	Develop questions at various learning levels.
14.	Demonstrate basic teaching competencies including transfer, establishing set, managing a block of instruction, and providing closure and transfer at the completion of a block of instruction.
15.	Understand how students learn and how to help students develop intellectually, socially, and personally.
16.	Plan a year-long vocational course.
17	Use various multi-media learning tools in presenting a lesson.
18.	Control and maintain equipment, tools, and supplies in a vocational laboratory.
19.	Display professional teacher behavior.
20.	Examine personal beliefs about teaching and begin to develop a personal teaching philosophy.
21.	Differentiate between best practices and poor teaching practices.
22.	Understand teacher liability and laws relating to teachers.
23.	Establish or maintain a vocational advisory committee.
24.	Understand the relationship between vocational and academic programs.
25.	Implement and provide a safe laboratory environment.

Teaching Competencies

In an effort independent of the present study, the researchers, who were the T&I educators responsible for the alternative teacher certification program, conducted interviews with T&I teacher supervisors and held focus group interviews with T&I teachers in order to identify essential T&I teaching competencies. In addition, the researchers examined lists of both general teacher competencies and state specific T&I teacher competences to extract a set of fundamental T&I teaching competencies. This process resulted in a list of 25 distinct core competencies associated with successful teaching in the T&I area. To conduct the study, the researchers developed a questionnaire consisting of these 25 core teaching competencies (see Table 1). The 25 core competencies that were identified were selected to address each of the ten INTASC teaching standards as well as the curriculum standards outlined and required by the Georgia Professional Standards Commission for certification in the area of T& I education (Georgia Professional Standards Commission, 2001). In addition, these competencies were specifically associated with successful completion of the alternative T&I teacher certification program in which the study participants were enrolled. Because the 25 core teaching competencies were those that the program was designed to address, study participants had opportunities to acquire the competencies through both formal methods in the academic setting of the university and informal methods on the job. This provided them a basis on which to evaluate the extent to which a competency on the questionnaire had been learned by one or the other method.

Extent of Formal versus Informal Learning
The measure of the extent of formal and informal learning was obtained by asking participants to rate the degree to which they perceived they learned each of the core teaching competencies through formal or informal learning activities. A four point scale was used that was developed by Enos, Kehrhahn & Bell (2003). The response alternatives were 1, *learned only from formal learning activities*; 2, *learned mostly from formal learning activities*; 3, *learned mostly from informal learning activities*; and 4, *learned only from informal learning activities* (Enos et al.,

2003). The current researchers provided a definition of formal and informal learning for the participants as, "formal training means competencies/skills learned in the teacher certification program, another academic course, or a staff development course while informal means on the job through trial and error or by suggestion from other teachers and colleagues." From the raw data, a median score for each of the items was calculated. In addition, for each core competency item, the percentage of the ratings that fell in each value of the four-point scale was calculated (see Table 2).

Perceived Proficiency

Participants also rated the extent of their perceived proficiency in each of the core teaching competencies. Respondents were asked to consider how well they felt they were able to perform each core competency skill and to rate themselves on a five-point scale developed by Enos, Kehrhahn, and Bell (2003). The response alternatives were 1, *extremely poor proficiency*; 2, *below average proficiency*; 3, *average proficiency*; 4, *above average proficiency*; and 5, *excellent proficiency* (Enos et al.). Again, a median score for each of the items was calculated as well as the percentage of the ratings that fell in each value on the instrument scale (see Table 3).

Procedures

The study data was collected from two separate sample groups in the spring of 2004 and 2005. The questionnaires were distributed to and completed by the participants at the close of the final program completion seminar for each of the two consecutive years. Potential participates were assured that their decision to complete the questionnaire was entirely voluntary and wholly independent of any of the grading procedures for the program. Participants were not identified by name on the questionnaires and were also assured that the content of their responses would remain confidential and would be reported in aggregate form only. Of the 55 teachers completing the teacher training program over the course of the two-year study, 85% took part by completing all sections of the questionnaires.

Table 2
New T&I teachers' assessment of the extent to which they learned core teaching competencies through formal versus informal learning
N = 48

Competency	Rating Value								
	1		2		3		4		
	n	%	*n*	%	*n*	%	*n*	%	median
1.	32	67%	14	29%	1	2%	0	0%	1.25
2.	19	40%	19	40%	9	19%	1	2%	1.76
3.	22	46%	18	38%	8	17%	0	0%	1.61
4.	14	29%	20	42%	13	27%	1	2%	2.00
5.	3	6%	9	19%	33	69%	3	6%	2.86
6.	13	27%	30	63%	4	8%	1	2%	1.87
7.	25	52%	17	35%	5	10%	0	0%	1.46
8.	14	29%	28	58%	5	10%	0	0%	1.82
9.	5	10%	26	54%	15	31%	1	2%	2.19
10.	6	13%	27	56%	13	27%	1	2%	2.17
11.	3	6%	19	40%	25	52%	0	0%	2.54
12.	27	56%	21	44%	0	0%	0	0%	1.39
13.	34	71%	14	29%	0	0%	0	0%	1.21
14.	38	79%	10	21%	0	0%	0	0%	1.13
15.	17	35%	24	50%	5	10%	1	2%	1.75
16.	15	31%	17	35%	12	25%	3	6%	2.03
17.	9	19%	14	29%	20	42%	4	8%	2.55
18.	4	8%	8	17%	23	48%	12	25%	3.02
19.	5	10%	14	29%	26	54%	3	6%	2.69
20.	11	23%	24	50%	11	23%	2	4%	2.04
21.	15	31%	27	56%	6	13%	0	0%	1.83
22.	22	46%	25	52%	0	0%	0	0%	1.58
23.	24	50%	17	35%	5	10%	1	2%	1.50
24.	6	13%	32	67%	8	17%	1	2%	2.03
25.	8	17%	15	31%	21	44%	2	4%	2.54

Percents may not add to 100 due to rounding.

Results

The numerical values of the survey instruments were used to determine whether a respondent had acquired a competency more or less formally or whether a respondent felt

Table 3
New T&I teachers' assessment of their proficiency in core teaching competencies
N = 47*

Competency					Rating Value					
	1		2		3		4		5	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	median
1.	0	0%	0	0%	18	38%	25	53%	3	6%	3.68
2.	0	0%	1	2%	8	17%	20	43%	18	38%	4.22
3.	0	0%	0	0%	9	19%	30	64%	7	15%	3.95
4.	0	0%	1	2%	12	25%	17	36%	17	36%	4.12
5.	0	0%	5	11%	14	30%	11	23%	17	36%	3.91
6.	0	0%	2	4%	15	32%	18	38%	12	26%	3.86
7.	0	0%	2	4%	8	17%	16	34%	21	45%	4.34
8.	0	0%	1	2%	12	26%	18	38%	16	34%	4.08
9.	0	0%	1	2%	14	30%	21	45%	11	23%	3.90
10.	0	0%	1	2%	4	9%	27	57%	15	32%	4.19
11.	0	0%	2	4%	15	32%	18	38%	12	26%	3.86
12.	0	0%	2	4%	14	30%	18	38%	13	28%	3.92
13.	0	0%	0	0%	20	43%	17	36%	10	21%	3.71
14.	0	0%	2	4%	13	28%	20	43%	12	26%	3.93
15.	0	0%	0	0%	21	45%	17	36%	9	19%	3.65
16.	0	0%	4	9%	17	36%	15	32%	11	23%	3.67
17.	0	0%	1	2%	5	11%	20	43%	21	45%	4.38
18.	0	0%	1	2%	6	13%	19	40%	21	45%	4.37
19.	0	0%	1	2%	9	19%	12	26%	25	53%	4.56
20.	0	0%	2	4%	7	15%	23	49%	15	32%	4.13
21.	0	0%	1	2%	10	21%	27	57%	9	19%	3.96
22.	0	0%	2	4%	23	49%	14	30%	8	17%	3.43
23.*	1	2%	3	7%	18	39%	15	33%	8	17%	3.50
24.	0	0%	1	2%	12	26%	24	51%	10	21%	3.94
25.	0	0%	1	2%	3	6%	20	43%	23	49%	4.48

Percents may not add to 100 due to rounding.
*N = 46 for competency 23.

him or herself to be more or less proficient in a competency and, as such, had no interval component. Because of the ordinal nature of the rating scale, the researchers employed median values,

using the idea of a grouped frequency distribution, to summarize the study participants' ratings of the 25 core competencies (Academic ICT, 2005). These median scores were used to analyze both how the respondents as a whole believed they had acquired each of the competencies—whether through formal or informal learning methods—as well as how proficiently the respondents perceived they were able to perform them.

Formal versus Informal Data

For the formal versus informal ratings, the respondents used the value of 1 to indicate a competency they felt they had acquired only through formal learning activities and used a value of 4 to indicate one they perceived they had learned only through informal methods. Thus, the lower the median score, the more formally the respondents as a group perceived they had acquired that core competency.

The lowest scoring competencies on the formal versus informal learning questionnaire were items 1, 13, and 14. Item 14 received the lowest overall score with a median score of 1.13. Item 13 earned a median score of 1.21. The median score for item 1 was 1.25.

The competencies which scored highest on the formal versus informal learning questionnaire were items 5, 11, 17, 18 and 19, indicating respondents tended to feel they had learned these skills largely through informal methods. Item 18 received the highest score with a median of 3.02. Item 5 received a median score of 2.86 and the median score for item 19 was 2.69. The median scores for items 17 and 11 were 2.55 and 2.54 respectively.

Proficiency Data

The rating scale for perceived proficiency ranged from 1 to 5, with 5 representing the highest perceived proficiency and 1 representing the least. In the proficiency questionnaire, items 17, 18, 19 and 25 received the highest scores. The highest scoring competency was item 19 with a median score of 4.56. Item 25 received a median score of 4.48. The median scores for items 17 and 18 differed only slightly. The median score for item 17 was 2.55 and for item 11, 2.54.

Items 22 and 23 scored the lowest in perceived proficiency. Item 22 had a median score of 3.43, the lowest proficiency score. The median score for item 23 was 3.50.

Discussion

A low median score on the formal versus informal learning rating scale indicated that the survey respondents, in general, perceived they had learned the corresponding competency largely through formal learning methods. Both item 1 (Write instructional objectives at different levels of cognitive, affective, and psychomotor domains) and item 13 (Develop questions at various learning levels), which each scored low on the formal versus informal questionnaire, are competencies that are theoretical in nature and therefore are more likely to be learned in formal settings. While item 14 (Demonstrate basic teaching competencies including transfer, establishing set, managing a block of instruction, and providing closure and transfer at the completion of a block of instruction) is a less theoretical competency, the wording of this item utilized language specific to the T&I alternative certification program in which the participants were enrolled. It is possible that the phrasing itself may have cued survey participants to rank item 14 as learned in the formal training program even if the respondents had, in fact, learned aspects of it on the job.

Items with high median scores on the formal versus informal learning rating scale represent competencies that, overall, the survey participants felt they had learned more through informal learning. Examining the four highest scoring survey items reveals some possible explanations for their relatively high scores. Item 5 (Maintain records and paperwork) and item 18 (Control and maintain equipment, tools, and supplies in a vocational laboratory) both pertain to classroom organization and the maintenance of records or supplies, skills that are more likely to be learned by trial and error than in a formal classroom setting. Item 17 (Use various multi-media learning tools in presenting a lesson) is an instructional skill that may involve technical expertise or the use of program-specific equipment such as smart boards or computer programs developed for particular T&I fields. When rating this item on the questionnaire,

respondents may have considered these specialized tools rather than the more generic audio-visual equipment whose use was taught in the formal teacher training program. Item 19 (Display professional teacher behavior) relates to school culture and is possibly acquired more frequently through mentoring and modeling, thus making it a largely informally learned competency. Item 11 (Handle discipline problems) which respondents indicated they tended to have learned informally, had a proficiency rating that placed it among the lower values of the median scores. This data may indicate that T&I teachers need more training in the area of classroom management, that the methods of delivering this training need to be improved, or that the challenges of classroom management are diverse and ongoing.

The competencies which received the highest proficiency ratings by the survey respondents also bear looking at more closely. Since the survey respondents came to the teacher preparation program with prior work experience in their fields, item 25 (Implement and provide a safe laboratory environment) and item 18 (Control and maintain equipment, tools, and supplies in a vocational laboratory) are likely to have been acquired by the T&I teachers while working in industry before they entered the teaching profession. For many of the study participants, these are perhaps not newly acquired skills, but ones which they had mastered on the job and felt confident in their abilities to perform. Similarly, item 19 (Display professional teacher behavior) is likely a direct carry-over from professional behavior in the industry environment and may therefore be a competency the T&I teachers had already acquired. Item 17 (Use various multi-media learning tools in presenting a lesson) may involve the use of specialized equipment whose operation the T&I teachers had likewise previously mastered.

The lowest proficiency ratings belonged to competencies 22 and 23. Both of these items have neither a strictly pedagogical function nor are they skill based. Item 22 (Understand teacher liability laws relating to teachers) is essentially a knowledge based competency and item 23 (Establish or maintain a vocational advisory committee) requires outreach, coordination, and management tasks beyond the realm of the day-to-day

classroom setting. It is likely that neither of these two items would lend themselves to a ready establishment of proficiency.

Answers to Research Questions

Research question one asked, "To what extent did new T&I teachers enrolled in an alternative certification program learn core teaching competencies through formal or informal learning?". The results of this study revealed that 76% of the 25 competencies had median values between 1.13 and 2.19, indicating they were perceived as being learned completely or mostly formally. The remaining 24% of the competencies received median scores between 2.54 and 3.02 indicating the respondents felt they had learned these skills mostly informally. No competencies had median scores in the range of 3.5 or above, indicating that no competency was perceived by the group of respondents as being learned completely informally.

In answer to research question two, "To what extent did new T&I teachers enrolled in an alternative certification program perceive their proficiency of the program's core teaching competencies?", the study results showed that 100% of the competencies received median scores of 3.43 or above, indicating at least average perceived proficiency on all 25 competency items listed on the questionnaire. All but two of the competencies receiving median scores between 3.5 and 4.48, hence 92% of the competencies ranked as having above average perceived proficiency. The two exceptions, with median scores of 3.43 (item 22) and 4.56 (item 19), nevertheless also ranked in the average to excellent proficiency range.

Research question three examined the relationship of perceived proficiency with the extent of informal learning or formal learning. Due to the small sample, it is difficult to assess a clearly defined relationship between perceived proficiency and the extent of formal versus informal learning. In addition there may be many other factors other than the method by which a skill or competency is acquired that have a bearing on proficiency. Nevertheless, it is interesting to note that competencies 17, 18, and 19, three of the five items on the formal versus informal questionnaire that scored the highest in terms of informal learning, also received the highest perceived proficiency ratings.

At the same time, items 22 and 23 which received the lowest perceived proficiency ratings, had scores that fell toward the formal end of the formal versus informal rating continuum. While far from definitive, this leaves open the possibility that a relationship may exist and, if so, suggests that competencies learned informally may lead to higher perceived proficiency than those learned through formal methods.

Figure 1
Formal versus informal learning ratings compared to perceived proficiency ratings
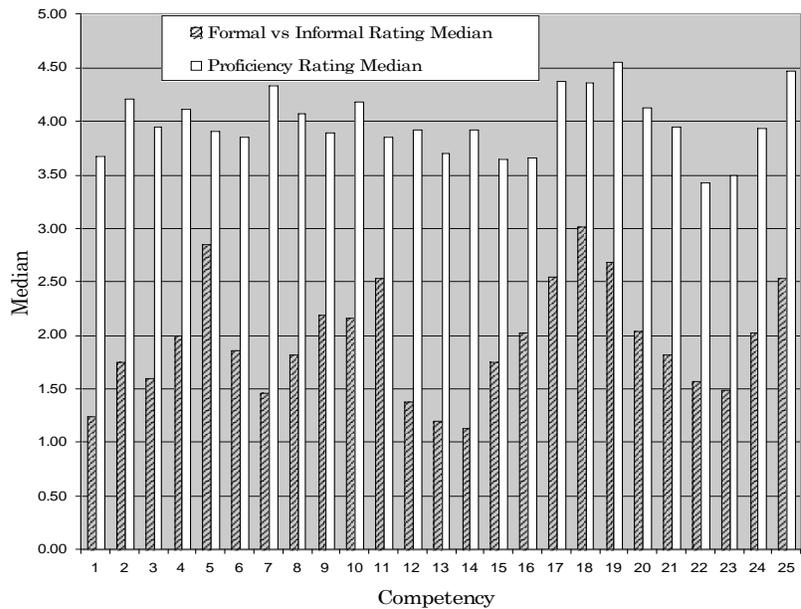
Implications and Recommendations

The results of this study are limited in several ways. First, the study was conducted using a sample of convenience. Therefore, generalizations of results to other populations should be viewed with caution. Second, the assumption was made that the respondents answered the self-report instrument honestly. Finally, the study design prevents making any inferences concerning cause and effect.

Conservatively, this study supports the conclusion that informal workplace learning occurs with new T&I teachers. The T&I teachers participating in this study indicated, as did those in the earlier study (Burns & Schaefer, 2003), that some form of informal learning takes place during an alternative teacher certification program. While the 2003 study used data reconstruction to capture categories of informal learning, in the current study respondents reported perceptions of formal or informal learning based on program-specific core competencies.

The results of this exploratory study suggest that new T&I teachers tend to learn the core teaching competencies more often through formal methods than through informal learning activities. These results differ from those of studies conducted with employees in corporate settings. Studies in corporate settings indicated that informal learning is the more prevalent of the two forms of learning (Fox, 1997; Leslie, Aring & Brand, 1998; Lohman, 2000). Perhaps a factor in explaining why teachers reported learning more through formal than through informal methods may be the differences in corporate and school environments. When one considers a teacher's typical work day, it may be vastly different from the standard work day of an employee in a corporate setting. For example, most T&I teachers operate alone in their classroom or laboratory and, for the majority of their day, interact largely with students. Their day is often spent isolated from other teachers or school employees. On the other hand, employees in a corporate environment tend to have more interaction with other employees during the course of a day, and may even perform their work in teams or groups. The tenants of social learning theory and social practice theory suggest that the limited interaction of teachers with other teachers may restrict their opportunities for informal learning in the workplace. Social learning theory suggests that informal

learning is accomplished through social modeling (Bandura, 1986). The tenets of social practice theory (Lave & Wanger, 1991) propose that learning is a social process that takes place through participation in communal work activities that cannot occur in isolation. It is conceivable that there are too few opportunities for social interaction among teachers in the workplace to promote informal learning for the majority of teaching competencies. This situation might be remedied by affording novice teachers opportunities to work collaboratively with veteran teachers, for instance, through team teaching or integrated curriculum partnering.

Several other factors may play a part in explaining the results of the formal versus informal survey data and may not have been adequately controlled for in the present study. In future studies, these factors should be considered in the design of the survey instrument. Factors such as where and how the T&I teachers use a particular skill or competency in their work day may affect how they view the extent of formal versus informal learning. The T&I teachers may consider competencies which rely on interpersonal skills or those that must be applied in the school work environment on a regular basis as being learned informally, even when some degree of formal learning actually took place. Competencies unrelated to more familiar industry skills, even though acquired informally, may be viewed as being learned through formal methods. Additionally, simply the wording of the competency may prompt respondents to score a competency item higher or lower on the formal or informal end of the rating scale. Complicated sentence structure or new and unfamiliar vocabulary and phrases such as "cognitive, affective and psychomotor domains" might steer a respondent towards the formal end of the scale, while direct, simple sentences such as "Display professional teacher behavior" might point the respondent towards the other, more informal side.

This study found that the T&I teachers as a group perceived themselves as possessing at least average proficiency in each of the 25 core competencies listed in the questionnaire. While some proficiency development models suggest that proficiency is largely developed through informal learning activities (Enos, Kehrhahn, & Bell, 2003), the present study

cannot draw a definitive conclusion as to a connection between how a competency was learned, whether formally or informally, and how well it was learned. The survey instrument used in this study had no way of eliminating the many other variables that can affect the level of perceived proficiency of a skill. Things such as ease of learning the skill, its level of complexity, how often the skill is called into use, or how closely the skill or competency relates to the respondents' areas of industry expertise might all affect the degree of perceived proficiency of the new T&I teachers who participated in this study.

More research is needed in order to understand the complex role that formal and informal learning plays towards the acquiring of teaching skills in T&I teacher education. For example, studies similar to the present one should be replicated in other alternate teacher certification programs in both T&I and other fields. This study indicates that both methods of learning occur and suggests that T&I teacher education programs should incorporate activities that facilitate learning experiences of both types. Since informal learning does take place with new T&I teachers, it should be harnessed to stimulate and complement the formal learning experiences. In order to employ informal learning effectively, more research is needed to discover which teacher education competencies are best learned informally. Additionally, if future teacher education programs rely more heavily on workplace learning, education researchers must investigate how a school's learning culture and climate affect informal learning. Likewise continuing research in how teachers become proficient is necessary, and if, in fact, informal learning promotes proficiency, new teachers must be provided more opportunities to observe, interact, and confer with other teachers. Furthermore, effective assessment instruments will need to be developed to track the proficiency values gained from these types of informal learning experiences.

The new T&I teachers in this study, while engaging in informal learning, also indicated that, overall, they acquired 76% of the core competencies of their training program through formal learning methods. Nevertheless in some cases, proponents of alternative teacher education programs endorse test-out options in which teacher training occurs predominantly informally in

school workplace settings (Georgia Professional Standard Commission, 2005). Data from the present study suggests caution in over reliance on either formal or informal training programs in the area of T&I teacher education.

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