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Instructors' Use of the Principles of Teaching and Learning During College Class Sessions

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Abstract

The purpose of this study was to measure the frequency of utilization of the Principles of Teaching and Learning (Newcomb, McCracken, Warmbrod, & Whittington, 2004) during college class sessions. Process-product research was implemented (Gage, 1972; Rosenshine & Furst, 1973) using the Principles of Teaching and Learning Assessment (PTLA) (Foster & Whittington, 2010). Frequency of use of the Principles of Teaching and Learning (PT&L) was measured in six-minute intervals (Webb, 1970) during class sessions. The PT&L most present during classes was: Directed learning is more effective than undirected learning. The PT&L least present during classes was: Transfer of learning is more likely to take place when what is to be transferred is a generalization, a general rule, or a formula. Recommendations included professional development for faculty regarding awareness of the existence of the PT&L, and examples of implementation of the PT&L into classroom learning environments. It was recommended that both incoming and established faculty participate in faculty development regarding PT&L. Further research should be conducted using process-product methodology to describe principles of teaching and learning that most influence student achievement. In addition, research should be conducted to describe quality and intensity of the presence of the PT&L during class sessions.

Keywords: Principles of Teaching and Learning, PT&L assessment, effective teaching, engaged learning

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Introduction

What happens in higher education classrooms matters (Svinicki & McKeachie, 2014). Soheili, Alizadeh, Murphey, Bajestani, and Ferguson (2015) reported research showing positive student and educator relationships in classrooms influenced what students learned and achieved. The authors also reported research indicating that the classroom environment was the most influential variable in developing student attitudes and behaviors.

As early as 1907, evidence exists in the research literature to suggest that education researchers were searching for best classroom practices. The 1907 April issue of the Journal of Education contained article excerpts presenting a list of books related to the *principles* and practice of *teaching* in the U.S. (Books on Principles and Practice of Teaching, 1907). Doyle (1977) wrote that during the 1920s, a line of inquiry contrasting characteristics between distinguished educators and those considered less effective, flourished. He indicated that the 1950s saw a rejuvenation of

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research on teacher effectiveness when the American Education Research Association designated a committee specifically to study the classroom phenomenon of teacher effectiveness. In the subsequent quest to specify criterion on which to measure teacher effectiveness, education researchers across the next several decades proposed sets of principles for teaching and learning (Dunkin & Biddle, 1974; McKeachie & Kulik, 1975) and variables to study principles that were effective for student learning (Rosenshine & Furst, 1971).

Process-Product Research

As proposed sets of principles of teaching and learning continued to emerge from the teacher effectiveness literature of the 1970s, Gage (1972) emphasized the process-product research framework for studying the relationship between the principles of teaching and learning that educators were using in the classroom (process), and the effect the principles were having on student learning (product). According to Gage, the framework created a prediction formula: "Define the criterion and find its predictors" (Doyle, 1977, p. 165). Gage indicated that the process-product research formula was so simple and so general, any principle of teaching and learning could be inserted "and the empirical associations can then be calculated" (Doyle, 1977, p. 165).

Rosenshine and Furst (1973) wrote prescribed steps to follow when implementing the process-product research formula in assessing principles of teaching and learning: Step One) develop an instrument that can be used systematically to record the frequency of certain specified teaching behaviors; Step Two) use the instrument to record classroom behaviors of teachers and students; Step Three) rank the classrooms according to student achievement; and Step Four) determine the behaviors whose frequency of occurrence is related to achievement scores. Rosenshine and Furst also recommended that the process-product research framework be implemented in natural classroom settings.

As a final note regarding the use of the process-product research framework for assessing principles of teaching and learning, Gage (1972) called process-product researchers *improvers not describers* of teacher effectiveness. Gage considered the results of process-product research on principles of teaching and learning to have a direct impact on teacher education by improving classroom teaching practices and student learning.

The Quest for Best Practices

Examining and describing best practices related to principles of teaching and learning during college class sessions is overdue. Stakeholders investing in higher education systems are demanding evidence that learning is taking place (Kuh, 2001). Rice (2006) stated, "The search for best practices in university teaching has been an elusive one" (p. 20). In addition, the Association of Public and Land-Grant Universities (APLU), in 2009, called for the implementation of "faculty development, informed by research, on… the teaching/learning process" (APLU, 2009, p. 8).

As evidence of the quest for best practices in teacher education in agricultural education, in the *Journal of Agricultural Education* from 1988 to 2009, studies regarding best practices in terms of the methods taught in agriculture courses (Ball & Knobloch, 2005) were identified. Research on cognition in the teaching/learning process (Ewing & Whittington, 2009; Whittington & Newcomb, 1993; Bowman & Whittington, 1994; McCormick & Whittington, 2000) provided evidence of seeking to better understand practices occurring during class sessions. In addition, the agricultural education profession issued a call for improving student learning in their *National Research Agenda: Agricultural Education and Communication* (Doerfert, 2011), by specifically identifying a research priority area for developing "meaningful, engaged learning in all

environments" (p. 9). The call was renewed in the *American Association for Agricultural Education National Research Agenda 2016-2020* (Roberts, Harder, & Brashears, 2016).

Principles of Teaching and Learning

A review of literature revealed sets of principles of teaching and learning both in higher education (Willingham, 1977; Chickering & Gamson, 1987; McKeachie, 2002; Ramsden, 2003) and in the discipline of agricultural education (Lancelot, 1929; Lancelot, 1940; Hammonds, 1950; Stewart, 1950; Crunkilton & Krebs, 1983; Phipps & Osborne, 1988), with no universal set of principles of teaching and learning being adopted as a whole. Although a review of literature did not reveal one adopted set of principles of teaching and learning for the agricultural education profession, Ball and Knobloch (2005) found the most frequently required reading in agricultural education methods courses in preservice teacher preparation in agricultural education was *Methods of Teaching Agriculture* (Newcomb et al., 2004). Therefore, the set of principles of teaching and learning advocated by Newcomb et al. was selected for this study.

Principles of teaching and learning, at their theoretical core, embody critical evidence for studying student learning. Newcomb et al. described 16 principles of teaching and learning organized into five constructs: Organization and Structure of Subject Matter, Motivation, Reward and Reinforcement, Techniques of Teaching, and Transfer of Learning. The authors proposed the following classroom characteristics as evidence of the presence of the principles of teaching and learning, as categorized within each construct: organization and structure of subject matter, readiness, motivation, student involvement, student success, reinforcement and reward, directed learning, problem solving, supervised practice, and transfer of learning. Understanding the presence of these classroom characteristics, through evidence measured during college class sessions, is critical to improving student learning, and thus, the undergraduate educational experience (Whittington & Newcomb, 1991; Whittington & Bowman, 1994; McCormick & Whittington, 2000; Ewing & Whittington, 2007).

Purpose and Objectives

The purpose of the study was to describe the frequency of utilization of the Principles of Teaching and Learning by instructors in the College of Food, Agricultural, and Environmental Sciences at The Ohio State University. The research objective guiding the study was adopted directly from Step Two of Rosenshine and Furst's (1973) prescribed steps to follow when implementing the process-product research formula for assessing principles of teaching and learning: *use the instrument to record classroom behaviors of teachers and students*. Step One of Rosenshine and Furst's prescribed steps: *develop an instrument that can be used systematically to record the frequency of certain specified teaching behaviors*, was addressed in 2010 by Foster and Whittington when the Principles of Teaching and Learning Assessment (PTLA) instrument was developed and tested. Specifically then, the objective guiding this research, was to describe instructors' frequency of utilization of the Principles of Teaching and Learning during college class sessions, as measured using the Principles of Teaching and Learning Assessment (PTLA).

Methods

After obtaining permission to conduct the study from the institutional review board human subjects' research panel, the sample of instructors was obtained. The sample for this process-product study was instructors who held teaching appointments in The College of Food, Agricultural, and Environmental Sciences at The Ohio State University. Instructors were nominated by their respective department chairs as *good teachers* based on student evaluations,

exit interviews, and annual reviews of teaching. The instructors represented all departments in the college: Agricultural, Environmental and Developmental Economics; Animal Sciences; Food, Agricultural and Biological Engineering; Natural Resources; Horticulture and Crop Sciences; and Agricultural Communication, Education, and Leadership. Participation in the study was voluntary. Twelve nominated faculty members participated in the study. Researchers sought two observations and video-taping sessions of each instructor, but scheduling conflicts allowed every instructor to be observed once, while nine instructors were observed twice. Consequently, 21 undergraduate class sessions were videotaped for analysis. Courses in this study were undergraduate level ranging from one hundred (first-year) level to four hundred (fourth-year) level. There were an average of 50 students per class session.

The PTLA (Foster & Whittington, 2010) was the instrument used to identify frequency of utilization of the PT&L (Newcomb et al., 2004) during the class sessions. Reliability for the PTLA was established using test-retest procedures (Ary, Jacobs, Sorensen Irvine, & Walker, 2014). The research team of three individuals independently watched a randomly selected videotaped class session and recorded the frequency of use of the indicators for each of the PT&L as the teaching was observed. Data were used to confirm intra- and inter-rater reliability at a 90% confidence band, set a priori, for each PT&L.

Content validity for the PTLA was established by a panel of experts (Foster & Whittington, 2010). The panel of experts consisted of the senior authors of *Methods of Teaching Agriculture* (Newcomb et al., 2004). The panel of experts utilized for establishing content validity held the necessary expertise in college teaching to establish face validity for an instrument for assessing college instruction (Foster & Whittington). In addition, researchers worked under the assumption that the authors' pre-established constructs from *Methods of Teaching Agriculture* were valid. The pre-established constructs used to organize the Principles of Teaching and Learning were: Organization and Structure of Subject Matter, Motivation, Reward and Reinforcement, Techniques of Teaching, and Transfer of Learning (Newcomb et al.).

In accordance with the PTLA instrument protocol (Foster & Whittington, 2010), and after intra- and inter-rater reliability were established by the researchers, videotaped class sessions were observed, and frequency of use of the PT&L was tallied on six-minute intervals (Webb, 1970). As each PT&L was observed, the corresponding time interval of occurrence was indicated. Principles were marked on the PTLA only once per six-minute interval, as the study was a measure of frequency, but not intensity nor quality of the use of the PT&L.

As can be seen in Figure 1, the total possible six-minute intervals for each class session was calculated by taking the number of minutes of the class session, dividing the minutes by six, and multiplying by sixteen (possible total frequency of uses of the PT&L). The total number of observations of PT&L was than divided by the total possible six-minute intervals.

Number of observations of principles of teaching & learning	O		66	41.25% of the six-minute time intervals showed a presence of a principle of teaching and learning
---------- =	-----	= % PTL =	--- =	
Number of six-minute time intervals	T		160	

Figure 1. Example Calculation for Percentage of Utilization of Principles of Teaching and Learning during Class Sessions.

Findings

Class sessions ranged from 25 to 100 minutes (see Table 1). Twenty-one class sessions were analyzed totaling 1,127 minutes of instructional time, yielding 192 total six-minute intervals. Taking the number of six-minute intervals and multiplying by 16 (the number of PT&L) created the total number of possible intervals of 3,072 (see Table 1). There were 1,124 intervals showing evidence of the presence of a PT&L. Thus, 36.58% of all possible six-minute intervals showed the presence of one of the 16 PT&L.

The highest frequency of utilization of the PT&L was class session four with 54.56% (see Table 1). Class session six reflected the lowest frequency of utilization of the PT&L with 15.63%. The average frequency of utilization of the PT&L during class sessions was 36.81%.

The PT&L evidenced most in the six-minute intervals was *Principle 10: Directed learning is more effective than undirected learning* with 183 observations (see Table 2). The PT&L evidenced least in the six-minute time intervals was *Principle 15: Transfer of learning is more likely to take place when what is to be transferred is a generalization, a general rule, or a formula* with two observations (see Table 2). The construct with the most observations was Techniques of Teaching with 325 observations (see Table 3). The construct with the least observations was Transfer of Learning with 166 observations.

Conclusions and Discussion

The purpose of the study was to describe instructors' frequency of utilization of the Principles of Teaching and Learning (Newcomb et al., 2004) during college class sessions, as measured using the Principles of Teaching and Learning Assessment (PTLA) (Foster & Whittington, 2010). It was concluded that the Principles of Teaching and Learning were utilized minimally in the college class sessions studied. It should be noted that the *good teachers* nominated by department heads for participation in this study, may not be representative of all faculty in the college. Therefore, if there is little evidence of the presence of the use of the PT&L among nominated *good teachers*, one could ponder the presence of the use of the PT&L among the general population of college instructors. If instructors are not utilizing the principles of teaching and learning during college class sessions, theoretically, a foundational, long-adopted educational practice is being missed during content delivery in college class sessions.

Table 1

Frequency of Utilization of the Principles of Teaching and Learning by Class Session.

Session number	Length of class session in minutes	Number of six-minute intervals	Total possible six-minute intervals	Total observations of principles of teaching and learning	Frequency of utilization of the principles of teaching and learning (%)
1	55	10	160	66	41.25
2	30	5	80	21	25.25
3	25	5	80	27	33.75
4	66	11	176	96	54.56
5	61	10	160	62	38.75
6	70	12	192	30	15.63
7	47	8	128	49	38.28
8	94	16	256	101	39.45
9	48	8	128	36	28.13
10	46	8	128	38	29.69
11	86	15	240	62	25.83
12	48	8	128	47	36.72
13	47	8	128	48	37.50
14	100	17	272	104	38.24
15	48	7	112	44	39.29
16	48	8	128	47	36.72
17	67	12	192	79	41.15
18	34	6	96	45	46.86
19	36	6	96	43	44.79
20	29	5	80	30	37.50
21	42	7	112	49	43.75
Total	1127	192	3072	1124	36.58

Table 2

Frequency of Utilization of the Principles of Teaching and Learning by Principle

Principle of teaching and learning	*Session number*																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
1	9	5	4	11	11	1	8	11	7	7	12	8	7	11	8	8	7	5	6	5	7	158
2	2	0	1	0	0	0	0	0	1	2	0	3	2	1	0	0	0	0	1	0	0	13
3	10	5	4	11	11	6	8	16	4	8	8	8	8	17	5	6	10	6	5	5	7	168
4	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	6
5	3	0	9	9	0	0	0	3	1	0	0	0	0	0	3	0	2	0	2	0	0	24
6	2	0	8	8	0	0	0	10	1	0	0	0	2	1	0	0	0	0	2	0	0	26
7	9	0	10	10	9	4	3	3	2	1	8	6	5	14	4	6	10	6	5	4	6	118
8	7	0	9	9	5	7	7	11	2	1	2	4	4	14	3	6	10	6	5	4	7	116
9	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4
10	10	5	11	11	10	2	8	16	8	8	15	8	8	17	8	8	12	6	6	5	7	183
11	3	1	10	10	2	0	7	12	3	1	2	2	3	12	4	5	11	5	5	2	6	97
12	5	0	6	6	0	10	0	4	0	0	0	0	0	1	0	2	7	1	0	0	0	38
13	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	2	0	1	0	0	1	7
14	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	3
15	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
16	6	5	2	8	11	0	8	14	6	8	15	8	8	16	8	4	10	6	6	5	7	161
Total	66	21	27	96	62	30	49	101	36	38	62	47	48	104	44	47	79	45	43	30	49	1124

Table 3

Frequency of Utilization of the Principles of Teaching and Learning by Construct

Construct	Total six-minute interval observations of principles of teaching & learning	Total possible six-minute intervals	Frequency of utilization (%)	Percent of total observations (1,124 total)
I. Organization & Structure of Subject Matter (Principles 1 & 2)	171	384	44.53	15.21
II. Motivation (Principles 3, 4, 5, & 6)	224	768	29.17	19.93
III. Reward & Reinforcement (Principles 7, 8, & 9)	238	576	41.32	21.17
IV. Techniques of Teaching (Principles 10, 11, 12 & 13)	325	768	42.32	28.91
V. Transfer of Learning(Principles 14, 15, & 16)	166	576	28.82	14.77

The individual PT&L most present during college class sessions was: *Directed learning is more effective than undirected learning.* Thus, instructors were frequently observed directing learning during college class sessions. However, while *directed learning* was observed (i.e. a specific instructional strategy was being implemented by the instructor), the *quality and/or intensity* of the instructional strategy being used during the class session was not measured.

The individual PT&L least present during college class sessions was: *Transfer of learning is more likely to take place when what is to be transferred is a generalization, a general rule, or a formula.* According to Pugh and Bergin (2006), transfer of learning is difficult to accomplish. Pugh and Bergin asked the question, if transfer of learning is not the goal of higher education, than what it is?

Recommendations and Implications

According to Kuh (2001), academic administrators in institutions of higher education would benefit from examining that which they are doing to guarantee that stakeholders needs are being met, "including. . . a more intensive reexamination of the tried and true methods of instruction

. . ." (Bess, 1998, p. 3). An opportunity exists to systematically increase the awareness of the existence of the principles of teaching and learning and how their presence can be exhibited in classroom teaching and learning. Professional development, designed to empower instructors to utilize the PT&L during class sessions, must be embraced. With the establishment of Professional Development Centers for teaching faculty on university and college campuses (Rice, 2006), traditional autumn faculty development workshops emerged. Since the use of the PT&L have the potential to challenge students to their fullest extent during content delivery, professional development personnel in teaching improvement offices on college campuses need to use the PT&L as a basis for providing continuous teaching improvement workshops, seminars, and in-service education to teaching faculty. Such workshops could offer topics related to using the PT&L during class sessions.

Professional development staff working directly with teaching faculty must explore the topics offered at education conferences, and provide subsidized registration for teaching faculty to attend workshops exploring the theory and implementation of the PT&L. Finally, incoming and junior faculty are potentially a starting point for targeting faculty with professional development discussions, perhaps in the form of brown bag seminars, regarding the PT&L and the challenges and benefits of applying them during college class sessions. When faculty are aware of and embrace the use of PT&L, student learning will benefit.

Recommendations for Future Research

Rosenshine and Furst (1973) wrote prescribed steps to follow when implementing the process-product research formula in assessing principles of teaching and learning: Step One) develop an instrument that can be used systematically to record the frequency of certain specified teaching behaviors; Step Two) use the instrument to record classroom behaviors of teachers and students; Step Three) rank the classrooms according to student achievement; and Step Four) determine the behaviors whose frequency of occurrence is related to achievement scores. Since step one was addressed by Foster and Whittington (2010), and Step Two was piloted though this study, completion of Step Three and Step Four are recommended for "Defin[ing] the criterion and find[ing] its predictors" (Doyle, 1977, p. 165) for the Newcomb et al.(2004) Principles of Teaching and Learning.

In addition, a large, heterogeneous sample size is recommended for analyzing the validity of the original 16 PT&L and their structure within the five constructs presented by Newcomb et al. (2004). In this study, the existing constructs were accepted as valid (Ary, Jacobs, Sorensen Irvine, & Walker, 2014); a future study could provide empirical evidence of the validity of the constructs.

The reexamination of what Bess (1998) called *tried and true methods of instruction*, is an ongoing recommendation in the quest for implementing best practices. Class sessions exemplifying the implementation of specific PT&L, could be observed and analyzed to describe impact on student academic achievement (Rosenshine & Furst, 1973). Sharing the findings with teaching faculty is necessary for moving process-product researchers to what Gage (1972) called *improvers not describers* of teacher effectiveness.

An additional recommendation for future research is that the PTLA instrument needs utilized with additional audiences including secondary and elementary learning environments. Researchers have advocated for measuring the frequency of use of the PT&L during class sessions as needed for documenting teaching effectiveness, and its relationship to student cognition (Whittington & Newcomb, 1990, 1993; Bowman & Whittington, 1994; McCormick & Whittington, 2000; Lopez & Whittington, 2002; Ewing & Whittington, 2007). College, secondary,

and elementary learning environments will benefit from measuring the frequency of use of the PT&L, and then modifying class session behaviors accordingly. As the PTLA continues to be used, research should be conducted for describing *quality and/or intensity* of the evidence of the presence of PT&L during class sessions.

Finally, it is recommended that studying the teaching effectiveness of faculty in the agricultural and related sciences, must continue to hold a place of prominence in the national research agenda for agricultural education, communication, and leadership professionals. After all, what happens in higher education classrooms matters (Svinicki & McKeachie, 2014).

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