The quality of classroom instruction by teaching assistants (TAs) is an issue of concern in higher education, because many TAs have very limited training and experience in teaching. To provide high quality instruction, TAs must have both discipline-specific knowledge and skills, and an effective teaching methodology. Such a methodology is contained in the principles and practice of instructional design. Giving teaching assistants the tools of instructional design can provide them with some skills of expert teachers, to facilitate better teaching.

This research demonstrated that teachers who learned ID principles and practices gained teaching self-efficacy and satisfaction, improved in teaching quality, and facilitated improved student motivation and learning. Instructional design offers a way for universities that utilize TAs as classroom instructors to enhance the quality of undergraduate education.

The Needs of Graduate Teaching Assistants

Graduate teaching assistants at many universities are given full instructional responsibilities based
primarily (or solely) on their domain expertise (Eble, 1987; Marincovich, Prostko, & Stout, 1998; Reiser, 1994; Tice, 1997). Many have no formal teaching instruction and as little as one term of supervised teaching experience (Hutchings, 1993; Lambert & Tice, 1993; Ryan, 2000). They often experience low self-efficacy and perceived competence, and score poorly on teaching evaluations (Gholson, 1997; Syverson & Tice, 1993). If these TAs who possess domain expertise were also given systematic tools for designing instruction, they could teach more effectively (Corno & Randi, 1999; Seldin, Ambrose, & Annis, 1995).

**Instructional Design—Facilitating Expertise**

Instructional design is a systematic method for designing instruction that can enable TAs to organize their existing knowledge along with new pedagogical knowledge, into a cognitively accessible, functionally usable toolkit (Hardré, 2002). As such, it offers a critical link between their content expertise and the needs of learners, so that it can significantly improve teaching practice (Hardré, 2002). The knowledge base of instructional design offers access to a foundational set of principles from educational psychology, instructional psychology, organizational psychology, and teaching best practices (Dick, Carey, & Carey, 2001; Smith & Ragan, 1999), organized in a way that enables new teachers to use them effectively without years of training. Further, this methodology is applicable to daily classroom teaching demands (Kemp, 1985; Morrison, Ross, & Kemp, 2001), so that TAs can continue to use it and develop ongoing professional expertise.

Teaching expertise is characterized not just by content knowledge, but by the ability to flexibly adapt principles of instructional delivery, communication, and content representation in ways that learners can understand and process, with the goals of learning and transfer (Berliner, 1988; Biddle & Anderson, 1986; Borko & Livingston, 1989; Glaser & Chi, 1988; Leinhardt & Greeno, 1986). Expert teachers make extensive (detailed) and extended (long-range) plans about their instruction (Borko & Livingston, 1989), and focus more on instructionally relevant characteristics of classroom events and interactions with students (Berliner, 1988; Borko & Livingston, 1989; Peterson & Comeaux, 1987). They also have greater ability to take in and process different, simultaneous input, and to monitor and interpret complex, concurrent classroom activities and events than do novices (Peterson & Comeaux, 1987; Sabers, Cushing, & Berliner, 1991). Expert teachers make more accurate and complete analyses that anticipate students’ needs and responses than do novices (Biddle & Anderson, 1986; Borko & Livingston, 1989).

Any skill requiring flexibly adaptive application of principles is facilitated by an effective system of cognitive organization, often represented by a functional concept or process model (Brown & Campione, 1996; Hardré, 2001a; Hardré, 2003). The core of the instructional design process is such a model, presenting the process of analysis, design, development, implementation, and evaluation (ADDIE) as a sequential and iterative process of generating and aligning instructional elements to optimize instructional resources.
and learning outcomes (Hardré, 2002; Smith & Ragan, 1999).

Because instructional design provides a systematic way of implementing the broader, “expert” view of instructional planning, development, and implementation, instruction in ID can help TAs function more like expert teachers (Reiser & Radford, 1990; see also Clark & Estes, 1998; Glaser & Chi, 1988; Stolovitch & Keeps, 2000). It is this connection to the development of teaching expertise that forms the basis for assessing classroom teaching performance. The model of instructional design used in this study represents ID as an integrative, reflexive, and iterative process (see also Reigeluth, 1999; Wilson, 1995).

### Building on Prior Research

Some naturalistic studies have demonstrated parallels between teachers’ and designers’ planning practices. Some teachers use elements of ID practice implicitly in planning, but do not use the complete ADDIE process that offers coherence and alignment (Branch, 1994, 1997). Teachers sometimes use similar strategies to instructional designers, but use different terms for them (Kennedy, 1994). An observational study demonstrated that elementary teachers used some tools of systematic instructional design but did not implement them consistently (Earle, 1996). Differences in teachers’ and designers’ conceptual thinking tend to influence their design decisions (Moallem, 1994, 1996).

A few studies have confirmed the utility of instructional design as an intervention for teachers. For instance, learning systematic instructional design improved K-12 teachers’ perceptions of competence (Magliaro & Shambaugh, 1999). Pre-service teachers taught the systematic ID approach adopted it over the short term, but not the long term (Reiser, 1994). However, few intervention studies have been done with practicing (in-service) classroom teachers, and fewer (if any) among graduate teaching assistants (TAs) with primary instructional responsibilities.

Instructional design is a knowledge base that can guide educational practice. Its principles are grounded in learning theory and applicable across age, settings, ability levels and content domains (see Druckman & Bjork, 1994; Reigeluth, 1999; Stolovitch & Keeps, 2000). Instructional Design supports learning because organized, theoretically-anchored instructional events and strategies promote learning, and enhance retention and performance (see also Gagné & Medsker, 1996; McGilly, 1996; Smith & Ragan, 1993, 1999).
Transfer to Teaching Performance

The contention that ID knowledge development will transfer to improved teaching performance is made on two theoretical linkages, plus the alignment of the ATQ assessment with the intervention content. The first linkage is via the development-of-expertise literature. The logic here is that if (as the sources cited above indicate) systematic ID supports the expert view of instructional planning, and that expert planning facilitates better classroom teaching, then TAs who know ID better should plan more effectively and consequently perform better in the classroom. The second linkage is via the self-efficacy literature in motivation. There is a robust literature supporting the relationships between task-specific, structured professional development in problem-solving strategies, and related self-efficacy perceptions, and between task-specific self-efficacy perceptions and consequent task performance (for review see Bandura, 1997). Self-efficacy profoundly affects work performance, professional development, daily decision making, and ability to cope with unexpected circumstances (Bandura, 1997; Pintrich & Schunk, 1996; Reeve, 1996). Thus, self-efficacy is particularly critical for tasks requiring high cognitive and performance flexibility, like classroom teaching (Ashton, 1985; Moore & Esselman, 1992; Tschannen-Moran, Woolfolk-Hoy, & Hoy, 1998; Wood & Bandura, 1989). The study logic here is that if ID knowledge enhances teaching self-efficacy, and self-efficacy facilitates better teaching performance, then TAs with better ID knowledge could demonstrate better teaching performance than those without such knowledge. The key here is that the predictor is not simply more knowledge, but task-specific, strategic knowledge that targets effective decision-making for teaching performance. Further, the assessment of teaching performance (the ATQ) addressed classroom practices aligned with this process of strategic decision-making taught in the intervention, so that it assessed not a general type of “teaching quality” but performance transfer of this strategic decision-making skill.

Hypotheses

1. Teachers who participated in the instructional design (ID) intervention would demonstrate greater ID knowledge than those who did not;
2. Teachers with greater ID knowledge would report greater satisfaction with their ID knowledge and strategies;
3. Teachers with greater ID knowledge would report higher perceptions of teaching competence;
4. Teachers with greater ID knowledge would report higher teaching self-efficacy;
5. Teachers with greater ID knowledge would demonstrate better teaching performance;
6. Teachers with better teaching performance would have students with higher perceived learning;
7. Teachers with better teaching performance would have students with higher academic engagement.

The prediction model for the study is contained in Figure 1.
Research Design
This study followed a pre-test, intervention, and post-test experimental design. Multiple measures included: Likert-style questionnaires, generative essay tests, and performance assessments (scored by multiple trained raters). It was conducted as a pilot of new instruments and a newly developed intervention for practicing TAs. Given the small sample size (Ng=18), this study is exploratory. Due to the relatively innovative nature of the design, it nevertheless offers important insights and implications for future research and application.

Participants
Teachers: 18 graduate teaching assistants at a large Midwestern research university, 6 males and 12 females, ages from 22-37. Students: 199 undergraduates taking the courses taught by the participating TAs, 111 males and 88 females, ages 18-26.

Procedures
Two instructional units were studied in each classroom: one unit prior to, and the other after, the intervention. Numeric codes were used on all data. TAs had no access to student responses. To reduce the probability of data contamination, TAs were instructed not to discuss the study or its content with peers outside their cohorts until after completion of the posttest assessments for all participants.

Prior to Intervention: teachers completed the pretests: (1) demographics questionnaires; (2) pre-assessments of teaching self-efficacy, perceived competence, prior knowledge, and satisfaction; and (3) videotaped classroom teaching perfor-
### Table 1
**Details on Intervention Content**

<table>
<thead>
<tr>
<th>Objectives:</th>
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<tr>
<td><strong>On completion of instruction, participants will be able to:</strong></td>
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<tr>
<td>1. Define the field of instructional design, including at least its primary global principles and five general phases.</td>
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<tr>
<td>2. Explain the importance of aligning objectives, instructional activities, and assessment in their own instruction.</td>
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<tr>
<td>3. Describe the characteristics of a learning environment and define it as a product of teacher/designer, institutional, and community characteristics.</td>
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<tr>
<td>4. Apply the process of systematic instructional design to preparing instruction for their own classes.</td>
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<tr>
<td>5. Apply the logic of strategically connecting design goals and principles, to develop instructional strategies as components of their instructional design.</td>
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<tr>
<td>6. Explain the importance of explicit attention to motivation in instructional design.</td>
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<tr>
<td>7. Select appropriate strategies for instructional objectives that include both learning and motivational outcomes.</td>
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<tr>
<th>Summary of Events &amp; Tasks:</th>
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<tr>
<td>o Instructor leads presentation &amp; discussion of ID process, principles, practice</td>
</tr>
<tr>
<td>o Participants practice analyses (needs, task, learners, content)</td>
</tr>
<tr>
<td>o Participants practice writing precise instructional objectives</td>
</tr>
<tr>
<td>o Participants practice using decision-making strategies for selecting activities</td>
</tr>
<tr>
<td>o Participants design lessons with interactions &amp; feedback to support learning</td>
</tr>
<tr>
<td>o Participants share and collaborate on refining instructional designs</td>
</tr>
<tr>
<td>o Participants practice designing well-aligned assessments for objectives</td>
</tr>
<tr>
<td>o Instructor leads presentation &amp; discussion of motivation theory and strategies</td>
</tr>
<tr>
<td>o Participants practice designing with strategies to promote motivation</td>
</tr>
<tr>
<td>o Instructor coaches and supports participants through incremental practice tasks</td>
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<th>General Specifications:</th>
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<tr>
<td>o Instruction is a total of six hours of intervention, in 2 sessions of 3 hours.</td>
</tr>
<tr>
<td>o Groups of 6 TAs participate in a classroom setting, with 1 instructor.</td>
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</table>

Performances. Students in the TAs’ classes completed pretest questionnaires of academic motivation, perceived learning, and teacher evaluation.

TAs were randomly assigned to the experimental or control group. Teachers in the experimental group participated in the six-hour ID intervention, and teachers in the control group received no instruction. The ID intervention was 2 sessions of 3 hours each. Participants viewed presentations, engaged in discussion, and interacted with their classmates in developing instruction and collaborative problem solving.

**Design of the Intervention:** the instructional intervention was a six-hour training and development opportunity (in 2 sessions of 3 hours each, a week apart). TAs attended the on-site events held in university classrooms (similar to those in which they taught their own courses). Sessions consisted of information on the process and principles of instructional design, discussions, and application activities. Materials were presented both as whole-group display (i.e., PowerPoint®) presentations with discussion and interactive task practice, and in the form of a reference manual that TAs received.
to take home, study, and use in their preparation and teaching. Content in the presentations and manual was taken from authoritative works in the field, including the instructional design professional standards (Richey, Fields, & Foxon, 2001), and textbooks of instructional design (e.g., Dick, Carey, & Carey, 2001; Smith & Ragan, 1999; Yelon, 1996; Zook, 2001) and learning theory (e.g., Bransford, Brown, & Cocking, 1999; Greeno, Collins, & Resnick, 1996; Mayer, 1999). Details on the intervention content are provided in Table 1.

Following Intervention: all teachers completed the post-experimental assessments (identical to pretests). Students completed posttests of learning perceptions and motivation (identical to pretests).

**Constructs and Measures**

Constructs, definitions, and measures for the study are described below, and also aligned in Table 2.

**Teaching Self-efficacy:** Self-efficacy is “cognitive coping” (Bandura, 1988, 1997), or the “capacity to translate skills one has into effective performance under trying circumstances” (Reeve, 1996, p. 77). The opposite of self-efficacy is self-doubt (Bandura, 1997). Strength of self-efficacy beliefs is influenced by performance experiences, modeling, persuasion, and physiological state (Bandura, 1997; Ozer & Bandura, 1990; Schunk, 1994). High efficacy positively influences: choice, persistence, decision making, and emotions (Bandura, 1997; Pintrich & Schunk, 1996; Reeve, 1996). The measure of self-efficacy was a contextualized version of the Teacher Efficacy Scale (TES; Hoy & Woolfolk, 1993; Tschan nen-Moran, Woolfolk-Hoy, & Hoy, 2000), an 8-item Likert-style questionnaire (1-6 scale) (alpha=.96).

**Perceived Teaching Competence:** Perceived teaching competence is the teachers’ perception of being capable of successfully meeting demands of teaching under normal or expected circumstances (see Pintrich & Schunk, 1996; Reeve, 1996). The measure of perceived teaching competence for this study is a contextualized version of the perceived competence scale from the Activity-Feelings States scales (AFS; Reeve & Sickenius, 1994), a three-item Likert-type scale (1-6) (alpha=.95) (Hardré & Reeve, 2003).

**Instructional Design Knowledge:** Instructional design knowledge, as assessed in this study, is the teacher’s ability to identify, explain and discriminate among the classroom-relevant knowledge components of the field of instructional design. TAs responded to 6 essay items; 3 focused on theory and knowledge, and 3 assessed classroom strategies. Three general subdomains of the essays are content and interaction design, environment design, and motivational design (see also Hardré, 2001b). As a predictor for this study, the construct of interest is not simply more knowledge, but task-specific, strategic knowledge that targets effective decision-making for teaching performance.

Items were scored by two independent, trained raters, using a standard rubric. Raters’ scores for each teacher were averaged, and then the item total means combined. Interrater reliability by item was .74-.93, all significant at p<.01, indicating adequate reliability. Inter-item correlations in the subscales were from .70-.85. Interscale correlations were .58 to .82 (alpha=.86). Based on the statistical
<table>
<thead>
<tr>
<th>Construct</th>
<th>Definition</th>
<th>Measure</th>
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<tbody>
<tr>
<td>Instructional Design Knowledge</td>
<td>Teachers’ objective ability to identify, explain, and discriminate among the core knowledge components of ID and related principles of learning and motivation theory (Hardré, 2002).</td>
<td>IDK test (Hardré 2002); 6 essay items, scored by 2 independent, trained raters, using a standard rubric (alpha=.86)</td>
</tr>
<tr>
<td>Satisfaction with ID Knowledge &amp; Strategies</td>
<td>Teachers’ belief that they have adequate knowledge and skills to meet their current and expected instructional needs (Hardré, 2002).</td>
<td>Satisfaction test (Hardré 2002), 4 items, Likert-type, 1-6 (alpha=.86)</td>
</tr>
<tr>
<td>Perceived Teaching Competence</td>
<td>Teachers’ feeling capable of meeting demands of teaching under normal circumstances (Reeve, 1996).</td>
<td>Perceived Competence subscale (from AFS; Reeve &amp; Sicknien, 1994), 3 items, Likert, 1-6 (alpha=.95)</td>
</tr>
<tr>
<td>Teaching Self-efficacy</td>
<td>Teachers’ feeling capable of meeting demands of teaching under trying and challenging circumstances (Reeve, 1996).</td>
<td>Teaching Efficacy Scale (Hoy &amp; Woolfolk 1993), 8 items, Likert, 1-6 (alpha=.96)</td>
</tr>
<tr>
<td>Teaching Performance Quality</td>
<td>Teachers’ ability to carry out planned instruction in ways that are consistent with the standards of ID &amp; teaching practice. This is the direct assessment of application transfer of the instructional principles to the classroom.</td>
<td>ATQ (Hardré, 2002), adapted from ACE University of Iowa, 2001, 18 items, Likert 1-6; 3 versions for student, teacher, and trained raters, collapsed into single measure based on strong intrascale &amp; interscale reliabilities</td>
</tr>
<tr>
<td>General Teaching Effectiveness</td>
<td>The overall perception that the teacher presented information in ways that gave students access to needed content (University of Iowa, 2001).</td>
<td>Overall teaching effectiveness subscale from ACE (U Iowa, 2001), 3 items, Likert, 1-6 (alphas=.88)</td>
</tr>
<tr>
<td>Students’ Perceived Learning</td>
<td>Students’ reflective perception that they have grasped the content being taught in a lesson or unit (Pintrich &amp; Schunk, 1996).</td>
<td>Perceived learning measure (Hardré &amp; Reeve, 2003), 2 items, Likert, 1-6 (alpha=.89)</td>
</tr>
<tr>
<td>Student Engagement</td>
<td>The students’ involvement in initiating and carrying out learning activities, including attending during instruction (Reeve, 1996). Combination of emotionality, effort, and value (Hardré, 2002).</td>
<td>Mean of emotionality &amp; effort subscales (from Patrick, Skinner &amp; Connell, 1993) with value subscale (from Reeve &amp; Sicknien, 1994)</td>
</tr>
</tbody>
</table>

tests and theoretical coherence of the subscales, I collapsed them into one measure of “instructional design knowledge.”

**Satisfaction with Instructional Design Knowledge and Strategies:** This construct addressed the teachers’ perception that they have adequate ID knowledge and strategies to meet their current and anticipated instructional needs. This measure was an original instrument that addressed the individual TAs’ satisfaction with current instructional
design knowledge and strategy. It is a four-item Likert-type scale (1-6) ($\alpha=.84$).

**Teaching performance:** In the present study, this construct refers to the teachers’ ability to carry out their planned instruction in ways that are consistent with standards of instructional design and teaching practice (see also Bransford, Brown, & Cocking, 1999; Richey, Fields, & Foxon, 2001). It focuses specifically on the task-specific, strategic knowledge that targets effective decision-making for teaching performance. The assessment instrument for this study (the ATQ) addressed classroom practices aligned with this process of strategic decision-making taught in the intervention, so that it assessed performance transfer of this strategic decision-making skill. Teaching performance (rather than design practice) was used here as the measure of transfer of learning for several reasons. First, based on a needs assessment, the primary need perceived by TAs and their supervisors (and thus the argued importance and utility for this study) is that ID training would support the development of TAs’ classroom teaching expertise, that it would transfer to classroom practice. While a design assessment would verify content learning, it would only test “near” transfer rather than the more critical “far”/remote transfer (see Bransford & Schwartz, 1999; Druckman & Bjork, 1991).

The Assessment of Teaching Quality (ATQ) is an original instrument adapted from the Assessment of Classroom Effectiveness (ACE; University of Iowa, 2001). Its 18 items address specific criteria of classroom practice that align with the ID principles contained in the intervention content. It divides into three subscales that correspond to the three subdomains of the ID knowledge test (content, environment, and motivation). Thus, this assessment functions as a test of whether the TAs transferred training-based ID principles to the classroom. Three parallel versions of the ATQ are phrased from different perspectives: the teacher’s (ATQ-T), an objective rater’s (ATQ-R), and the student’s (ATQ-S). Responses are on a 1-6 Likert-style scale. The three parallel versions were completed by the appropriate participants, with reference to the same session of each TA’s class.

Though items were assigned *a priori* to the subscales, inter-item correlations confirmed the appropriateness of the subscales (content subscale: $r=.46-.70$, $p<.07-.001$, $\alpha=.74-.80$; environment subscale: $r=.46-.77$ ($p<.06-.001$, $\alpha=.80-.85$; motivation subscale: $r=.34-.78$, $p<.18-.001$). To check consistency of subscales within the three versions of the ATQ, I generated subscale means for the three measures, and they were adequately correlated within the original instruments: ATQ-T .83-.93, ATQ-S .69-.92, ATQ-R .65-.81. Further, the individual subdomain scales across the three instruments correlated at .42-.56 ($\alpha=.73$). Based on this strong interscale and intrascale reliability data, I collapsed the three instruments into one measure of “teaching performance.”

**General Teaching Effectiveness:** This scale addressed the global perception that the teacher has taught the unit effectively, that is, in such a way that students were able to access the content being presented (University of Iowa, 2001). This subscale was a three-item subscale from
the ACE (University of Iowa, 2001), in this study delivered on the ATQ (all three versions), and was responded to by students, teachers, and trained raters. Based on correlations across the three measures ($r=.64-.87; \alpha=.73-.91$), the three versions of this measure were collapsed into one measure of general teaching effectiveness. This scale also correlated at $r=.79$ with the overall teaching performance measure ($\alpha=.88$).

**Perceived learning (students):** This construct refers to the students’ perception that they have learned the content from a given lesson, that is, that they had encoded and could recall the essential content (Pintrich & Schunk, 1996). It was assessed using a 2-item perceived learning measure (Hardré & Reeve, 2003) ($\alpha=.89$).

**Engagement (students):** Engagement refers to the quality of a student’s involvement in initiating and carrying out learning activities in the school setting, including attending to instruction from the teacher (Connell & Wellborn, 1991; Reeve, 1996). In educational psychology academic engagement is the composite of positive emotionality and effort (Patrick, Skinner, & Connell, 1993). In instructional design, Richard Clark (1998) proposed positive emotionality, effort, and value. I used Clark’s three elements and Patrick, Skinner, and Connell’s (1993) emotionality and effort measures, with the value subscale from Reeve and Sickenius (1994) to measure academic engagement. The value scale generated a reliability coefficient of .83, and the effort and emotionality scales demonstrated internal consistency at $\alpha=.78-.83$. Interscale correlations of .54-.80 ($\alpha=.83$), were sufficient to collapse the three into one measure. Thus, the measure of engagement in this study is the mean of the emotionality, value and effort subscale means for the students in each teacher’s class.

**Results**

To confirm that there were no differences between the treatment and control groups on the individual difference and outcome variables, I conducted two sets of tests. On the categorical variables I conducted Chi-square tests, and on the continuous variables I conducted on-way ANOVAs. Both sets of tests confirmed no significant differences between the experimental groups on the relevant individual characteristics and pretest measures for predicted outcomes of the intervention (i.e., ID knowledge, self-efficacy, perceived competence, satisfaction with strategies, and teaching performance).

I predicted that teachers who participated in the instructional design (ID) intervention would demonstrate greater ID knowledge than those who had not. Since the comparison was ID intervention compared to none, I conducted a one-way ANOVA, using group differences on the posttest score for the teachers’ ID knowledge test. The result was significant: $F(2,15)=32.059, p.<.01$ (control group: $M=18.5; SD=1.97$; treatment group: $M=39.83; SD=5.29$). Since the teachers in the treatment group were significantly higher than the control group on ID knowledge after the intervention, and not before it, these results indicate that the intervention was successful in enhancing the TAs’ ID knowledge.

To further support this conclusion, I computed learning scores for the teachers (posttest score – pretest...
score) on the instructional design knowledge test, then conducted an independent samples t-test of the intervention and control group difference scores, to check for learning effects. The result was significant: $t(16)=4.30; p<.01$ (treatment group: $M=12.17; SD=6.49$; control group: $M=.67; SD=4.59$). This difference in learning scores showed that the teachers in the treatment group improved significantly in their instructional design knowledge between the pretest and posttest, while the teachers in the control group did not. Even though the random assignment was successful in producing groups with no significant differences, I chose to add the test of difference scores to further support the strength of the intervention effects.

Having established the effectiveness of the intervention in increasing TAs’ ID knowledge for the subsequent test, I used the whole sample (both treatment and control) to test the hypotheses regarding other outcomes predicted by ID knowledge. I predicted that teachers with greater ID knowledge would report greater satisfaction with their ID knowledge and strategies. A correlation was significant ($r=.65; p<.01$), indicating an important relationship between ID knowledge and satisfaction with instructional knowledge and strategies.

I further predicted that teachers with greater ID knowledge would report higher perceived teaching competence. The correlation was significant ($r(18)=.87; p<.01$) indicating an important relationship between instructional design knowledge and perceived competence.

Next, I predicted that teachers with greater ID knowledge would report higher teaching self-efficacy. The correlation was significant ($r(18)=.93; p<.01$) indicating a strong relationship between instructional design knowledge and teaching self-efficacy.

I predicted that teachers with greater ID knowledge would demonstrate better teaching performance. The correlation, using the composite measure of teaching performance was significant ($r(18)=.68; p<.01$), indicating a moderate but significant relationship between instructional knowledge and teaching performance.

I also predicted that teachers with better teaching performance would also have students with higher perceptions of learning. The correlation was significant ($r(18)=.80; p<.01$), indicating a strong relationship between quality of teaching performance and student perceptions of learning.

Finally, I predicted that teachers with better teaching performance would also have students with higher academic engagement. The correlation was significant ($r(18)=.72; p<.01$), indicating a strong relationship between teaching performance (as measured in this study) and students’ academic engagement.

**Discussion**

In this study, I proposed that instructional design knowledge represented important skills and strategies for university teaching assistants. Results confirmed that even a brief (6-hour) intervention could enhance TAs’ instructional design knowledge.

I further proposed that instructional design knowledge development would improve teachers’ self-perceptions and their classroom performance. Instructional design knowledge as measured in this study
was significantly related to teachers’ satisfaction with their knowledge and strategies, and to their teaching self-efficacy and competence perceptions. These results are consistent with the theoretical relationships among these variables, and with the findings of previous empirical studies (see Moore & Esselman, 1992; Schunk, 1991).

I then contended that if instructional design knowledge were taught to teaching assistants, it would enhance their classroom teaching practices, so I tested correlations of teachers’ instructional design knowledge with the evaluations of teaching performance.

This finding was very strong: instructional design knowledge, as assessed for this study, correlated with evaluations of teaching performance across the groups of teachers, by multiple raters, and for the whole sample of students.

A critical value in enhancing teachers’ knowledge and practice is in their power to enhance student outcomes. I tested the relationships between teachers’ classroom performance (as measured in this study) and students’ perceived learning and engagement. Both relationships were significant: when teachers performed better in the classroom, students were more engaged and felt they learned more.

Admittedly, small sample size severely limits the application of these results. Given the small sample size, and that the tests are correlational rather than directional, these findings must be interpreted as exploratory rather than conclusory. An additional limitation is that the study used a passive control group rather than an active control; that is, it was the full intervention versus nothing (rather than compared to something without ID content). This design decision was made based on the availability of participants and their time constraints (practical rather than theoretical reasons). Utilizing an active control is clearly a recommendation for a future study. However, the treatment-control design issue affected only one of the seven hypotheses in this study, as the other six were tested using individual characteristics of the whole sample rather than by group comparisons. Findings indi-
cate directions for future research, including differential contributions of variables and possible mediated relationships.

**Importance of this Study**

First, there is concern over the lack of empirical research on the utility of systematic instructional design for classroom teachers and the potential for developing teachers’ design skills (ISPI, 2003; Kemp, 1985; Moallem, 1996). This research contributes one such study. Clearly, not all ID interventions are equivalent, so findings must be cautiously applied. However, for this ID training with these teachers and student groups, it is clear that systematic instructional design training made differences in both perceptions and job performance.

Second, it adds to the literature on teacher education by demonstrating that teachers can gain and apply some principles of systematic instructional design even from a brief intervention. It further contributes to understanding the utility of systematic instructional design for classroom teachers by testing desirable instructional outcomes with practicing teachers. Additionally, this study’s student participants were young adult learners, whose needs are different enough from children that applying K-12 research wholesale onto college teaching and learning is insufficient to make clear and effective judgments about instructional effects (Knowles, 1990). So this study extends the existing research (which was primarily done in K-12 classrooms or with pre-service teachers) in two ways: to both in-service teaching contexts and with young adult learners.

Third, this study contributes to the literature on the education of graduate teaching assistants. There is perennial and ongoing concern for the quality of teaching in higher education (Hutchings, 1993; Ryan, 2000), and academe is challenged by the reality that graduate teaching assistants may be domain experts, but are often underprepared for either graduate school teaching or their eventual entry into the professoriate (Marinkovich, Prostko, & Stout, 1998; Seldin, Ambrose, & Annis, 1995).

Fourth, beyond the present experimental group, these findings offer potential for enhancing the teaching/training skills of subject matter experts (SMEs) when they are called into service as trainers in their areas of content expertise. Like TAs, SMEs come with high content knowledge and skill, but typically little training and experience in learning theory and teaching strategy. Called into service for what may be brief and occasional training events, they need clear, efficient, effective tools for developing task-critical teaching skills. This research suggests that ID can serve just such a need.

**Directions for Future Research**

Some extensions and refinements of this research are indicated. First, a larger sample is necessary to support generalizability of findings and facilitate directional tests. Second, a more diverse sample including different groups of teachers and in various settings will also improve the generalizability of the assertions made here. However, the ID interventions must be targeted to assessed and perceived needs within the instructional context. Third, a more sustained intervention (beyond the six-hour workshop used in this research) is indicated. Given
the limited time for face-to-face instruction in practicing teachers’ and trainers’ schedules, sustaining content exposure may include an online electronic performance support system (EPSS). Fourth, a multiple cohort, multi-year study would reduce the potential influence of timing effects on the outcomes. Fifth, the inclusion of a design practice measure (in addition to the knowledge and classroom performance measures) could strengthen the linkages between knowledge, design, and application of design-based strategies as teaching outcomes. At least one such extension of this research is currently in progress, but much more work is indicated.

Since the quality of foundational education for university undergraduates may rest largely on the instructional and pedagogical skills of teaching assistants, it is important that we develop ways to efficiently and effectively enhance their teaching ability and classroom performances. Thus, this research offers tremendous potential for informing both administrative policy and instructional practice, and contributing to the improvement of foundational post-secondary education.

References


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