Learning Styles and Classroom Distractions: A Comparison of Undergraduate and Graduate Students

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ABSTRACT
This study extends our previous research on classroom distractions to examine the relationship between learning style and various types of external and self-generated distractions. We propose that the potency of particular distractions would be affected by student learning style. In contrast to the standard position that learning style affects comprehension, we speculate that distractions operate at a more basic perceptual level. The ratings obtained in this study of 60 business students were consistent with the ratings of the potency of distractions in our previous one. Undergraduate and graduate students differed in the perceived potencies of some of the distractions and in learning style. We found some support for our hypothesis that there are relationships between learning style and the potency of certain distractions. The implications of these preliminary findings are discussed in terms of classroom management and alignment of pedagogy.

INTRODUCTION
The literature on learning styles is extensive but controversial. While differences are found in the learning styles preferences of students in different academic disciplines and other populations, it is not clear if developing pedagogy to align with these styles is beneficial. Pashler, McDaniel, Rohrer and Bjork (2009, p. 105), after critically reviewing the empirical research, concluded, "at present, there is no adequate evidence base to justify incorporating learning style assessment into general education practices." While there may be inadequate evidence to support learning style adjustments in teaching, the relationship between the learning environment (i.e., classroom distractions) and learning style has not yet been explored.

LITERATURE REVIEW
Our previous research (Tesch, Coelho and Drozdenko, 2011) examined student perceptions of the magnitude of 36 externally produced and 21 self-produced classroom distractions. Difficulty in understanding the instructor and students talking in class were rated the most potent distractions. Overall, external distracters (i.e., those produced by other people and things) were significantly more potent than distractions produced by the students themselves. In that article we proposed

that future research could be directed toward examining the relationship between student learning style and these classroom distractions.

A literature review of classroom distractions is presented in the aforementioned paper and will be summarized here. We concluded, as did Bugeja (2007), that most of the research focused on distracting effects of technology in the classroom (e.g., cell phone ringtones, texting, laptop use for personal activities such as email, gaming and web surfing.) As far back as 2003 in commenting on data collected on 1,162 college students that showed one-third played video games on their cell phones and laptops during class, Gilroy reported it did not affect their academic performance. However, Campbell (2006) found that institutional policies banning cell phone ringing during class would be supported as most students had strong attitudes about the distraction of ringing. Shelton, et al, (2009) conducted four experiments in the college classroom lecture setting involving gradiated measures of cell phone ringing. Performance on a surprise quiz revealed low accuracy rates on material presented while the phone was ringing.

Kay and Lauricella (2011) utilized paired-t-tests that revealed structured use of laptops resulted in significantly more time spent on note taking and academic activities and significantly less time spent on sending personal emails, instant messages and playing games during class

LEARNING STYLES OF TODAY'S STUDENTS

Learning styles of students have evolved way beyond the notebook and pen. Incoming freshmen are proficient with many aspects of technology. Although it may not always be pedagogically effective, Bruen (2002) states that students are already comfortable using the web as a learning tool. However, its use can be improved by good instructional design. Learning traits, aptitudes and preferences for processing information can differ dramatically among students. Even when students self-report their classroom activities, it becomes apparent that their styles of learning are being compromised. An extensive study by Fried (2008) showed that students who used laptops in class spent considerable time multitasking and that laptop use posed a significant distraction to both users and fellow students. Most importantly, the level of laptop use was negatively related to several measures of student learning, including self-reported understanding of course material and overall course performance. In contrast, Murray (2011) felt that a perceived decline in class participation could be attributed to student learning preferences rather than the laptops they are using in class.

Gerow, Galluch, and Thatcher (2010), were surprised to find that student's deliberate cyber-slacking was influenced heavily by the students themselves and only slightly by the surrounding environment. They found that multitasking significantly impacted the intention to slack through cognitive absorption. The significance of the mediators strongly suggests that students choose their information processing preferences. They concluded that multitasking causes slacking directly and also by increasing absorption in off-task activities. Honey and Mumford (2000) developed tools for measuring learning styles. Kappe, et al. (2009) used a Learning Style Questionnaire to measure learning criteria and felt that learning style theory was a subset of personality theory but does not receive sufficient empirical examination.

Despite the lack of convincing evidence on the value of matching teaching methods and learning style preferences, we speculate that these learning style preferences may be differentially affected by other aspects of the classroom interactions. Certain types of classroom distractions may have a more basic perceptual impact on students with different learning styles. We speculate that class distractions may directly impede or block the acquisition of information.

MODEL AND RESEARCH QUESTIONS

Our objective is to examine the relationship between learning style preferences of business students and the perceived potency of common classroom distractions. In order to test that hypothesis, it is necessary first to determine (a) if there are learning style differences among groups of business students and (b) if there are differences in the perceived potency of distractions. Our assumption is that graduate and undergraduate students differ on the perceived potency of classroom distractions and also on aspects of preferred learning style.

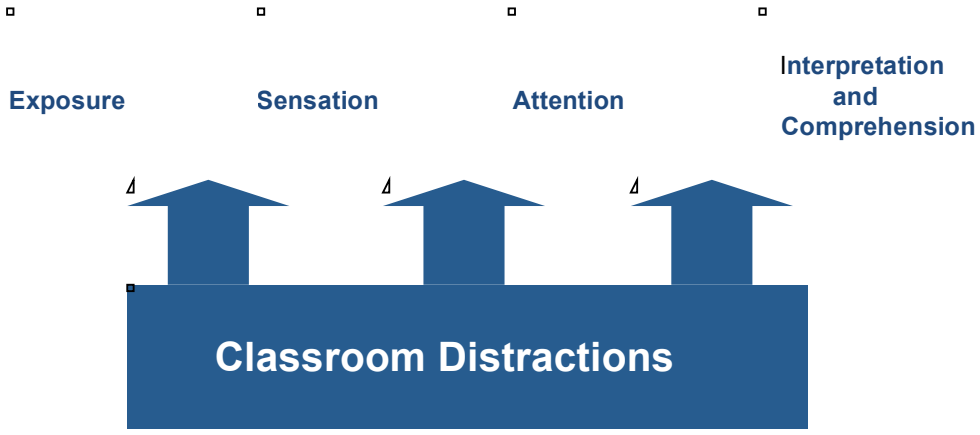
We present a model showing how learning style preference might be differentially affected by different classroom distractions. Using a simple model of information processing (Figure 1.), the classroom distractions can affect the processing of information at the sensation, attention and interpretation stages. For example, a student leaving the classroom can physically block the visual sensation of course materials (e.g., projection of a PowerPoint slide.) A student talking can directly interfere with another student's capability to process auditory input (e.g., instructor explaining a key course concept.) Consequently, students who have auditory or visual learning preferences may be differentially susceptible to different types of distractions.

Research Question 1: Will students preferring visual or auditory modalities report different levels of potency from distractions that affect those specific modalities?

Research Question 2: Is a learning style that is less directly related to sensory modality, in this case group versus individual study preference, also be affected by classroom distractions?

Research Question 3: What are the learning styles that are significantly affected by the most potent distractions?

Figure 1. Effects of Classroom Distractions on Information Processing



METHOD

This study used a modified Felder-Silverman instrument to measure learning style in a convenience sample of 35 undergraduate and 25 graduate business students. (The reliability and validity of the Felder-Silverman instrument is discussed in Felder and Spurlin, 2005, and also by McChlery and Visser, 2009, who argued that the Felder model gives a more rounded assessment of students' learning styles and adds the dimensions of Verbal/Visual and Sequential/Global which are important characteristics of the learning environment). The Felder-Silverman learning style instrument includes 44 items with contrasting statements. Instead of using the instrument's forced choice format, we used a 5-point scale to allow respondents to indicate the relative degree (or no) preference for the statements. Converting the instrument from a nominal to an ordinal output provides more sensitivity for examining potential relationships among variables in the study. We did not combine the items in the scale to produce the Felder-Silverman learning style indices, but rather used the individual items in the analyses. While specific groups of items in the Felder-Silverman instrument reflect an underlying learning style constructs (active-reflective, sensing-intuitive, visual-verbal, sequential-global) we did not want to limit our analysis to these constructs.

We asked students to rate the potency of 36 external and 21 self-produced classroom distractions. These distractions were examined in our previous research and were found to significantly vary in potency.

RESULTS

The overall mean ratings of the external and self-produced distractions are presented in Tables 1 and 2 respectively. Larger numbers indicate more distraction on a 1 to 7 scale. Significant differences (Bonferroni adjustment for multiple comparisons, 0.05 level) between undergraduate and graduate students are indicated by an asterisk. Generally, the graduate students were less tolerant of external and self produced distractions, consistent with our previous research. The Pearson correlation between the ratings of distraction in this study with our previous study is 0.946; P<.001.

Table 1.
External Distractions

* Significant Differences between Undergrad and Graduate Students	Mean	Std Dev
Instructor who is difficult to understand	6.02	1.46
Students talking with others in class*	5.59	1.38
Temperature (too hot/cold)	5.45	1.50
Classroom odors	5.35	1.41
Poor personal hygiene of other students (odors, looking dirty, etc.)*	5.16	1.59
Ringing phones & pagers*	5.14	1.62
Instructor spitting while talking*	5.10	1.76
Students asking irrelevant questions or making irrelevant comments	4.94	2.07
Students making repetitive movements (tapping fingers, pen clicking, etc.)	4.65	1.60
Equipment problems (e.g., malfunctioning computers)*	4.51	2.12
Students using MP3 players*	4.35	2.17
Instructor making repetitive or unusual speech sounds	4.29	1.87
Instructor exhibiting repetitive or unusual movements	4.29	1.91
Students using video games	4.27	2.07
Student illness symptoms (coughing, sneezing, sniffling, etc.)	4.27	1.86

Especially attractive students	4.08	2.21
Students arriving late*	3.94	2.11
Ambient noise (e.g., AC noises, road noises, etc.)	3.90	1.70
Instructor using repetitive words or phrases	3.86	1.85
Lighting (glaring, too bright, etc.)	3.71	1.80
Furnishings (e.g., chairs, tables that are broken, dirty, etc.)	3.69	2.05
Students texting*	3.53	2.02
Students leaving/returning to class*	3.51	2.12
Students leaving early	3.43	2.01
Students using laptops for email, surfing*	3.37	2.05
Provocative clothing worn by other students*	3.33	1.95
Students using smart phones	3.24	2.16
Students eating in class	3.22	1.98
Student response devices (Clickers)*	2.88	1.91
Students playing paper and pencil games, doodling, etc.	2.78	1.96
Students sleeping*	2.57	1.97
Students doing work for other courses	2.31	1.60
Clothing worn by other students (words, colors, styles, etc.)	2.24	1.55
Students drinking in class	2.10	1.70
Tattoos, piercings, hair color, bling, etc., of other students	1.86	1.24
Hats, hoods, etc. worn by other students	1.55	1.00

Table 2.
Self-Produced Distractions
*** Significant Differences between Undergrad and Graduate Students**

	Mean	**Std Dev**
Talking with others in class*	4.97	1.73
Your illness symptoms (coughing, sneezing, sniffling, etc.)	4.75	1.82
Sleeping	4.73	2.45
Playing video games	4.60	2.12
Your phone / pager ringing*	4.57	2.20
Using your MP3 player*	4.40	2.26
Using a laptop for checking your email, surfing, etc.	4.28	2.19
Doing work for other courses	4.25	2.33
Poor personal hygiene (odors, looking dirty, etc.)	4.13	2.09
Texting during class*	4.03	2.16
Using your smart phone	3.92	2.26
Playing paper and pencil games, doodling, etc.	3.70	2.19
Arriving late to class	3.67	2.03
Leaving/returning to class*	3.63	2.13
Leaving early*	3.60	2.23
Student response devices(Clickers)	3.12	2.16
Eating in class	2.83	2.03
Wearing provocative clothing*	2.60	1.92

Wearing clothing with unusual words, colors, styles, etc.	2.02	1.42
Drinking in class	1.90	1.54
Wearing hats, hoods, etc. to class	1.65	1.27

We found significant differences between the learning styles of graduate and undergraduate business students (see Table 3). Graduate students were more cognitively oriented and preferred independent thinking.

Table 3. Significant Learning Style Differences Between Undergraduates and Graduate Students

UG	Grad	1 Side of Scale	5 Side of Scale
1.85	2.75	When I am learning something new, it helps me to talk about it.	When I am learning something new, it helps me to think about it.
1.89	3.15	I understand something better after I try it out.	I understand something better after I think it through
2.04	3.20	For entertainment, I would rather watch television.	For entertainment, I would rather read a book.
2.48	3.15	Once I understand all the parts, I understand the whole thing.	Once I understand the whole thing, I see how the parts fit.
2.70	3.30	When I have to work on a group project, I first want to have "group brainstorming" where everyone contributes ideas.	When I have to work on a group project, I first want to brainstorm individually and then come together as a group to compare ideas.
3.15	3.75	Some teachers start their lectures with an outline of what they will cover. Such outlines are somewhat helpful to me.	Some teachers start their lectures with an outline of what they will cover. Such outlines are very helpful to me.
3.22	4.20	The idea of doing homework in groups, with one grade for the entire group, appeals to me.	The idea of doing homework in groups, with one grade for the entire group, does not appeal to me.
3.41	2.20	In reading nonfiction, I prefer something that teaches me new facts or tells me how to do something.	In reading nonfiction, I prefer something that gives me new ideas to think about.
3.56	4.35	I prefer to study in a study group.	I prefer to study alone.

There was tentative support for Research Question 1: Students preferring visual or auditory modalities will report different levels of potency from distractions that affect those specific modalities. Considering that there were significant differences between undergraduate and graduate students on the ratings of the potency of the distractions, two separate step-wise linear regression analyses were performed. (Note for this and all subsequent step-wise regression

analysis, 0.05 was the enter criterion and 0.10 was the removal criterion.) The findings are summarized in Table 4. The variance accounted for (R^2) by the variables is large, 0.801 and 0.895 for undergraduate and graduate respectively. Students who have a visual learning preference are more likely to be affected by some distractions that are potentially visual (e.g., doodling, using a smart phone, equipment problems, other student's clothing or attractiveness), while students with an auditory preference are more likely to be affected by some auditory distractions (e.g., cell phones ringing, students using mp3 players, other students eating.) A few of the relationships are not immediately clear, for example the affect of furnishings and using a laptop on auditory learners.

Table 4.
Distractions and Learning Styles
Stepwise Linear Regression, Significant Relationships

Undergraduate (R^2=.801)	**Graduate (R^2=.895)**	**Learning Style**
Playing paper and pencil games, doodling. Other students texting Using own smart phone Especially attractive students	Equipment problems Clothing worn by other students (words, colors, styles) Other students using response devices	Visual Preference
Other cell phones ringing Eating in class Using own laptop	Other students using MP3 players Other students eating Other students playing paper and pencil games, doodling. Furnishings (broken, dirty)	Auditory Preference

For Research Question 2: Is a learning style that is less directly related to sensory modality, in this case group versus individual study preference, also affected by classroom distractions? Only one classroom distraction for the undergraduates was significantly related. That distraction was other students using an MP3 player. This accounted for about 22% of the variance (i.e. R^2=.22) in the stepwise linear regression analysis. Students with a preference for individual study rated this distraction more potent. For the graduate students there were no significant relationships between this learning preference and the distractions.

Research Question 3: What are the learning styles that are significantly affected by the most potent distractions? The most potent external distraction was an instructor who is difficult to understand. Significant relationships were found between this distraction and learning style. Using a stepwise linear regression, two learning styles were significantly related to an instructor who is difficult to understand, 1) students who tend to understand detail relative to overall structure and 2) individual learners relative to group learners. The R^2 for the model with these two variables was 0.216. For the graduate students, another learning style appeared to be affected by an instructor who is difficult to understand. This item is related to sequential learning; *When writing a paper, I am more likely to work on (think about or write) the beginning of the paper and progress forward* versus *When writing a paper, I am more likely to work on*

(think about or write) different parts of the paper and then order them. Sequential learners were more affected by an instructor they could not understand.

DISCUSSION

Findings of this study replicate our previous research. That is, there are significant differences among the perceived potencies of classroom distractions. Again, an instructor who is difficult to understand and students talking in class are at the top of the list. Graduate students overall seem to be more sensitive to classroom distractions compared to undergraduates. In particular, they are more distracted by the actions of other students. Consequently, the classroom environment for graduate students might be enhanced by allowing more physical separation between students, thereby reducing the possibility of distractions from other students.

Based on the previous assessments of the efficacy of pedagogy adjustments to learning style (i.e. Pashler, McDaniel, Rohrer, & Bjork, 2009), we cautiously offer the following suggestions. Learning styles were found to be different between the undergraduate and graduate students. Graduate students were more cognitively oriented and preferred independent thinking. While the greater cognitive orientation would be expected for graduate students, instructors should be aware of the preference for independent versus group thinking. This is in contrast to the usual emphasis on group work in graduate programs in response to workplace needs. However, how the group work is implemented may help to align it to the learning style preference of the graduate students. One of the learning style items might offer a guide for this alignment; *When I have to work on a group project, I first want to brainstorm individually and then come together as a group to compare ideas.* Additionally, graduate course instructors should be sensitive to the graduate students' preference for individual versus group grades. Including a graded individual component to a group project may work toward this preference.

There is support for the hypothesis that students with different learning styles are distracted by different types of environmental stimuli. In particular, we found that sensory input preference (visual versus auditory) related to some corresponding distraction types. We also examined the relationship between the most potent distraction and learning style. It seems that students that are detail oriented and sequential in their learning style may be more affected by an instructor who is difficult to understand. Instructors who have this limitation, possibly as reported through course evaluations, should consider supplementing their lectures with detailed, sequentially organized notes.

While the relatively small convenience sample used in this study limit scientific generalization of the findings, the aforementioned pedagogical recommendations carry little risk if implemented. Again, we offer any recommendation about teaching alignment with learning style with caution. These teaching modifications will need to be empirically assessed to determine efficacy. Testing modifications in the physical environment might be easier to assess. That is, does limiting visual distraction through better classroom management facilitate learning differentially in students with a visual learning style?

Our future research will be directed toward replicating these findings with other samples and further examining relationships between the distractions and learning styles. In particular, we plan to examine the relationship between the distractions and the four learning style indices that can be derived from the Felder-Silverman instrument.

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