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Abstract

Since the advent of PowerPoint and course delivery programs like Blackboard, more instructors in higher education are providing students with outlines of their lectures and expecting students to supplement these with their own notes. Although some have found that instructor-provided notes appear to enhance student learning, others suggest that students benefit from the act of taking detailed notes since it engages them in the learning process. While controlling for fidelity of lecture delivery, the present study examined the impact of three conditions on the posttest performance of 154 undergraduate and graduate students enrolled in an introductory special education course: (1) no instructor-provided notes were available, (2) instructor-provided notes were available immediately following lectures, and (3) instructor-provided notes were available before lectures. Analyses revealed that pretest scores were significantly correlated to posttest scores and that students who did not receive instructor-provided lecture notes received statistically significant lower posttest scores than students who received instructor-provided lecture notes before or after lectures. The implications for university instruction are discussed.

Keywords

instructor-provided lecture notes, effective teaching, higher education, PowerPoint lecture notes, university learning

The presentation or non-presentation of instructor-provided lecture notes

Despite innovations in instructional technology, class lecture remains the primary method to communicate course content to college students. It is commonly held that, by taking notes, students deepen their understanding and relate lecture topics to current knowledge, which, in turn, may positively influence their academic performance (Brazeau, 2006; Castello and Monereo, 2005). Researchers have suggested that the act of taking notes engages students more directly in the learning process and increases their ability to apply new material (Katayama and Crooks, 2003). The act of taking notes may have an influence on the encoding function of the brain by requiring students to prioritize and paraphrase information, which engages the learner's attention and moves the

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information into long-term memory (DiVesta and Gray, 1972). Additionally, when preparing for exams, effective students tend to review their lecture notes.

This view of the value of taking notes is consistent with the information-processing model of learning that suggests that incoming information is coded, organized and stored for future use (Klahr and Wallace, 1976). Using this same line of thinking, Castello and Monereo (2005) asserted that note taking represented a dialogue between the teacher, the student and his/her classmates that resulted in important contextual understanding. Brazeau (2006) and Suritsky and Hughes (1991) argued that active learning, a key aspect of student engagement, is reduced when students are not directly involved in the process of collecting and organizing information for note taking. Note takers were found to recall more high-importance concepts than non-note takers did, which led Einstein et al. (1985) to conclude that note taking aided the organization and recall of lecture information. According to Kiewra (1985) and Kobayashi (2006), student-taken notes are recalled more readily than those provided by the instructor.

Despite the fact that student-taken notes may be beneficial, a number of college students have weak note taking, analytic and organizational skills (Cukras, 2006) and may find instructor-provided lecture notes useful. These students may take inadequate or incomplete notes during lectures or may take notes with little synthesized information (Kiewra, 2002). Students who miss or mis-record key aspects of the lecture are at a considerable disadvantage when using their notes to review for an examination (Grabe, 2005). Bonner and Holliday (2006) proposed that typical note takers have limited strategies for selecting and achieving goals when compared with self-regulated note takers who selected goals and moderated their note-taking efforts to achieve those goals. In lecture settings, students' personal notes may contain as little as 11%–70% of the lecture information presented (Anderson and Armbruster, 1991; Hughes and Suritsky, 1994; Kiewra, 1985). Based on this limited research, it would appear that instructor-provided notes may be an advantageous instructional support for instructors in higher education settings to offer to an increasingly diverse student population.

In addition to examining the value of providing or not providing instructor notes, researchers have examined the utility of providing partial versus full notes to students. Full notes typically contain the main ideas of the lecture with supporting details, whereas partial notes, also called guided or outline notes, offer a structured outline and allow students to fill in key and supporting information, which may serve to prioritize lecture information (Hughes and Suritsky, 1993). Both types of instructor-provided notes have been reported to positively influence learning in adults. For instance, Austin et al. (2004) studied the value of partial notes with undergraduate students by examining students' notes for the number of critical points of the lecture included, number of examples recorded from the lecture and the number of supporting details. These researchers found that, in terms of critical points recorded, slides and slides plus partial notes were found to be similarly high (97% and 100%, respectively). Katayama and Crooks (2003) examined the effects of providing complete versus partial notes on three types of immediate and delayed tests. Students' fact and structure test scores revealed no significant effects, but students' application test scores (immediate and delayed) were positively influenced by the partial notes condition. Kiewra (1985) found that students who reviewed full notes provided by the instructor achieved significantly higher scores on a delayed exam than those students who reviewed only their own notes. In contrast, Barnett (2003) found that students who took their own notes or completed partial notes performed better than students with a full set of the instructor's notes.

Further, the timing of when instructor notes are provided has been studied. Grabe (2005) explored the impact of providing notes online in advance in a psychology class. Data from 183 students on

the pattern of notes usage, student attendance, and relationship to exam scores indicated that students who accessed the advance notes outperformed students who did not utilize the advance notes on two of three examinations. Later, Grabe and Christopherson (2007) examined the usage of advance and postclass notes and exam performance, finding that students who accessed the partial notes achieved higher examination scores on two of three examinations than those who did not.

The benefits of note taking at the university level have been under study for over 30 years producing inconclusive, and at times contradictory, outcomes (Hughes and Suritsky, 1993; Kobayashi, 2006; Mercer and Mercer, 2005; Suritsky and Hughes, 1991). In spite of this, note taking is implicitly required in higher education classes even though it is understood by most instructors that some students take inadequate notes (Hughes and Suritsky, 1994). For this reason, the present study attempted to systematically determine the impact on student learning of the presentation or non-presentation of instructor-provided notes, and the timing of those notes. Specifically, two research questions were asked: (1) What is the effect of providing or not providing instructor-generated lecture notes on the learning of undergraduate and graduate students? (2) What is the effect on the learning of undergraduate and graduate students of the timing of when instructor-provided lecture notes are given?

Method

Participants and setting

The participants in this study were 154 students enrolled in an introductory special education course at an urban, public university located in a southeastern state in the United States. The course was a combined 400-level (undergraduate) and 500-level (graduate) course with differentiated assignments, although exams were the same for both groups. Of the participants who completed a survey providing demographic and anecdotal information, most were female (87%), third year (juniors) and graduate students (postbachelor) (80%), special and general education majors (82%), aged 18–35 years old (57%), with the majority taking the course to earn a special education teaching license (46%). About 10% of the participants had registered with the university's disability services office because of a special learning need. The majority of these students indicated they had a learning disability or a health impairment. Table 1 shows characteristics of the participants.

Experimental design

Three intact sections of the class, taught by different instructors, were randomly assigned to one of three conditions: (1) *no notes* (no instructor-provided lecture notes were available), (2) *notes after* (instructor-provided lecture notes were available during the final 5 minutes of the class meetings), and (3) *notes before* (instructor-provided downloadable lecture notes were available before lectures). The 'no notes' group (condition 1) had 42 students; the 'notes after' group (condition 2) had 47 students; and the 'notes before' group (condition 3) had 65 students. The characteristics of the participants in the three sections (conditions) were fairly comparable. During the study, all sections of the class received identical course content and instructional delivery style through the use of prerecorded DVDs of another instructor teaching the course. The designated content of the study comprised eight chapters from two assigned textbooks. A pretest was administered before the content was introduced, and the same test was given as a posttest after the target content had been taught. Participants had no access to students in other conditions, nor knowledge of their existence.

Table 1. Participant characteristics

	Frequency	Percentage
Gender		
Male	19	12.9
Female	128	87.1
University standing		
First Year (Freshman)	1	.7
Second Year (Sophomore)	4	2.7
Third Year (Junior)	34	23.1
Fourth Year (Senior)	24	16.3
Post Bachelor/Graduate-Degree-Seeking Student	20	13.6
Post Bachelor/Graduate-Non Degree-Seeking Student	64	43.5
Anticipated discipline/major		
General Education	52	35.4
Special Education	69	46.9
Speech Language Pathology	6	4.1
Other	20	13.5
Age category		
18–25	42	28.6
26–35	41	27.9
36–45	32	21.8
46–55	21	14.3
Over 56	11	7.5
Receiving accommodation for disability		
Hearing impairment	1	.6
Visual impairment	1	.6
Learning difficulties/disabilities	6	4.0
Health impairment (ADHD, traumatic brain injury, etc.)	4	2.7
Other	3	2.0
Reason for taking class		
To get a special education teaching license	68	46.3
It is required for my undergraduate degree in general education	38	25.9
To complete masters degree in special education	10	6.8
Required for undergraduate degree in teacher education	6	4.1
For my own personal and professional knowledge	7	4.8
It is required for my special education minor	18	12.2

Procedures and materials

Since each section of the course met for differing periods of time each week, the study was conducted for a period of 6–13 class sessions. Two of the class sections met for 2 hours and 45 minutes twice a week, while one met for 2 hours and 25 minutes every day. During the first class meeting in each condition, students took a 50-item, multiple-choice pretest on the target content. This exam was developed by the instructor featured on the DVD lectures and was strongly aligned to content presented in lectures and in the assigned readings. About half of the items on the pretest/posttest exam probed main ideas and the other half focused on details relating to those main ideas. The

instructor on the DVD spoke at a regular lecture pace (110–127 words per minute on three sampled lectures) and was aware that she was being recorded. Pre and posttests were taken online via Blackboard, a web-based course management system. The posttest was given 3–7 days following the conclusion of the content (depending on the condition). All participants signed a consent form. No extra credit was given for participation in the study, nor was there a penalty for non-participation. However, students who chose not to participate still had to watch the prerecorded lectures but were not required to take the pre and posttests or complete the survey. Of the available students, 60% chose to participate in the study.

Participants were advised that the pretest and posttest scores would not be calculated into their course grades, but that they should approach and prepare for the tests as they would any exam. Students were tested for course credit on the target content, as well as additional material, 3–7 class sessions following the conclusion of the study. Additionally, to evaluate the qualitative effect of the presentation or non-presentation of lecture notes and the timing of instructor-provided lecture notes on students' learning, participants completed an online survey following the posttest. The survey requested demographic information, had two questions designed to record participants' perceptions of the most and least effective strategies used in the classes during the time of the study, and posed one open-ended question that attempted to evaluate participants' attitudes regarding the impact of the timing of notes on their learning. After the pretest, posttest, and survey were completed, the course sections were taught by their instructors of record and proceeded as outlined in each individual course syllabus.

The instructor-provided lecture notes given to students in the 'notes after' (condition 2) and 'notes before' groups (condition 3) were 'full notes' in that they contained each lecture's main ideas with some details, and provided space for note taking if students opted to do this. These notes were provided in two forms: (a) copies of the PowerPoint slides used in the lectures, and (b) an outline of content presented in the PowerPoint slides. Students could print either one or both of the choices. Notes ranged from 3–6 pages per lecture. Figure 1 shows a sample of lecture notes provided for one class session. Students were neither encouraged nor discouraged from adding to and/or highlighting information on these notes. The lecture notes were made available online so students were free to print them whenever they wanted. Most students in the 'notes before' group chose to print the notes before class and brought them to class with them, although they were not instructed to do this.

Procedural fidelity

The three instructors were given a script to explain to the students why the first third of the course would be taught differently from the remaining portion of the class. Students were also advised that they would be watching someone else teach the class on DVDs during the first part of the class. Instructors were instructed to answer questions regarding content presented in the DVD lectures only for the final five minutes of each class meeting. Instructors were not informed which students opted to participate or not participate in the study.

Results

A Pearson correlation analysis revealed that pretest scores were significantly correlated to posttest scores, $r^2 = 0.307$ with statistical significance < 0.001 . The pretest means and standard deviations were as follows: 'no notes' group (condition 1) ($M = 22.76$, $SD = 4.48$); the 'notes after' group (condition 2) ($M = 22.47$, $SD = 4.76$); and the 'notes before' group (condition 3)

DEFINITION OF MENTAL RETARDATION

✧ **IDEA:** "Significantly subaverage general intellectual functioning existing concurrently with deficits in adaptive behavior and manifested during the developmental period that adversely affects a child's educational performance."

1

Limitations of IQ Scores

- ✧ Concept of intelligence is hypothetical construct.
- ✧ IQ tests measure only performance on items on test, at one point in time.
- ✧ IQ can be culturally biased.
- ✧ IQ scores can change significantly.
- ✧ IQ testing is not an exact science.

2

Figure 1. A sample of an instructor-provided lecture note provided to participants in the 'notes after' (condition 2) and 'notes before' groups (condition 3)

($M = 23.47$, $SD = 4.16$). The posttest means and standard deviations were: 'no notes' group (condition 1) ($M = 24.90$, $SD = 5.00$); 'notes after' group (condition 2) ($M = 31.60$, $SD = 6.43$); and the 'notes before' group (condition 3) ($M = 30.63$, $SD = 6.67$). Both pretest scores and type of lecture note distribution were statistically significant in an ANCOVA predicting posttest scores, with p -values of < 0.000 . The ANCOVA revealed that there was a statistically significant difference in the posttest scores of participants in the 'notes after' group (condition 2) and the 'notes before' group (condition 3) when compared with participants in the 'no notes' group (condition 1). After controlling for pretest scores, the participants who did not receive instructor-provided notes (condition 1) had statistically significantly lower posttest scores than those who received notes before (condition 3) or after the lecture (condition 2). Participants who were not given instructor-provided lecture notes (condition 1) had posttest scores that were an average of 5.408 points lower than those who received notes before the lectures (condition 3) and an average of 6.837 points lower than those who received notes after lectures (condition 2), after adjusting for pretest scores. There was no statistically significant difference between the posttest scores of participants in the 'notes before' group (condition 3) and participants who received notes after lectures (condition 2). Table 2 provides a summary of these analyses.

Table 2. ANCOVA results

Source	N	d.f.	F	p
Pre-test	154	1	18.630	< 0.000
Condition		2	16.902	< 0.000
Condition	N	Mean	Standard error (After adjusting for pretest scores)	95% CI
1 – No notes	42	24.992	.903	(23.207, 26.777)
2 – Notes after	47	31.829	.855	(30.138, 33.519)
3 – Notes before	65	30.400	.728	(28.962, 31.838)

Additionally, after the taking the posttest, 147 of the 154 participants completed a survey designed to gather qualitative information about the impact of instructor-provided lecture notes on students' perception of their learning. When asked to identify the most effective strategy that instructors used to help students learn the course content, participants in the 'no notes' group (condition 1) identified reading the assigned chapters as the most helpful strategy (38.9%) as did those in the 'notes after' group (condition 2) (24.5%). Having a copy of the lecture notes before the lecture was determined to be the most effective strategy reported by participants in the 'notes before' group (condition 3) (72.6%). Table 3 presents a sample of representative written comments to an open-ended item on the survey that asked participants to: *Indicate how the timing of the presentation of lecture notes influenced or did not influence your learning in this course.* Students who were given instructor-provided lecture notes before or after lectures tended to have more positive comments and fewer complaints about the DVD lectures when they responded to this question.

Discussion

This study found that providing instructor-developed, full lecture notes produced statistically significant higher scores on a posttest given in an introductory special education class consisting of undergraduate and graduate students. The provision of instructor lecture notes increased students' performances by as much as 5–7 points on a 50-item, 50-point posttest. The timing of these notes, whether given before or after lectures, was not found to have a critical influence on the students' test performances. Participants in the study were exposed to the same classroom conditions and identical presentation of material through the use of prerecorded DVDs used to deliver course content. In addition, the testing that occurred was directly related to the course content, controlling for two weaknesses to external validity identified by Bonner and Holliday (2006) and Grabe and Christopherson (2007) in previous studies. Although few would disagree that the prerecorded lectures were not as engaging as 'live' class sessions, students still performed more effectively when they had access to instructor-provided lecture notes.

The survey given after the posttest, designed to collect qualitative information about the three conditions, was revealing. About 73% of the participants given instructor-provided notes before the lectures (condition 3) rated having these notes as the *most* important strategy used by their instructor to enhance their learning, and consequently their performance on the posttest. Having access to the instructor-provided lecture notes before lectures appeared to be viewed by the students in this group as a positive teaching strategy. As one student wrote: 'I was able to listen, absorb, and expand on the topic when lecture notes were provided beforehand.' Another

Table 3. A sample of participants' write-in comments to the survey question regarding how the timing of lecture notes may have influenced or not influenced their learning

Condition	Student comments
Condition 1 – No notes	<p>"I did not like the presentation of material because I am a kinesthetic learner. This has been very difficult for me to just listen and watch someone talk on a screen. I have not enjoyed this at all."</p> <p>"I prefer not to watch a video or take television [distance] classes as it is not very personable and much harder to get individualized help from the professor. I prefer the teacher to be there in the classroom to answer any questions and engage in class discussions."</p>
Condition 2 – Notes after	<p>"From previous classes I have found that receiving the lecture notes prior to class is influential in my learning. Receiving the notes after the lecture has resulted in a disorganization of my material."</p> <p>"... I prefer having notes ahead of time so that I can follow along with the instructor as she is lecturing ... I believe that the notes would be more beneficial if you could get them before class. I do better when I have the notes in front of me before the lecture, this way I can add comments onto the notes when I hear them and this reinforces my learning."</p>
Condition 3 – Notes before	<p>"At times the lecture moved very quickly, I was thankful to have had the notes available to follow along. Having the notes ahead of class allowed me to follow along and make notes on the corresponding slides."</p> <p>"Having notes before the lecture allowed me to read over them which helped me to understand the lecture."</p>

student commented to her instructor that having lecture notes before lectures kept her mind from drifting. This is counter to what Neef et al. (2006) have asserted; they expressed a concern that giving full notes before lectures might lessen input requirements from students and may encourage inattention. This effect was not found in the survey responses of participants in the present study.

In fact, the absence of instructor-provided lecture notes (condition 1) proved to be frustrating for some students. For example, one student wrote: 'It [the prerecorded lectures] went too fast for me to take the needed notes, then after a while I stopped taking notes.' The instructor on the DVD was presenting information in a standard conversational rate and paused occasionally to facilitate note taking. It may be that some students *perceived* the instructional pace as faster than it was since they only had the visual input of the PowerPoint slides as referents for content when the instructor lectured. It may be noteworthy that, after the conclusion of the study, the majority of students expressed relief when downloadable lecture notes were provided to everyone prior to lectures.

Although it was not formally measured, the three instructors in this study observed that the majority of the students in their classes took personal notes, although they were not instructed to

do so. Some instructors have commented that they are concerned that if they provide lecture notes their students will not develop the ability to take notes effectively. However, the students who were given notes before lectures also took their own notes on those provided by the instructor. In the 'no notes' and 'notes after' conditions, students tended to attempt to write down the material included in the PowerPoint presentation, apparently verbatim. Consequently, some appeared to miss some information because they were writing an earlier statement when the instructor proceeded to new information. As one student commented in the survey, 'I enjoyed the PowerPoint as a different teaching technique, but I missed some of the information . . .' The inability to prioritize and quickly record lecture information may have negatively impacted the posttest scores of students in the 'no notes' group.

In contrast, several students who were given the instructor-provided notes beforehand (condition 3), commented that having copies of the lecture notes allowed them to hear more of the instructor's comments and emphasis, which allowed them to be more engaged in the lecture. Since these students were freed from copying the PowerPoint slides, they may have been better able to attend to the instructor's message, organize critical information, and be more involved in discussions. This observation is supported by Austin et al. (2004), who reported that the use of slides with partial notes substantially increased the number of examples and supporting details recorded by students in their personal notes. Further, it may be that giving instructor-provided notes in advance served to reduce cognitive overload and allowed students to use their auditory and visual skills to attend to the discussion, resulting in more dimensional learning (Brazeau, 2006; Stefanou et al., 2008).

In the present study, 15 of the 154 participants were identified as having special learning needs such as visual impairments or learning disabilities. The research suggests that students with special needs tend to record less complete information in notes they take in class (Biddulph et al., 2006; Boyle, 2007). In general, the written comments of these students paralleled their classmates in the present study. One student with a disability in the 'notes after' group (condition 2) wrote this: 'I often write too much and do not listen enough. If I had had the notes beforehand, I could have written in notes from the PowerPoint and listened more.' Since this kind of statement was also given by students without special learning needs, it seems that instructor-provided lecture notes have the potential to benefit the learning of typical university students as well as students with learning needs, whether disclosed or not.

It is possible that some university instructors may be leery of posting instructor-provided notes in advance of class meetings because of concerns that students will not attend class. Much of the research regarding the timing of the presentation of the notes has found little connection between posting the notes in advance and decreases in class attendance (Grabe and Christopherson, 2007; James et al., 2006; Vandehey et al., 2005). James et al. (2006) surveyed 230 students and 30 faculty members regarding their perceptions of the use of PowerPoint notes on cognitive learning, classroom interaction, attendance, and note-taking quality. Regarding attendance, faculty members were significantly more likely to believe that posting notes in advance (that is, on Blackboard or on the Internet) would result in lower student attendance, while students reported that having the notes in advance would not reduce their attendance. Additionally, both students and faculty reported that the use of PowerPoint notes given in advance had a positive impact on note taking and recalling content during an exam.

Interestingly, Grabe (2005) found that posting advance notes did impact class attendance, but not student performance on examinations. He reported that 30% of the 126 students who admitted using the notes in place of class attendance six or more times did not fare substantially worse on

examinations. Although no formal records were collected, the instructors in the three conditions of this study reported no observed difference in class attendance between the study portion of the course and the last part of the course.

Implications for practice

The past research conducted on supplementing students' personal notes with instructor-provided notes has been equivocal. The outcomes of this study suggest two immediate implications for teaching in higher education settings. First, it appears that instructor-provided notes, in the form of lecture outlines with some supporting details, can have a positive influence on student learning as measured by multiple-choice exams. Notes given by instructors will be more precise than students' personal notes and for this reason may serve as a better guide to the content to be learned. Providing these notes does not appear to inhibit students from adding their own notes, in which they may synthesize or add to the material that an instructor is teaching. Second, making instructor-provided lecture notes available either before or after the lecture appears to be equally effective in facilitating learning. As more students receive instructor-provided lecture notes as a standard component of online and distance education courses, students may come to expect these notes as just one aspect of any well-organized course. Owing to faulty note-taking skills that some students exhibit, students may achieve optimal performance if they are provided with instructor-developed notes and encouraged to supplement them with their own notes.

The present study encountered some limitations which may influence the generalizability of the results. Participants were able to opt out of the study, which may affect the validity of the results. Since intact class sections were used, the observed group differences might be the result of student differences, class time, or the number of class meetings. The participants were not asked if they reviewed their own notes and/or instructor-provided notes in preparation for the posttest, and no formal attendance data were collected. Further, it is possible that different outcomes might have been observed if the study had been conducted for a full semester.

Most will agree that note taking appears to be a beneficial student activity when contrasted to not taking notes at all (Kobayashi, 2006; Titsworth, 2001). The present study suggests that when instructors provide students with lecture notes before or after lectures students' test scores improve. Although the value of instructor-provided lecture notes is becoming better supported by research, the utility of full versus partial notes and how instructor-provided notes may actually influence learning is far from conclusive and should be addressed by research in the future. Additionally, future research should examine whether the value of instructor-provided notes is influenced by the content that is being taught. Further, instructors continue to need more guidance on how to develop effective ways for building a deep understanding of the material they teach and how to assist students in learning how to apply this content in meaningful ways. Future research should focus on these issues and attempt to identify the level of detail required to allow instructor-provided notes to enhance, but not inhibit, independent learning. Considering the diverse nature of the skills and abilities of students entering universities today and the importance of their success, all available measures must be taken to improve students' academic performance. Students in colleges and universities should not have to face additional struggles because their instructors continue to avoid the use of evidence-based strategies when they teach.

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