

Using the Cornell Note Taking Method for Instruction

Russell Jay HENDEL

Department of Mathematics, Towson University
Room 316, 7800 York Road
Towson, Maryland 21252, USA
RHendel@Towson.Edu

ABSTRACT

There are several popular note-taking methods, amongst which the Cornell note taking method is very well-known. The method consists of taking notes by dividing the page into three parts: the main notetaking part; the part summarizing themes, key-, and cue- words; and a part summarizing, in a few lines, contents. This article explores using the Cornell method, originally designed for students, as a means of pedagogy delivery for instructors. Hendel's four pedagogic pillars, rooting pedagogic excellence in fundamental psycho-neurological processes, explain the success of the Cornell method as attributed to its encouraging executive function and optimal goal-setting techniques. The paper also examines the contrastive practices of some textbooks and confirms critiques of these approaches as employing lower levels of the Bloom-Anderson hierarchy.

Keywords: Cornell, pedagogical hierarchy, Bloom, Anderson, executive function, goal setting, note taking,

1. OVERVIEW¹

There are several popular note-taking methods, amongst which the Cornell note-taking method is very well-known. After describing the method (Section 2), the paper explores using it instructionally as a pedagogic delivery method (Section 3). To assess the success of the method, Hendel's four pedagogic pillars, all rooted in naturally occurring psycho-neurological processes, are employed. It is shown that the Cornell method has desirable attributes of executive function and good goal setting (Section 4). The paper concludes (Section 5) by reexamining certain textbook practices critiquing them for their low level on the Bloom-Anderson hierarchy of instruction and exercises.

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2. THE CORNELL NOTE TAKING METHOD

The Cornell note taking method advocates a 3-component approach to note-taking [35].

- **Main narrative note taking:** This is a portion of the notes, typically on the *right-hand* side of the page, in which traditional note taking of lecture material is taken using hand-written notes.
- **Themes, key-words, and cue-words:** A second portion of the notes, typically on the *left-hand side* of the page, and sometimes produced after, rather than during the lecture, has key words, cue words, themes, or short questions, which point to the content of the notes on the *right-hand* side of the page.

Summary: A third portion of the notes, typically at the *bottom side* of the page, and often written after the lecture, summarizes in a few sentences the lecture.

The Cornell note-taking method is rooted in cognitive processes, its three components corresponding to the three basic types of memory, sensory, short-term, and long term [29]. For convenience of reference, in the sequel, we will refer to the *left, right, and bottom* side of the notes.

The primary cognitive benefits of any note-taking method are increased attention and the act of summarization [28]. To appreciate this emphasis on attention and summarization, we compare several note-taking strategies. *Guided notetaking*, in which the instructor gives students a set of brief phrases outlining the lecture with the students filling in details of each outline topic as the lecture progresses, is superior to *total student notetaking* and *total instructor note provision*, for example through Power Point, precisely because it encourages more attention and summarization [25]. An analysis of the strengths, weaknesses, opportunities, and threats (SWOT) of the Cornell note-taking method shows that its chief strengths are the increased focus on attention and summarization (the *left-hand* and *bottom* side of the note taking sheet); its main

drawback is the burden of simultaneously listening to the lecture and taking notes [27].

The Cornell note-taking method is considered one of the half dozen best note-taking strategies and vies with other methods such as outlining, charting, flow-based, and mind-mapping note-taking [1]. It has been applied to a variety of subjects (composition writing [2, 9], grammar [17], nursing [3]), a variety of grade levels (K-12 [7,17] and college level [3, 18]), a variety of student types (including students with disabilities [7], and foreign students [2]), and its efficacy is independent of the student's native language [18].

Several of the studies cited so far emphasize that most students are poor in note-taking skills, for example, they don't know how to distinguish key information and secondary information [13, 27]. Therefore, many studies accompany their research with explicitly teaching the note-taking method to the students.

The Cornell note-taking method, besides being rigorously studied in several articles, may be popularly found on many university and other websites as advice to students [12, 15, 34, 39, 40, 46, 47, 48] and is also presented in books for success in college [35]. Several websites provide a popular pro and con analysis of the Cornell and other note-taking methods [11, 12, 36, 38].

3. USING THE METHOD INSTRUCTIONALLY

The initial idea is simple: If the method is deemed successful for students, then it should be equally successful for instruction. This section presents a multi-disciplinary set of examples illustrating this approach. In employing this approach, the instructor primarily uses the first two components of the Cornell method: The *right-side*, the main lecture material and the *left-side*, the key words, themes, and cue words. The *bottom side*, the summaries, are left to the students who may provide a summary during class, as an exit pass, or for homework. The examples presented are selected from simple mathematical and grammatical material providing accessibility to all readers. However, the author has utilized the method in upper-level undergraduate mathematics courses with (anecdotally) improved performance and student satisfaction.

3.1 Personal Pronouns: It is well known that English pronouns have *person, number, and plurality* and differ on whether they are used in the nominative as subjects of a sentence or in the accusative and genitive as objects of the sentence or a preposition. A lecture could therefore begin with the following table summarizing the various available pronouns and their usage.

Usage	1 st person sing	2 nd person sing.	3 rd person sing.	1 st person plural	2 nd person plural	3 rd person plural
Nominal	I	You	(S)he	We	You	They
Objects	Me	You	His / her	Us	You	Them

Table 1: Personal pronouns by usage, person, and plurality.

Instructions: In each sentence below fill in the blanks with appropriate entries from Table 1.

Example 1: John said that he was wearing his tuxedo to the wedding. He asked what Cynthia would wear and was told that _____ would wear _____ rose dress.

Example 2: The pastor was unhappy with how the Smiths were using their inheritance for attending gambling Casinos. The pastor pointed out that the money would be better spent if contributed to his house of worship or to the community charities. The Smith's responded: This inheritance was given to _____ not to _____ nor to _____.

Answers: The blanks are sequentially filled in each sentence as follows: Sentence 1: she, her. Sentence 2: us, you, them.

Figure 1: Typical exercises involving personal pronouns.

Table 1 corresponds to the *left-side* of the notes since it provides key-words, cue-words and themes. It could be presented initially in the lecture, or, later in the lecture after some initial examples. The main part of the lecture would then present examples or model questions whose analysis depends on proper selection from the table. Some sample questions in the form of fill-ins are found in Figure 1 and resemble classical textbook material [6]. One key difference between some textbooks and the Cornell method applied to instruction is an emphasis on explicitly teaching using the interaction of Table 1 and Figure 1. Thus, an instructor would present each example in Figure 1 by pointing to the chart and asking for or indicating the identification of the relevant table entries.

Figure 2 displays the instructional presentation using the traditional 3-part Cornell note taking format. The *left side* presents the keywords and cues presented in Table 1. The *right side* presents the actual lecture given by the instructor as presented in Figure 1. The instructor is free to place the left side before, during, or after the presentation of the right side. The bottom summary section is filled in by students, it is designed to engage the student to provide a synopsis of the lecture meaningful to them.

<i>Left side:</i> Cues and brief summaries; Table 1	<i>Right side:</i> The actual lecture; Figure 1
<i>Bottom:</i> Summary, to be filled in by the student either during the lecture, as an exit pass, or for homework.	

Figure 2: Use of the Cornell note-taking method for instruction.

3.2 Solving Linear Equations.

Rule 1: Add the same quantity to both sides of the equation.
Rule 2: Multiply both sides of the equation by the same number
Rule 3: Expand parenthesis in the equation.

Figure 3: The three rules for solving single linear equations.

Instructions: Solve each example using rules in Figure 2.
<u>Example 1:</u> $3X = 12$
<u>Example 2:</u> $X + 4 = 14$
<u>Example 3:</u> $2(X + 5) = 40$
<u>Answers:</u> <i>Example 1:</i> Multiply both sides of the equation by $1/3$ leading to the solution $X = 4$. <i>Example 2:</i> Add -4 to both sides of the equation leading to the solution $X = 10$. <i>Example 3:</i> First expand parenthesis to obtain $2X + 10 = 40$; then add -10 to both sides of the equation obtaining $2X = 30$; finally multiply both sides of the equation by $1/2$ leading to the solution $X = 15$

Figure 4: Typical exercises involving linear equations.

<i>Left side:</i> Cue words, brief summaries, rules (Figure 3)	<i>Right side:</i> Actual instructional exercises (Figure 4)
<i>Bottom side:</i> Summary to be provided by the student during lecture, as an exit pass at the end of the lecture, or for homework.	

Figure 5: Use of the Cornell note-taking method for instruction.

Individual linear equations can be solved using the three rules presented in Figure 3. Figure 4 illustrates typical exercises. Figure 5, similar to Figure 2, shows how an instructor would use the Cornell note-taking method to prepare the lecture. One possibility, frequently employed by the author, is to place the *left side* on the left side of a

blackboard at the beginning of the lecture. This left side is never erased. The *right side* of the board is then used for the instruction on the right side, possibly filling up the right side of the board with each example as the lecture progresses.

4. THE FOUR PEDAGOGIC PILLARS

This section briefly reviews the four pedagogic pillars of Hendel [26]. The pedagogic pillars facilitate explaining the success of the Cornell method. This explanation complements and supplements other neuro-cognitive explanations such as the understanding the three components of the Cornell note-taking methods as corresponding to the three basic types of memory, sensory, short term, and long-term [29], or as the explanation that the Cornell note-taking method encourages increased attention and summarization [28].

Theories of pedagogy [4, 8, 19, 32, 44] starting with Bloom's pioneering work [8], traditionally provide pedagogic hierarchies, that is, lists of descriptors, to assess the level of pedagogic challenge in instructional material. For example, when using the Bloom hierarchy, to decide whether a given homework exercise is pedagogically challenging, the instructor must judge whether the given exercise primarily requires memorization, analysis, or creativity for its solution. Within each theory, each descriptor has associated with it supportive descriptors facilitating classification. For example, *analysis* can be recognized if the instructional material involves *matching, classifying, analyzing errors, generalizing, or specifying* [32].

There are half a dozen such established pedagogic hierarchies introduced by a variety of researchers. Recent research suggests that there is an underlying unity among these theories in the precise sense that their impact on pedagogic improvement is the same [45]. With a goal of unification, Hendel [26] introduced the idea that the descriptors should explicitly link to known psycho-neurological categories, for then, the resulting theory of pedagogy can be justified by these psycho-neurological concepts. Hendel called his descriptors *pedagogic pillars*. Two important pedagogic pillars are *executive function* and *goal-setting*.

Executive function refers to that aspect of the brain that integrates several other brain areas [43]. Executive function has counterparts in other approaches to pedagogy which typically refer to it as *multiple* modalities [14, 24, 33]. One key feature of executive function is this *multiplicity*. Experiments confirm that even a simple

twoness adds pedagogic challenge. For example, the trail-making test has two parts: Test A and Test B, one exclusively involving numbers and the other involving numbers and letters. Although Test B involves numbers and letters versus Test A which involves just numbers, it is nevertheless more challenging, requires executive function, and despite its simplicity is predictive of a variety of neurological attributes such as the possible speed and recovery from stroke [10, 16, 20, 37].

This *twoness* also succinctly describes the Cornell method with its emphasis on the interaction of a theme-list and examples. By explicitly requiring instruction to involve two separate items, executive function is required, leading to pedagogic challenge with its consequent improvement to instruction, retention, and satisfaction with the learning experience.

Another pedagogic pillar is proper goal-setting which refers to the optimal breakdown of a terminal goal, such as understanding proper use of personal pronouns, or being able to solve a single linear equation, into sub-tasks. Goal-setting theory posits that the sub-tasks leading to optimal goal-setting should be clear, specific, and atomic, that is, not subject to further breakdown [30, 31]. The Cornell method achieves this by reducing an instructional module to a collection of atomic themes or keywords. Upon the student mastering each theme, they are ready to master the goal by applying multiple themes. Figures 2 and 5 are typical and illustrative.

5. COMPARISON WITH OTHER APPROACHES

This section reviews five textbooks teaching a specific topic in trigonometry: the four parameters of periodicity. As will be seen, many textbooks focus primarily on one-parameter exercises, which can typically be solved by rote memorization, a low-level cognitive pedagogy. A superior pedagogic technique would require students to simultaneously select and use multiple parameters thereby exercising executive function, a higher cognitive pedagogy [26]. The Cornell method has the potential to naturally encourage this. We begin with some background.

Trigonometric functions are used to study periodic phenomena. An illustrative example is presented in Figure 6, presenting the duration of daylight in Manhattan, New York over a 24-month period. Several features of this graph are apparent:

- Periodicity: The graph repeats (it is periodic).
- **D**, Displacement: The low point of the graph is about 9 (the shortest day in Manhattan is 9 hours).
- **A**, Amplitude: The difference between the shortest and longest day is about $15 - 9 = 6$ hours.

- **F**, Frequency: The graph repeats every 12 months.
- **P**, phase shift: The graph begins at its lowest point.

Because this paper is written for a wide audience, including non-technicians, the paper suffices with a *description* of the parameters without presenting any formal functions. Consequently, in the sequel, the letters, *D, A, F, P* refer to the parameters *displacement, amplitude, frequency,* and *phase shift.*

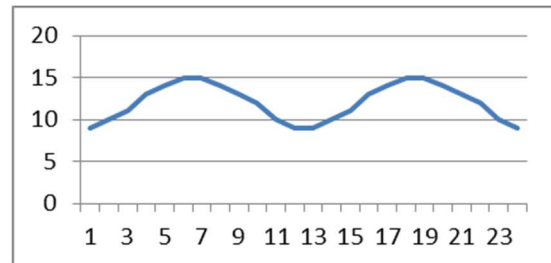


Figure 6: Duration of daylight in hours, over a 24-month period, starting in January (labeled 1), in Manhattan New York

At the time of the study, the author had available from publishers many sample textbooks dealing with trigonometric functions. They were examined, not for the content taught in which they were very similar, but for the types of practice exercises provided. A wide variety was discerned. Table 2 summarizes for five representative textbooks the percentage of textbook exercises whose solutions require using one, two, three or four of the parameters, **D, A, F, P**.

By comparing the Swokowsky textbook [42] with the other four textbooks, several salient features emerge. i) Swokowski has 4-8 times as many four-parameter exercises as the other textbooks. These exercises requiring addressing four parameters use more executive function than the other textbooks. ii) The other four textbooks, by contrast, may supply more 1 and 2 parameter exercises thereby achieving a sufficient overall number of exercises but with many of the exercises, say those with only one parameter, not involving executive function but just involving rote memorization and recall of formulas.

An additional point not summarized in Table 2 is that the Swokowski textbook is richest in verbal exercises covering such diverse applications as brain waves, heart waves, temperature, and daylight. These real-world exercises naturally involve all four parameters. These real-world exercises provide stronger use of executive function since they integrate the verbal and mathematical parts of the mind, through modeling.

We might summarize this by pointing out that some textbooks create sufficient exercises by focusing on low

level pedagogic exercises (such as those involving one parameter). This paper's basic thesis, based on executive function, and consistent with the Common Core and the NCTM standards, posits that proper instruction should i) use an incremental approach introducing one parameter at a time; one should then ii) provide sufficient illustrative examples and exercises until students can master *simultaneous* use of all parameters; finally, one should climax the teaching unit with iii) presentation of verbal exercises addressing the verbal and formal area of the brain and using all four parameters. Such pedagogy is rich and motivating, creating student engagement.

Textbook	# Exercises	1	2	3	4
[41]	56	18%	71%	11%	0%
[5]	70	24%	54%	20%	2%
[22]	28	57%	28%	11%	4%
[42]	73	30%	30%	23%	17%
[23]	52	31%	38%	27%	4%

Table 2: Five textbooks, the number of exercises on trigonometric functions provided, and the percentage of those exercises whose solution requires 1,2,3 or 4 of the parameters, D , F , P , and A .

The application of the Cornell method to instruction avoids this lower-level instructional pedagogy by deliberately requiring the instructor to place the keywords outlining the lesson on the left side of the board. During the lesson, the instructor reviews examples of each parameter and then, following the outline, reviews multiple parameter exercises. Additionally, the outline should encourage modeling of real-world phenomena, reminding the instructor to include such examples in the lesson.

In a typical module, the instructor would prepare a theme-table which would contain the four parameters and a variety of real-world phenomena that are naturally modelled using them. Such a theme table reminds the instructor of obligations to present exercises and examples addressing both individual and multiple parameters as well as real world phenomena.

6. CONCLUSION

This paper has advocated using the Cornell method of note-taking as a means of instruction. Such an approach to instruction is consistent with important pedagogic pillars associated with higher cognitive learning such as executive function and goal-setting. The approach also facilitates avoiding some of the pitfalls leading to instruction and exercises at a lower cognitive level. Multi-disciplinary

illustrations of the application of the Cornell method to instruction are presented. The author recently started using this method; preliminary and anecdotal results show improved student performance and increased student enthusiasm of the teaching. It is hoped that other instructors will adopt this approach in their respective disciplines of instruction.

In preparing the final manuscript the author learned that the Cornell note-taking method was actively being used in a Maryland Middle School. One instructor there told Towson University faculty, "When I taught Transitions Mathematics, students would take notes at home and come to me with some background knowledge before I taught the lesson. I modeled how to use Cornell notes on the first day of school, and they consistently used them. Now that I have IM (Illustrative Mathematics (BCPS mathematics curriculum, grades 6-12)), we don't use Cornell notes. Our science department does use them, and I believe our new AVID classes (Advancement Via Individual Determination (an educational program that fosters a safe and open culture, high expectations for teachers and students, and collaboration in all classrooms) use them as well." Such developments where schools for younger students use the Cornell note-taking method are extremely welcome. It will be interesting to assess a decade or two from now how these students perform in high school, college, and their chosen professions.

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