Prestige Journal of Counselling Psychology, Vol. 3, No. 2, September 2020
A publication of the Association for the Promotion of Innovation in Education (APIE)
ISSN: 2651-5687 (Print)
ISSN: 2651-5709 (Online)

Cornell Note-Reviewing Technique and Students' Recall of Lecture in Nigeria

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Abstract
This study investigated the effects of Cornell note-taking/reviewing on recall of lecture. Eighty (80) year 2 students of two Colleges of Education in Plateau State were randomly assigned to four (4) experimental and control groups. The recall measures were immediate free-recall and achievement tests. 2x2 ANOVA and Tukey HSD statistics were used to test the hypotheses. Findings of the study indicated that participants in the Cornell note-taking group performed better on recall tests than those in the No Notes group. Also, participants that reviewed Cornell notes performed better than those who reviewed Lecturer's notes. The study recommended that students should be trained in Cornell note-taking/reviewing techniques in order to enhance students' recall of lecture and to enhance academic performance.
Keywords: Cornell, note-reviewing, recall, techniques, lecture, college, students

Introduction
Recall of previously learnt information by students is vital to achieving academic excellence. Learning will be impossible without retrieval (Encyclopaedia Britannica, 2009). Retrieval enhances learning (Karpicke, 2016). Much of classroom learning at the tertiary level depends on understanding, retaining and retrieving information from lectures. Often times, students in higher institutions of learning are expected to take notes during lectures and use such for subsequent review in preparing for examinations (Akintunde, 2012). In spite of modern technology promoting the use of personal computers as learning aids, note-taking with paper and pen remains significant in achieving learning goals (Kobayashi, 2006). In Nigeria, paper-based note-taking is widely used during lectures. Note-taking is considered a necessary learning skill that enhances students' memory and academic success (Ilter, 2019; Dietsche, 2017).

Researchers have identified two main functions of note-taking – encoding function and an external storage function (Jiang, Clarke-Midura, Keller, Paquette & Ocumpaugh, 2018; Akintunde, 2015). Note-taking serves an encoding function by helping to transform lecture material into more meaningful form and so enhances recall (Jansen,

Lakens & Ijsseisteijn 2017; Boye, 2012). The external storage function of note-taking entails the use of notes by the students for later review (Gonzalez, 2018; Boye, 2012; Bauer & Koedinger, 2006). As such, review is also an important technique to aid comprehension and retrieval.

However, there are conflicting reports on the quality of notes reviewed and the effects of such on recall. Some researchers have reported that respondents who reviewed lecturers' notes did not perform significantly better on recall test than those who reviewed their own notes (Fisher & Harris, 1973; Thomas, 1978), while others found that reviewing lecturer-provided notes enhanced recall better than student-generated notes (Kiewra, 1985; Howe, 1970). Generally, the type of review, timing of review, type of notes reviewed and quality of notes reviewed are perceived as factors influencing retrieval of information. These call for further investigations. Note-taking precedes note-reviewing. Cornell note-taking is deemed an effective note-taking strategy that aids retrieval. It has an in-built review system. The present study sought to investigate the effectiveness of the Cornell note-reviewing technique in facilitating recall of lecture information. Since Cornell note-taking is not popular in Nigeria, a brief description of what it entails is necessary.

Cornell note–taking was developed by Walter Pauk, an emeritus Professor of Psychology and Education, at Cornell University, United States of America (USA). It was designed to help students take more organized notes to improve their test scores. It was also identified as a widely used system throughout the United States. According to Pauk (2001), Cornell note-taking is a "system that efficiently takes you through a completely natural learning cycle on the same sheet of paper" (p.238). Cornell note-taking is relatively a simple format to use and requires very little training (Johnston, 2006; Vanderleun, 2005).

In using Cornell note-taking system, there are steps to be taken by the learner, before, during and after the lecture:

Phase 1: Before the lecture. The learner prepares for the lecture by dividing the lecture note sheet into 2 columns: Recall column (left side) and Main notes column (right side). At the bottom of the sheet is Summary section. Also, learner writes the date, topic, subject and lecturer's name.

Phase 2: During the lecture. The learner uses the main notes column to write the main ideas or points of the lecture including examples and illustrations used. Abbreviations and telegraphic sentences are also used by the learner.

Phase 3: After the lecture. The learner takes 3 steps immediately after the lecture:

a) The learner writes on the Recall column, keywords, cues, raises questions on the lecture and gives answers. He/she also writes 'cues' in the summary column. The process of writing, summarizing words and phrases, helps to fix the information in the learner's mind, as this is already a kind of review.

b) The learner uses the recall and Summary segment cues to practice recalling the main points of the lecture (after covering the main notes column). This is also a review process.

c) Learner reflects on the meaning of the lecture by relating the lecture to personal experience. He/she may add personal examples to illustrate the main points of the lecture. This is also a review process.

Specifically, the present study sought to discover the effectiveness of reviewing Cornell notes in enhancing recall. Also, the effectiveness of using in-built-review features of Cornell notes to review was compared with reviewing lecturer-prepared note.

Objectives of the study

The objectives of this study were to:

1. Investigate the effects of Cornell note-reviewing technique on recall of lecture information.
2. Find out whether respondents that review Cornell notes will perform better in recall tests than those who review lecturer-provided notes.

Hypotheses

Ho1: There is no significant Mean difference in recall test performance between Cornell note-takers that review their notes and Cornell note-takers that do not review their notes.

Ho2: There is no significant Mean difference in recall test performance between Cornell-notes group and No-notes group.

Ho3: There is no significant Mean difference between Cornell-note-reviewers and Lecturer-note reviewers on recall test.

Methodology

This study was an experimental research. Post-test control group research design was adopted. This study also involved the use of 2-Way factorial design whereby two note-taking styles were crossed with two review styles. Being an experimental study, eighty (80) Year 2 students from two Colleges of Education in Plateau State, Nigeria were the participants. 40 participants from each college of Education were randomly assigned to the 4 treatment groups (10 participants per group x 4=40). Data collected from the 2 Colleges of Education were pooled (40 x 2 = 80) in all analyses since same

procedures were used and equivalence was achieved through randomization. Also, the participants shared similar characteristics such as being year 2 students, approximately same age group and living in similar environments.

There were 4 treatment conditions, comprising 2 note-taking groups and 2 No-Notes groups. Groups 1 and 2 took Cornell notes (Experimental groups) while Groups 3 and 4 did not take notes (Control groups). Also, there were 2 Review- Notes groups (Experimental) and 2 No-Review groups (Control). Groups 1 and 3 reviewed notes (Cornell or Lecturer notes) while Groups 2 and 4 did not review notes. The four treatment conditions were:

1. Take Cornell notes - Review your Cornell notes (CN-RCN)
2. Take Cornell notes - No review (CN-NR)
3. No notes - Review lecturer's note (NN-RLN)
4. No notes - No review (NN-NR)

Participants in the experimental groups were trained on how to take Cornell note and how to review. After training the participants from the two schools for a total of eight weeks (4 weeks each), the same post-tests were administered on all groups. Only the experimental groups were trained, the control groups were not given treatment. For the post-tests, each group received an experimental package containing instructions based on the experimental conditions. There were different instructions on the note-taking, review and test procedures. These instructions were followed by participants while listening to a video-taped lecture. Thereafter, all groups were tested for 'Free recall,' short term objective and short answer tests (designated as Achievement Test). The Free Recall test and Achievement test were the two (2) instruments used for data collection. There were 20 test items in all. A total of 35 idea units drawn from the passage were used to score the Free recall test. Instruments used for data collection were validated by experts drawn from the University of Jos. Thereafter, 2-way ANOVA and Tukey HSD statistics were used for testing the null hypotheses.

Presentation of results

Ho1: There is no significant Mean difference in recall test performance between Cornell note-takers that review their notes and Cornell note-takers that do not review their notes.

The analyses were divided into 2 parts: The first part showed a test for significance between Note-reviewers (irrespective of Note-taking styles) and Non-note reviewers. The second part showed a test for significance, specifically, between Cornell note-reviewers and Non-note reviewers. A 2x2 ANOVA was used for each recall measure as shown in Tables 1 and 2.

ISSN: 2651-5687 (Print)
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Table 1: 2x2 ANOVA Summary Table of Free-recall

Source of variation	**Sum of Squares**	**Df**	**Mean square**	**F**	**P 0.05**	**α<**
Rows (Review Conditions)	68.45	1	68.45	7.1	0.0094	s
Columns (Note-taking Styles)	224.45	1	224.45	23.3	<.0001	s
R x C (Review x Note-taking)	110.45	1	110.45	11.46	0.0011	s
Error	732.2	76	9.63			
Total	11.35	79	-	-	-	

Table 2: 2x2 ANOVA Summary of Achievement test

Source of variation	**Sum of Squares**	**Df**	**Mean square**	**F**	**P 0.05**	**α<**
Rows (Review Conditions)	45	1	45	9.95	0.0023	s
Columns (Note-taking Styles)	88.2	1	88.2	19.5	<.0001	s
R x C (Review x Note-taking)	5	1	5	1.11	0.2954	s
Error	343.8	76	4.52			
Total	482	79		-	-	

Tables 1 and 2 reveal significant differences in the performance of review and no review groups, irrespective of note-taking style. In Tables 1 and 2, under Rows, P of 0.009 is less than 0.05 for free-recall, and P of 0.002 is less than 0.05 for achievement test. This implies that a significant difference exists between the performance of Review and No review groups. Generally, note-reviewers performed better than non-note reviewers, regardless of note-taking style.

Specifically, in order to further test for significant difference between Cornell Note-takers that reviewed their notes and Cornell note-takers that did not review their notes, Tukey HSD tests were conducted. The results are presented in Table 3.

Table 3: Tukey HSD Test (Cornell - Review vs Cornell - No Review) – Free-recall and Achievement Tests

	Mean Diff.	**Crit. Value.**
Free-Recall:		
CR vs CNR	4.2	2.58 (cell) s
Achi. Test:		
CR vs CNR	2.05	1.77 (Cell) s

P < 0.05

Key:
s = Significant
CN = Cornell - Review
CNR = Cornell - No Review
Diff. = Difference
Achi. = Achievement
Crit. = Critical

The Tukey HSD results revealed that the average Mean score of Cornell - Review group (10.7) and that of Cornell - No Review group (6.5) produced a mean difference of 4.2 (free recall). Since 4.2 is greater than the critical value (Cells) of 2.58, the difference is thus significant. Also, for Achievement test, Cornell-Review group had a mean of 14.05 while Cornell-No Review group had 12.05, producing a mean difference of 2.05. These indicate a significant difference in the results of Cornell note-takers that reviewed their notes and Cornell note-takers that did not review their notes. Consequently, hypothesis 1 is rejected.

Ho2: There is no significant Mean difference in recall test performance between Cornell-notes group and No-notes group.

Tables 1 and 2 reveal significant main effects of note-taking styles. In Table 1 (Under Columns), it should be noted that P of .0001 is less than 0.05; hypothesis 2 is therefore rejected. That means a significant difference exists among note-taking scores in Free-recall test. Also, in Table 2 (Under Columns), P-value (.0001) is less than 0.05; the hypothesis is also rejected, indicating that there is a significant difference among the mean scores of note-taking groups in Achievement Test. These imply that Cornell note-taking is more effective compared to not taking notes at all.

Ho3: There is no significant Mean difference between Cornell-note reviewers and Lecturer-note reviewers on recall test.

Tukey HSD statistical tool was used to test this hypothesis. The results are presented in Table 4.

Table 4: Tukey HSD Test (Cornell note- Review vs Lecturer note- Review) – Free-recall and Achievement Tests

	Mean Diff.	**Crit. Value.**
Free Recall:		
CNR - LNR	5.7	2.58 (Cell) s
Achi. Test:		
CNR- LNR	2.60	1.77 (Cell) s

P < 0.05

Key:
s = Significant
-- = versus
CNR = Cornell note- Review
LNR = Lecturer note- Review
Diff. = Difference
Achi. = Achievement
Crit. = Critical

The Tukey HSD test results in Table 4, reveal that the average mean score of Cornell notes reviewers (10.7) and that of Lecturer note reviewers (5.0) produced a mean difference of 5.7 (Free recall). Since 5.7 is greater than the critical value (Cells) of 2.58, then the difference is significant. Also, for Achievement test, Cornell note reviewers had a mean score of 14.05 while Lecturer note reviewers had 11.45 thus producing a mean difference of 2.60. These indicate a significant difference between Cornell note reviewers and Lecturer note reviewers.

Discussion of the findings

Cornell note-takers who reviewed their notes performed better than Cornell note-takers that did not review their notes. The study indicated that the effectiveness of Cornell note-taking strategy is embedded in its powerful in-built review strategy. Using the Summary Column, Cornell note-takers were engaged in active review of their notes using self-questioning which enhanced their comprehension. In other words, getting the best out of Cornell note-taking strategy entails the use of its summary column.

Also, the study showed that Cornell note-taking is very effective in enhancing recall of information from memory, since Cornell note takers performed better than the Non-

note takers. Cornell note-taking stimulated critical thinking in learners and aided learners in active processing of information. The finding supports the submission of Jansen, Lakens and Ijsselsteijn (2017), that deeper processing of information as a result of taking notes can improve the amount of information that students remember from lectures. The study has shown that using effective note-taking strategy like Cornell will promote students' recall of lecture information than not taking notes at all.

Furthermore, Cornell note reviewing was also found to be more effective than Lecturer note reviewing. This finding contradicted that of Kiewra (1985) that found that students that reviewed Lecturer-provided notes performed better than those that reviewed own notes. A plausible explanation for the difference is perhaps the quality of note-taking strategy used in taking student-owned notes.

Generally, the findings of this study demonstrated that Cornell note-taking/note-reviewing is very effective in enhancing students' retrieval of lecture information.

Conclusion

This study investigated the effects of reviewing Cornell notes on students' recall of lecture information. The findings revealed that Cornell note-reviewing enhances retrieval of lecture. Learners need to imbibe this strategy for effective learning and academic success.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Students should be trained in using Cornell note-taking to promote test performance, since this note-taking strategy was found to be effective in enhancing students' recall.
2. Students need to value regular note-reviewing. They should be trained on how to review Cornell notes as Cornell note-review was found to be effective in aiding recall.

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