

# E-Learning & Note-Taking: A Comparative Study

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*Abstract:* - The purpose of note-taking as a tool for assisting memory is vital and therefore the technique adopted important. This paper examines a number of techniques such as the Cornell note-taking method, one that is overwhelming in terms of its popularity and simplicity. A comparative analysis into other methods has been conducted stating the appropriateness to students in an academic learning environment. Research into e-learning and its significance with note-taking has been conducted highlighting the pedagogical principles involved in designing an e-learning environment. Furthermore, the use of Tablet PC's, annotation applications such as Microsoft OneNote and other factors has been investigated. The influence of multimedia metaphors in particular earcons has been discussed in conjunction with memory and cognitive psychological factors being addressed.

*Key-Words:* - Cornell, Earcons, E-Learning, Memory, Multimedia, Microsoft OneNote, Note-Taking, Tablet PC's.

## 1 Introduction

Notes are made to mark information into short paraphrases for the purpose of assisting memory. The core entity associated with note-taking is students who undertake this skill regularly. This paper carries out an investigation into the techniques used to take notes including the most popular Cornell note-taking method. A comparative analysis is performed with the Outlining method and Mapping method stating the strengths and weaknesses of both. Research into e-learning and its relevance to note-taking is discussed. Underlying pedagogical principles have been researched instructing how to create an e-learning environment. Moreover, the use of Tablet PC's replacing the blackboard and annotation applications such as Microsoft OneNote have been investigated. Following on, the exploration into cognitive psychology studying cognition, memory, attention, concentration and stimuli factors including multimedia influences has been conducted. Finally, the paper is summarised with development ideas.

## 2 Note-Taking Techniques

To capture notes there are many techniques one can adopt however, different techniques are appropriate in different situations [1, 2]. The most popular technique to date is the Cornell note-taking method [3]. The Cornell method is a systematic approach

for arranging and condensing notes without multiple copying. This method is simple consisting of three main sections: Area A-Keywords; Area B-Notes and Area C-Summary.

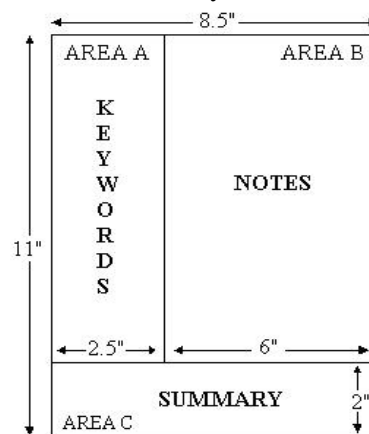


Fig. 1. The Cornell Note-taking Method adapted from [3].

The major strength of this technique is its ability to deploy it within any area of study from chemistry, physics, and mathematics to non-technical modules such as history. It is a straight-forward effective way of capturing and organising notes instantaneously [4].

At an experimental engineering and applied sciences workshop a number of benefits of this technique have been identified where students felt this method is “simple to do” [4]. The authors suggested this

method “provides organisation, requires interaction, and concentration” and reviewing can be done immediately highlighting keywords. Students are also able to summarise content “improving comprehension through individual understanding” [4].

Comparatively, the Outlining method involves dash or indentation and is not suitable for subject areas such as mathematics or physics. Specific facts are indented with spaces to the right; relationships are also represented via indentation therefore, eliminating the need for letters, numbers, and roman numerals [5]. The advantage of this technique is the neatly organised structure reviewing with ease. However, the downfall is, to achieve well-organised notes the student must fully concentrate. Thus, this technique is not preferred if the lecturer is going at a fast pace [5].

Example: -

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Note-taking
  _definition: short paraphrases to assist memory
  _types -
    _Cornell
    _Outlining
    _Mapping
  _factors -
    _cognition
    _memory
    _sensory
    
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Fig. 2. Example of the Outlining Method.

The Mapping method in comparison to the Cornell method and Outlining method is that it is a graphical representation of the lecture content. Hence, to maximise the accuracy and quality of notes the student must actively participate and initiate critical thinking [6].

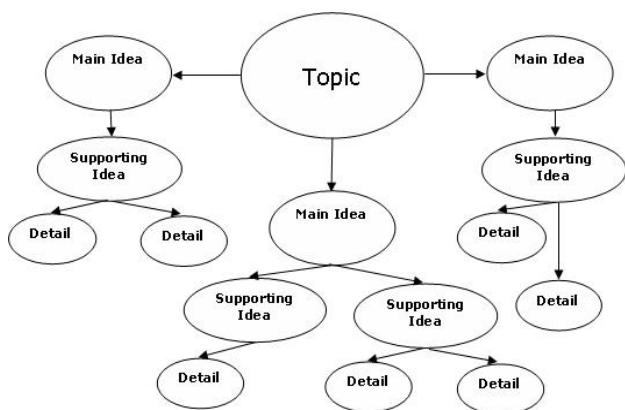


Fig. 3. The Mapping Method adapted from [7]

### 3 E-Learning

Initially, e-learning became a corporate training solution for educational institutes [8] delivering academia via the Internet. E-learning is a vast area of research and development although; we are concerned with its significance to note-taking.

Technologies involved with e-learning have increased such as the use of internet access, bandwidth and so on [9]. Two key technologies used to deliver e-learning are “Scheduled Delivery Platforms” and “On-Demand Delivery Platforms” [9]. Scheduled delivery platforms consist of virtual libraries, multicasts, remote laboratories and are structured to simulate the classroom environment [10]. This is enhanced further by providing 24/7 support and so on-demand delivery. Limitations of these include time and area constraints [9].

To develop an e-learning environment underlying pedagogical principles must be applied. The seven parameters derived include institutional support; course development; teaching and learning; course structure; student support; faculty support; evaluation and assessment [11].

A developed instructional methodology highlights five phases, analysis, design, initial production, formulative evaluation and the production phase [adapted from 11]. The learners, students, have been classified according to learning style inventories, “divergers”, “assimilators”, “convergers”, and “accommodators” [12]. These classifications were later modified according to student’s strength and weaknesses [13]. Therefore, students able to employ these techniques are known as effective learners.

Moreover, when analysing learning styles towards Information and Communication Technology (ICT) they have been categorised as “activist, reflector, theorist or pragmatist” [14]. Attitudes have been categorised as “comfort, interactivity, self-satisfaction, value for new technology, experience and content” [13]. It has been found that students feel uncomfortable using computers and lack personal contact therefore, value new technology, interactivity and context obtained lower scores [15]. Additionally, the more theoretical a student is the more negative their attitude towards ICT [14]. Thus, to improve the student ICT experience accessibility must be improved [14].

Within the e-learning global environment users are not only able to read many multimedia books online but also annotate, collaborate and discuss subject content [16]. Many annotation programs are available such as Microsoft Word, OneNote, SharePoint and also Re:Mark. Microsoft OneNote is the most popular because not only are users able to insert and edit audio and visual data [17] but also record lectures [18]. However, the drawback is in order to use it each end-user must have a copy of the program [19].

As technology evolves learning is becoming more flexible and the significance of going online encompasses Information Assimilation (IA). This has been described as users gathering information through the Internet yet engaging in more incorporate processes [20]. Moreover, IA is well known for when users edit and manipulate information. This involves the gathering and filtering of information in order to complete the specific task. This does however raise the issue, would students have the desire to learn?

Person-centered teaching is a solution delivering benefits such as electronic module content; course homepage; communication and participation for example the blackboard for discussions; evaluation to review material in preparation for exams and courseworks [adapted from 21]. However, this approach is quite expensive [22, 23]. Students are provided the opportunity to explore a variety of topics depending on their individual preference. If a student is supported by a facilitator then not only do they achieve higher academic results but also mature individually, also known as experiential learning [21].

Student convenience through flexible learning has also been enhanced by the devices available such as a Tablet PC. In an experiment the Tablet PC was connected to a data projector and Microsoft OneNote to imitate the blackboard experience [24]. In doing so many factors have been identified such as efficiency, convenience, portability and clarity [24]. However, drawbacks include deficient displays and smaller drawing areas [24].

## 4 Cognition

In higher education the most common mode of instruction is lectures where attending students take notes based on the lecture content [25]. Lectures are known as a prime source of information and allow

students to engage their interest within a particular area [26, 27]. An important finding is that students take notes in every lecture regardless of the reason [28-30]. However, further research shows students take notes due to their usefulness towards learning and due to social pressures [25]. Yet American students value note-taking more than English students as they feel they have more social pressure [29].

Student learning is assisted by taking notes [31, 32] and effects occur during the encoding and storage processing phase. The encoding stage is when attending students capture relevant content and the storage phase is the reviewing of notes. When the encoding and storage phases are both combined then it is more effective than encoding only [33-36]. Optimum student performance is achieved when students review the lecturer's notes rather than their own [37-41]. The method of reviewing is important because lecture material is influenced by the generic nature of processing the content [35, 36]. Furthermore, writing summaries and answering questions have effective effects in exams and other academic tasks [2, 42].

Memory plays a key role regarding the cognitive process of remembrance and retention [43]. The human memory is of three types: *Sensory memory* visual and auditory memory being the initial storage and lasting only an instant [44]; *Short-term memory* where information is stored for up to 30 seconds prior to being forgotten or transferred to long-term memory [45]; *Long-term memory* stores memories in the cortex over a period of time [46]. Moreover, forgetfulness is caused by retrieval failure that is of two types; *proactive interference* is disruptive effects prior to learning during recall of new information and *retroactive interference* disruption effecting new learning during recollection of old information [47].

To enhance learning the exploration ideas of multimedia stimuli on learning and teaching are essential. Consequently, the means to "perceive information and learn by using visual, aural, haptic and other senses" [48]. The use of computers within teaching is advantageous over other media such as static and text-based material though its existence is inadequate [49]. The auditory multimedia metaphor provides many benefits and when used with visual output it can increase the wealth of information communicated to the user or reduce the amount the user has to receive [50]. When comparing to visual, sound provides greater flexibility because it can be

heard 360 degrees without concentrating on the output device [51]. When designing auditory systems earcons are an essential representation of the interface. These are dependent upon rhythm and pitch that varies with intensity, timbre and register [52].

## 5 Conclusion

From the research conducted, the e-learning technologies to support learning and teaching incorporate the traditional means of study. This is achieved by integrating lecture notes, handouts, discussions and so forth into one application. The integration issues and affects have been highlighted however; our focus is upon identifying a technique of note-taking and computerising this to develop an e-notetaking application. The favoured approach has been the Cornell note-taking method due to its simplicity and ability to apply to any area of study. The computerised adaptation of this with the integration of multimedia metaphors draws our attention to capturing usability issues to personalise the student learning experience. Moreover, it has been demonstrated that the use of audio earcons are most influential when used in conjunction with visual output and so to enhance the experience.

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