Written or Typed Note-Taking and Memory Retention:
Considerations for Electronic Continuing Medical Education

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Statement of Purpose:

- The Office of Continuing Professional Development, Faculty of Health Science at Queen's University is promoting the use of electronic CME to our learners, and we have developed an innovative electronic platform to CME initiatives.
- As an accredited CME provider, it is important that we understand the effects of note-taking approaches on knowledge retention, reflective behaviors and subsequent content application, so that we may engage our learners in a manner that is associated with better patient care.

Background:

- With advances in technology, there is widespread movement toward the adoption of electronic approaches to supplement CME and faculty development education, and there are currently a range of technologies are embedded in most CME (Barnes 1998)
- Health care professionals are increasingly using mobile technology (i.e. laptops, netbooks, tablets and iPads) to take notes during medical education events (Hembrooke & Gay, 2003)
- For learners who are comfortable with technology, the incorporation of electronic approaches to CME has greatly enhanced their learning experiences
- But not all health care professionals are intuitively able to use emerging technology, and prefer to engage in traditional approaches to CME (Mamary & Charles, 2000)
- Emerging research suggests that learners who take electronic notes may not engage in as much content reflection as those who take written notes (Mueller & Oppenheimer, in press); however, many clinicians take notes electronically when completing CME offered through electronic platforms (McGagahil e et. Al., 2009).

"Is there existing evidence of an effect of note-taking style on the retention of information provided through electronic CME?"

Methods: *Scoping Review (Arksey & O'Malley, 2005)*

- Preliminary literature search yielded no research specifically pertaining to the topic of note-taking style on memory retention in relation to CME
- York Scoping Review Methodology is commonly used to map key concepts and relevant literature in areas of research not comprehensively reviewed previously
- Comprised of a clearly defined 6-stage framework:

1. Identify the research question:

"Is there existing evidence of an effect of note-taking style on the retention of information provided through electronic CME?"

2. Identify relevant literature

- Databases searched: PubMed, PsychInfo, MedLine, Google Scholar, Web of Science, Google, Queen's University Summons search (library search tool)
- Key words: memory; retention; recall; note taking; writing; typing; notes; written; pen; computer.
- Select journals hand-searched
- Reference sections of key articles and-searched
- Key authors contacted directly

3. Select relevant literature

- 56 selected for detailed review
- Articles excluded based on language, redundancy, applicability of content

4. Chart Data

- Data were charted and categorized according to the grounding approaches taken in the studies.
- Key terms were pulled from the data, and each article summarized for further analyses.

5. Collate, summarize & report results

- Data were analyzed using the qualitative analysis tool NVivo10

6. Consult with key stakeholders

- Key authors in emerging literature were directly contacted and provided guidance throughout the scoping review.

Results:

Disciplinary Focus	# Publications*	Key Concepts
Psychology	28	Writing skills; executive functioning; load; cognition; working memory; learning; planning; encoding
Education	16	Fluency; generative learning; recall; encoding
Cognition	13	Levels of processing; transfer; long-term retention
Memory	12	Directed forgetting; information suppression; rehearsal
Computers/Technology	11	Multitasking; distraction; typing speed; divided attention; limited capacity
Writing Research	6	Fluency; linguistic encoding; verbal/visual working memory
Behavioral Science	2	Verbal working memory; syntactic processing; conscious controlled processing
Medicine	1	Distraction; documentation; computer use

**note: many publications fit into two distinct disciplinary categories, e.g. "educational psychology"*

- There is limited research on the relationship between note-taking behaviors and memory retention, with only a small amount of evidence describing the relationship between working memory and writing, and even less evidence comparing the effects of typing on memory.
- Research emerging from Princeton University (Mueller & Oppenheimer, in press) looks at this relationship in undergraduates; report that typing notes is inferior to longhand
- Electronic note-taking is associated with less learner reflection on the content, less understanding of the material.
- The production of writing, speaking, and typewritten language all involve different synaptic mechanisms, where they use the same processing structures but the encoding process is associated with different physiological structures in the brain.
- Note-taking has two functions: facilitating the encoding of information and the later review of that content from a learners notes. The encoding process of note-taking can occur through long-hand or typed notes; however, research indicates that it is processed differently according to the tools used
- There are fragmented clusters of information on about the effects of note-taking behavior on subsequent application of new information in specific disciplines, but no comprehensive descriptions of the implications these effects could have on professional application of new information.
- Most of the information discussing the impact of technology on learning is anecdotal.
- The little research that has been featured on the topic in medical disciplines has focused on patient documentation practices, and using hand-held technology as a practice tool.

Conclusions:

- There is no research that has compared the impact of note-taking style on memory retention as it pertains to CME.
- Further research needs to examine the effects of note-taking style during electronic CME events on information retention and application, in order to inform our recommendations for physician participants in our CME events.

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