



# Text Mining as a Tool for Program Evaluation

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#### Purpose

When evaluating a curricular change open-ended questions can identify unanticipated benefits and problems, but coding and analyzing responses is labor intensive. Text mining methodologies can help guide and streamline the interpretation of open-ended textual responses. We applied a simple and accessible text mining tool – word clouds – to student survey data regarding the introduction of PharmWeb, an optional web-based pharmacology supplement, to the Case Western Reserve University School of Medicine curriculum.

## Methods

All 162 students in the class of 2012 were surveyed about whether they had used PharmWeb [Question 10: "Did you complete at least half of all the PharmWeb modules available (Blocks 2 & 3 combined)? There were a total of 17 modules available in both blocks combined'], and then asked open-ended questions about its strengths and weaknesses (if they used it); and (if they did not use it) why not.

Word clouds are graphical representations of word frequencies in a text or corpus, with font size representing frequency. Word clouds were generated using the "tm" text mining module (http://tm.rforge.r-project.org) from the open-source data analysis software "R" (http://www.r-project.org). The word clouds of raw user survey responses to the two open-ended questions excluded words with frequencies less than 4, a standard list of English "stop" words (the, and, etc.) and a custom list of stop words (case, western, however, also, actually, something, rather).

The responses were also coded using a traditional content-analysis procedure in which a human coder intuitively identified response categories and then coded each response. Word cloud representations of coding category frequencies treated each category label as a single "word" and included all coding categories.

#### Results

The two open-ended questions generated 124 responses (from 59 PharmWeb users and 65 non-users) consisting of 3442 words of

Content Coding. Because the survey responses were being used in an exploratory rather than a hypothesis testing context, response categories were not mutually exclusive – a response could be classified with more than one category label. PharmWeb users most often cited as positive features the brevity of the modules (coded as Concise) and their usefulness for creating a conceptual framework for subsequent pharmacology instruction (coded as Scaffolding). The main reasons non-users cited for not using the modules were lack of time (No time) and not being aware of them or forgetting about them (Forgot).

Word Clouds. Frequent words from the PharmWeb users' responses were related to the most frequent coding category, Scaffolding (introduction, principles, first, concepts) and to the second most frequent category, Concise (short, time, basic), although the most frequent words were either unhelpful (pharmacology, pharmweb, pharm, modules) or related to the generically positive category Good (good).

The main message from the word cloud of non-user responses was clear; the most frequent words were didn't and time, corresponding to the most frequent coding category No Time. Also fairly prominent were words corresponding to the second most frequent coding category for non-users, Forgot (forgot), and a frequent suggestion, Make Mandatory (optional, mandatory)

Thus the simple word frequencies represented in word clouds clearly did not capture all the richness of a traditional content analysis, but did help identify key student concerns.

#### Conclusions

Text mining can be a useful tool for examining open-ended responses in program evaluation data. Even simple techniques such as word clouds can quickly identify key issues and guide further content analysis for small data sets such as ours. For larger data sets, more sophisticated text mining techniques may provide a practical alternative to labor-intensive content analysis methods.

# Resources and Downloads

Many web sites provide the ability to paste in text to create a word cloud, but privacy concerns may argue against doing so with student survey responses. A more secure approach is to create them using R on your own computer. An R script for creating a word cloud, along with a sample input file of texts and a copy of this poster, is provided at the following URL:

# https://github.com/davidallbritton/jamse2015

To try generating word clouds of your own:

- Download and install R http://www.r-project.org
- Download and install the Desktop version of Rstudio
- Download the R script and sample input file (click "Download Zip" if you do not use GitHub)
- https://github.com/davidallbritton/iamse2015 4. Place the R script and sample Excel file in a folder on your
- computer (after extracting from the zip archive) 5. Open the R script in RStudio and click "source"

## Open-ended Question 1 (PharmWeb Users)

If yes to question 10 please list strengths and areas for improvement for PharmWeb. What were the major factors in why you decided to use it? What if anything would have improved your experience and caused you to use it more?

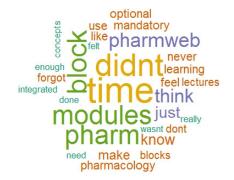
## Word Cloud of PharmWeb User Responses

examples decided better lot complete information pharmacology introduction lecture good make easier really time good just short thinkpharmweb CK Ebasic start principles much ught pharm materialweb helpful g les use like problems modu Concepts lectures used way add blocks sure help presented knowledge understanding

#### Open-ended Question 2 (PharmWeb Non-users)

If no to question 10 then why didn't you use the PharmWeb modules? Is there anything that could have been done to increase

#### Word Cloud of PharmWeb Non-user Responses



#### **Human-Coded Response Categories (Users)**

## PharmWeb Users: Positive Comments

Frequency	Coding Category
21	Provided scaffolding, preview, or conceptual overview
14	Concise and low time commitment
13	Good (general positive comments)
3	Provided useful review

Understandable, clear, easy

#### PharmWeb Users: Suggestions

Coding Category Frequency 10 Expand the content and scope Should be better integrated with curriculum

Should be mandatory Start earlier in the curriculum

Start later during the pharmacology block Make them more prominent and accessible

#### PharmWeb Users: Negative Comments

Coding Category Frequency Did not have time

Content issues (clarity, lack of new information)

Too much duplication of lecture material

Not Useful: Tried them but did not find them very helpful

#### **Human-Coded Response Categories (Non-users)**

#### Non-users: Suggestions

Coding Category Should make them mandatory Should integrate them better with curriculum

Make them more prominent and accessible

Other suggestion / not specified

Start earlier in the curriculum

#### Non-users: Negative Comments

Coding Category Frequency Did not have time

9

12 Forgot about them or was unaware of them

Not Useful: Tried them but did not find them very helpful

Not needed: Other resources were sufficient

Do not like web modules

Other reason / not specified Usefulness was not evident at the time

Not Accessible enough: Did not know about or remember them

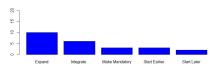
Were not mandatory

Do not make them mandatory

"Not Applicable"

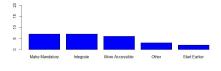
# Veb Users: Positive Comments

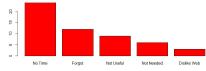
#### PharmWeb Users: Suggestions





# PharmWeb Non-Users: Suggestions





# Category Frequencies as a Word Cloud: Users

# Category Frequencies as a Word Cloud: Non-users



Not Needed Start Earlier Integrate Other Forgot Not Useful Make Mandatory More Accessible NA