Leveraging data science to analyze and interpret qualitative data from student evaluations of teaching

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Meet the team!

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(student partner)

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Land Acknowledgement

We recognize and acknowledge that students of McMaster University meet and learn on the traditional territories of the Mississauga and Haudenosaunee nations, and within the lands protected by the "Dish With One Spoon" wampum, an agreement to peaceably share and care for the resources around the Great Lakes.

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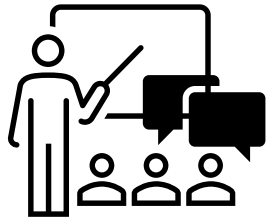
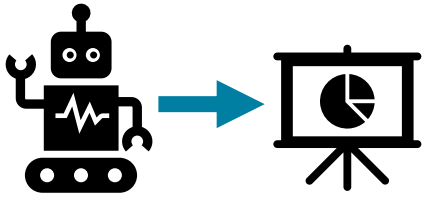
Context and Rationale



- Student comments provide rich and contextualized information; use midterm data to close the feedback loop

- Interpreting qualitative data is challenging



- Our tool will use **natural language processing** and **machine learning** to provide **semi-automated** analysis

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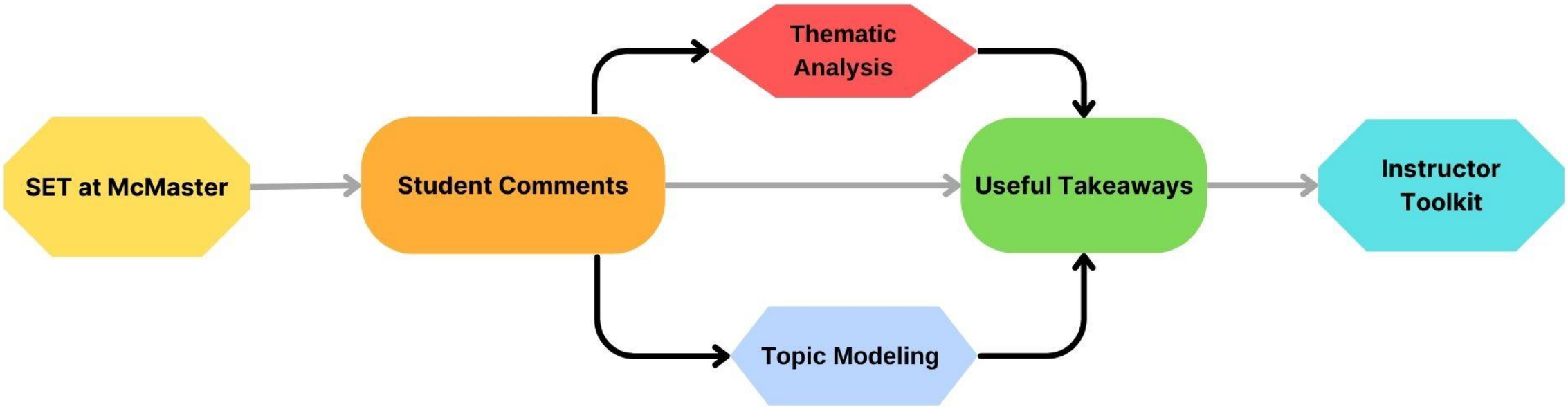
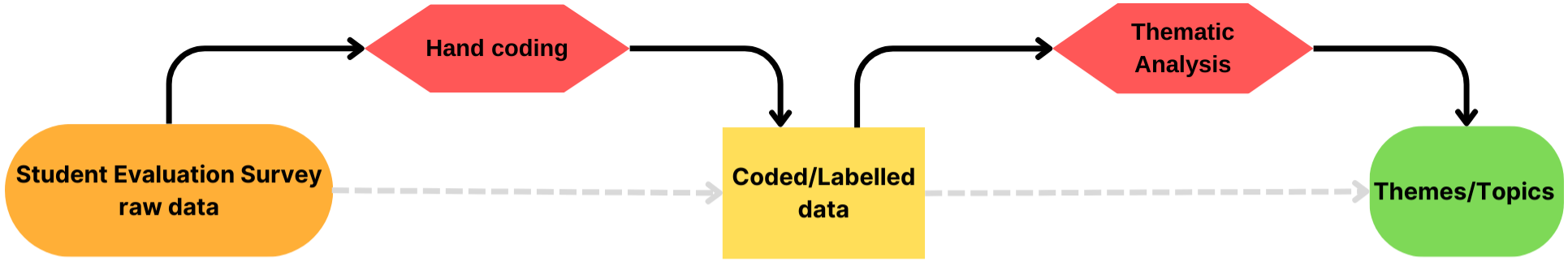
Project overview

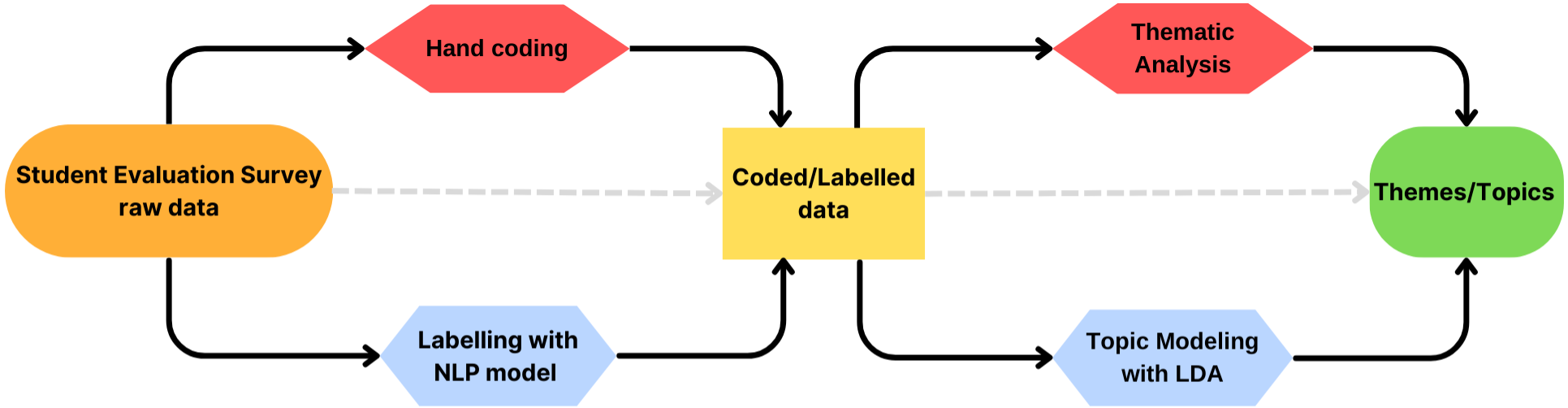


Qualitative analysis methods

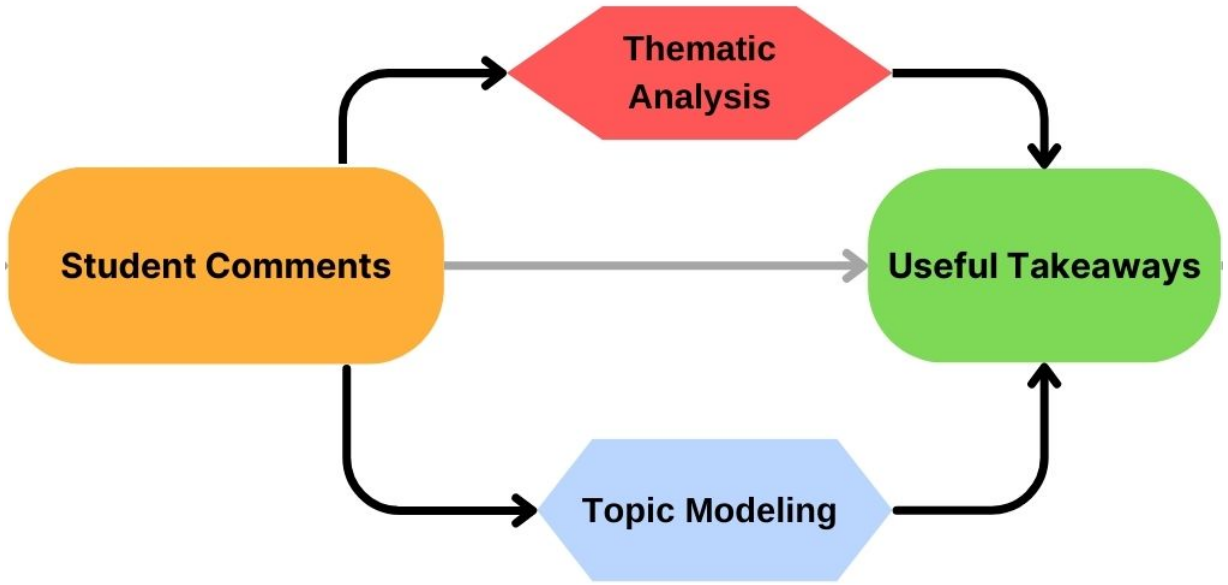
Qualitative analysis methods

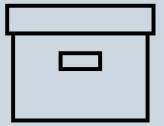


Qualitative analysis methods



Thematic analysis vs topic modelling – terminology



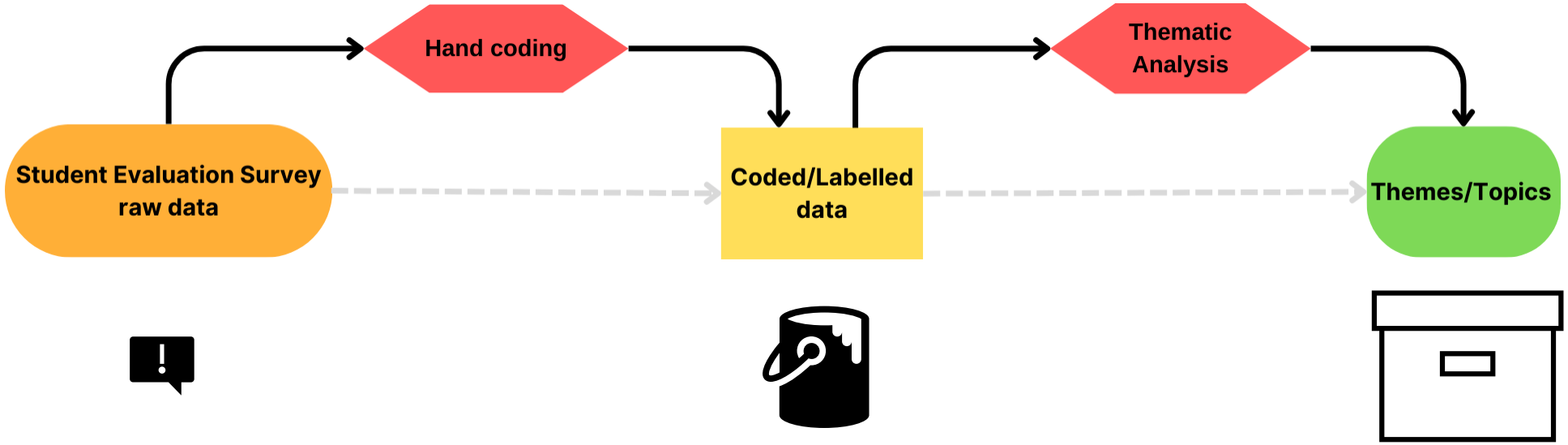
	Thematic Analysis	Topic Modelling
	Comment	Document
	Code	Label
	Theme	Topic

Data sets for case study

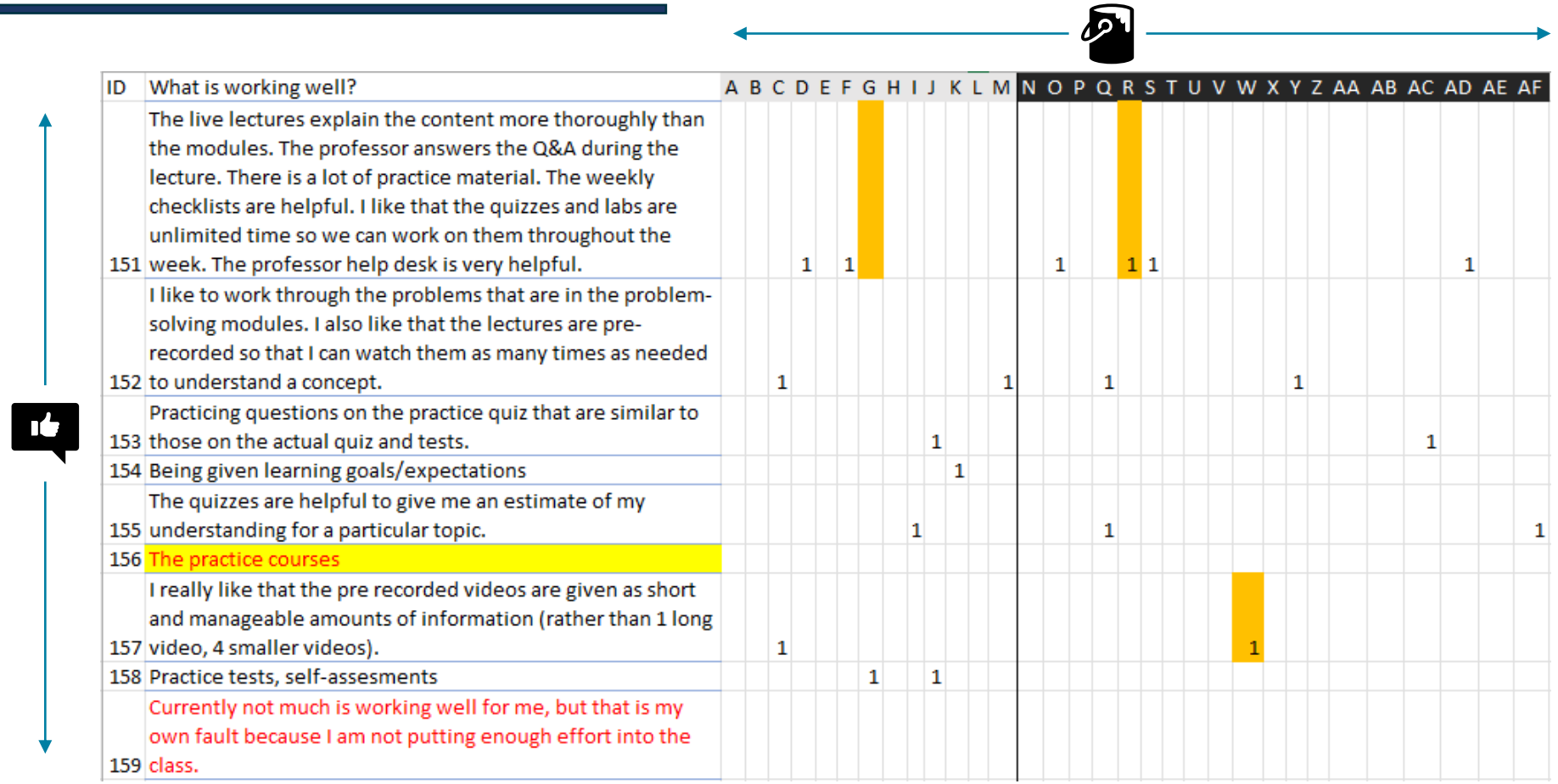
- 3 large-enrollment first-year chemistry courses during COVID-19
- ~1500 responses in each data set

- Rank the resources in this class from most useful to least useful (quantitative)
- What is working well in this course? (qualitative)
- What suggestions do you have for this course? (qualitative)

Thematic analysis

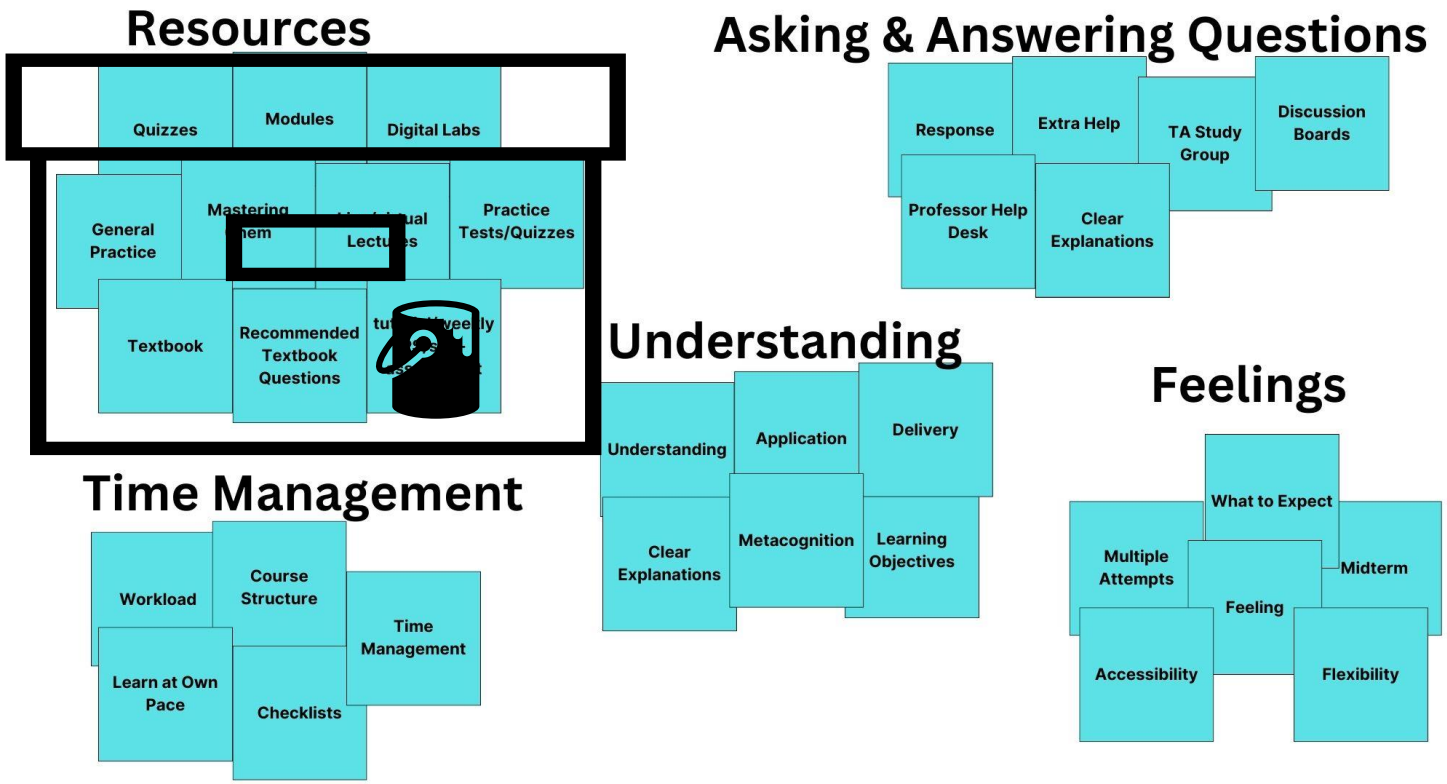


Sample qualitative coding



ID	What is working well?	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF
151	The live lectures explain the content more thoroughly than the modules. The professor answers the Q&A during the lecture. There is a lot of practice material. The weekly checklists are helpful. I like that the quizzes and labs are unlimited time so we can work on them throughout the week. The professor help desk is very helpful.				1		1									1			1	1											1		
152	I like to work through the problems that are in the problem-solving modules. I also like that the lectures are pre-recorded so that I can watch them as many times as needed to understand a concept.			1										1				1								1						
153	Practicing questions on the practice quiz that are similar to those on the actual quiz and tests.										1																		1			
154	Being given learning goals/expectations											1																					
155	The quizzes are helpful to give me an estimate of my understanding for a particular topic.									1								1															1
156	The practice courses																																
157	I really like that the pre recorded videos are given as short and manageable amounts of information (rather than 1 long video, 4 smaller videos).			1																				1									
158	Practice tests, self-assesments							1			1																						
159	Currently not much is working well for me, but that is my own fault because I am not putting enough effort into the class.																																

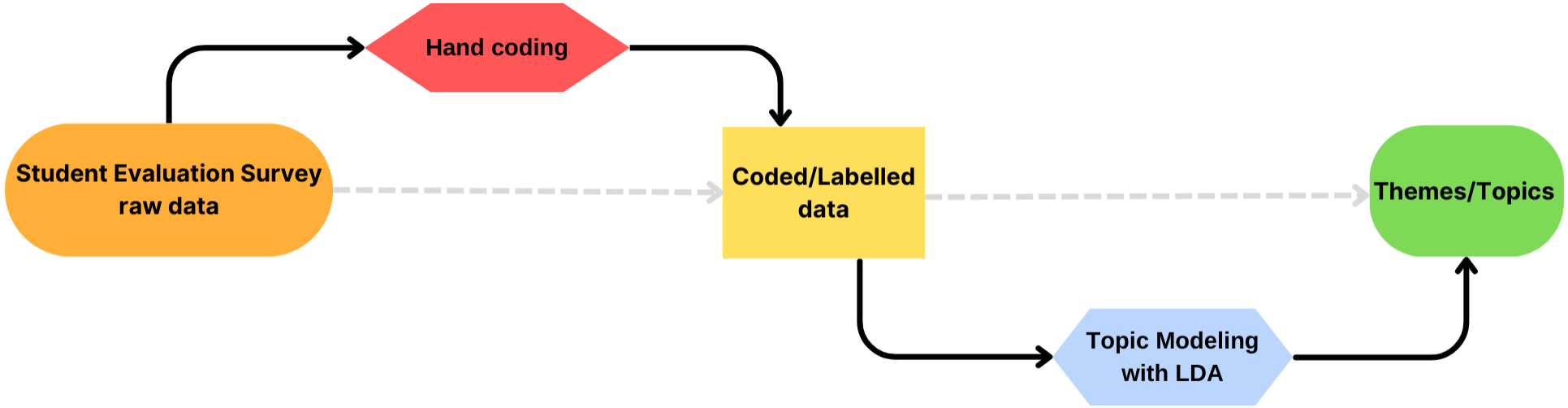
Sample thematic analysis map



code

theme

Methods for qualitative analysis



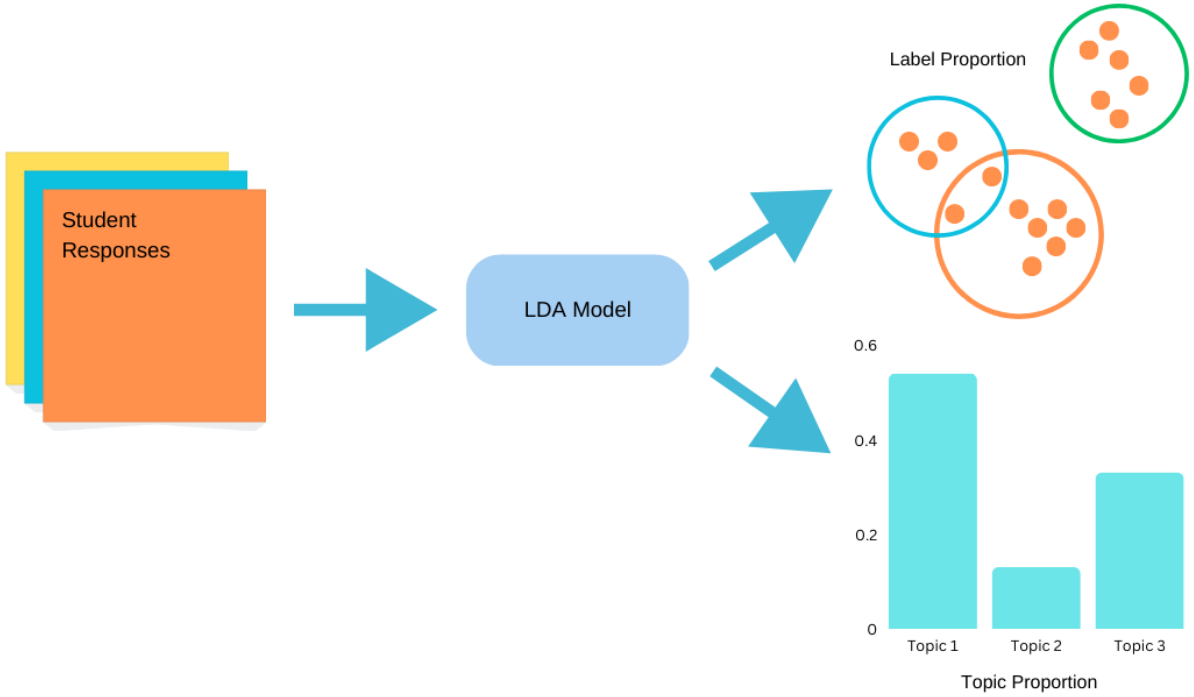
Topic modelling

- Topic Modeling is a way to identify the abstract topics that occur in a collection of documents.

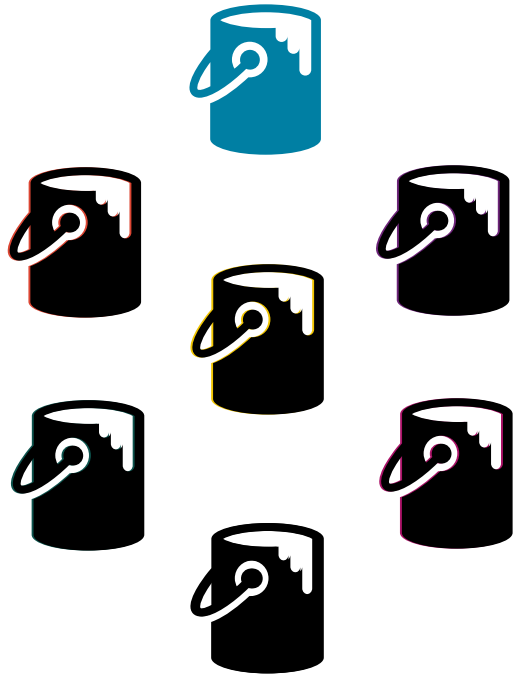
- Topic Modeling is like a smart highlighter identifying keywords and phrases within these comments. It then groups these words into topics, helping us understand the main themes these comments are talking about.

Latent Dirichlet Allocation (LDA)

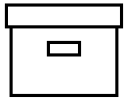
- Latent Dirichlet Allocation (LDA) is a generative model widely used for topic modelling. It represents comments as mixtures of topics that produce words based on their probability distribution.
- Labels Proportion associates the labels with different topics
- Topic Proportion shows the mixture of topics for a given comment
- The number of topics in LDA is a hyperparameter and needs to be pre-determined



Topic modelling

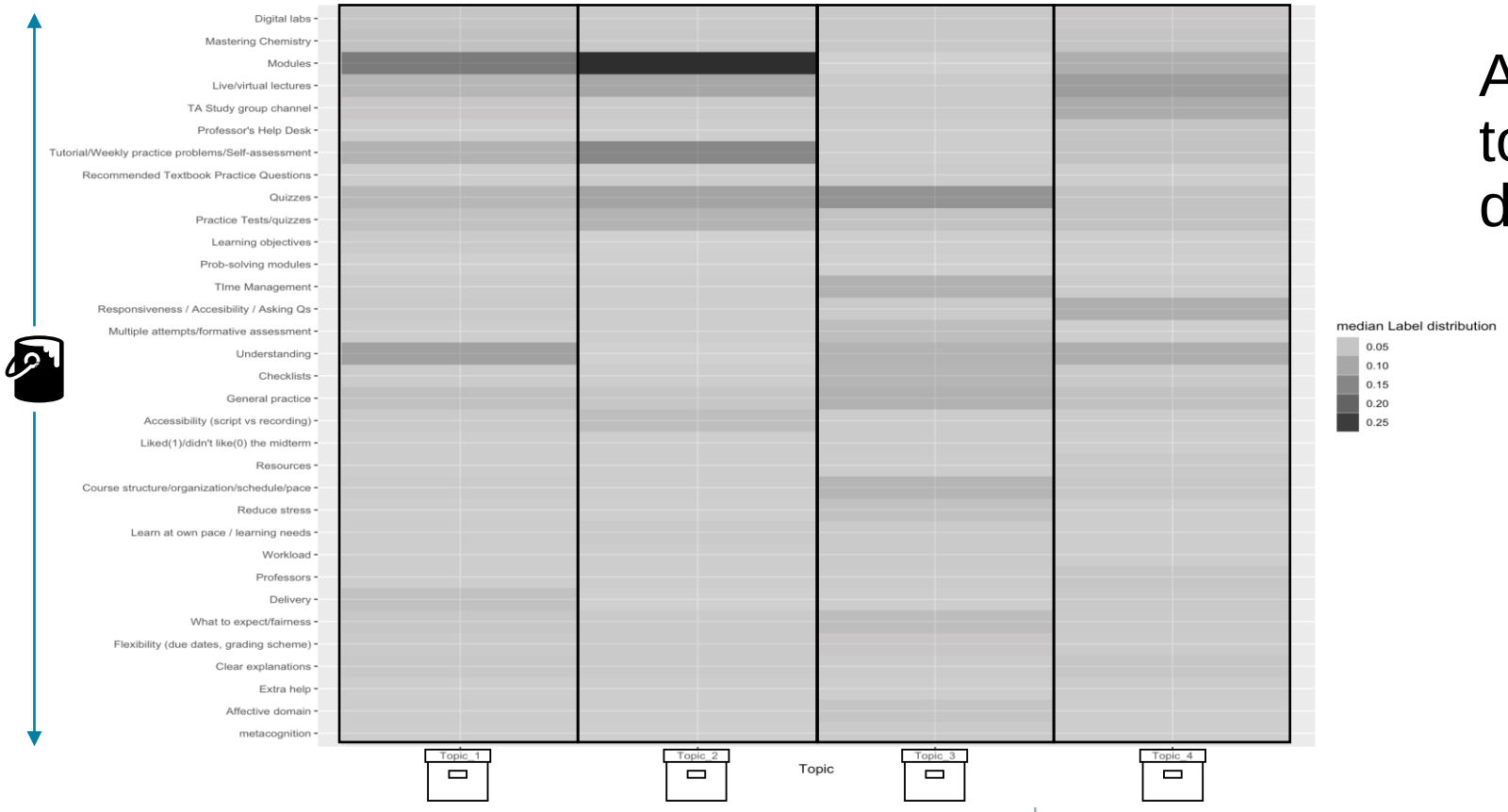


label



topic

Optimized label distributions



Adjust hyperparameters to differentiate label distribution

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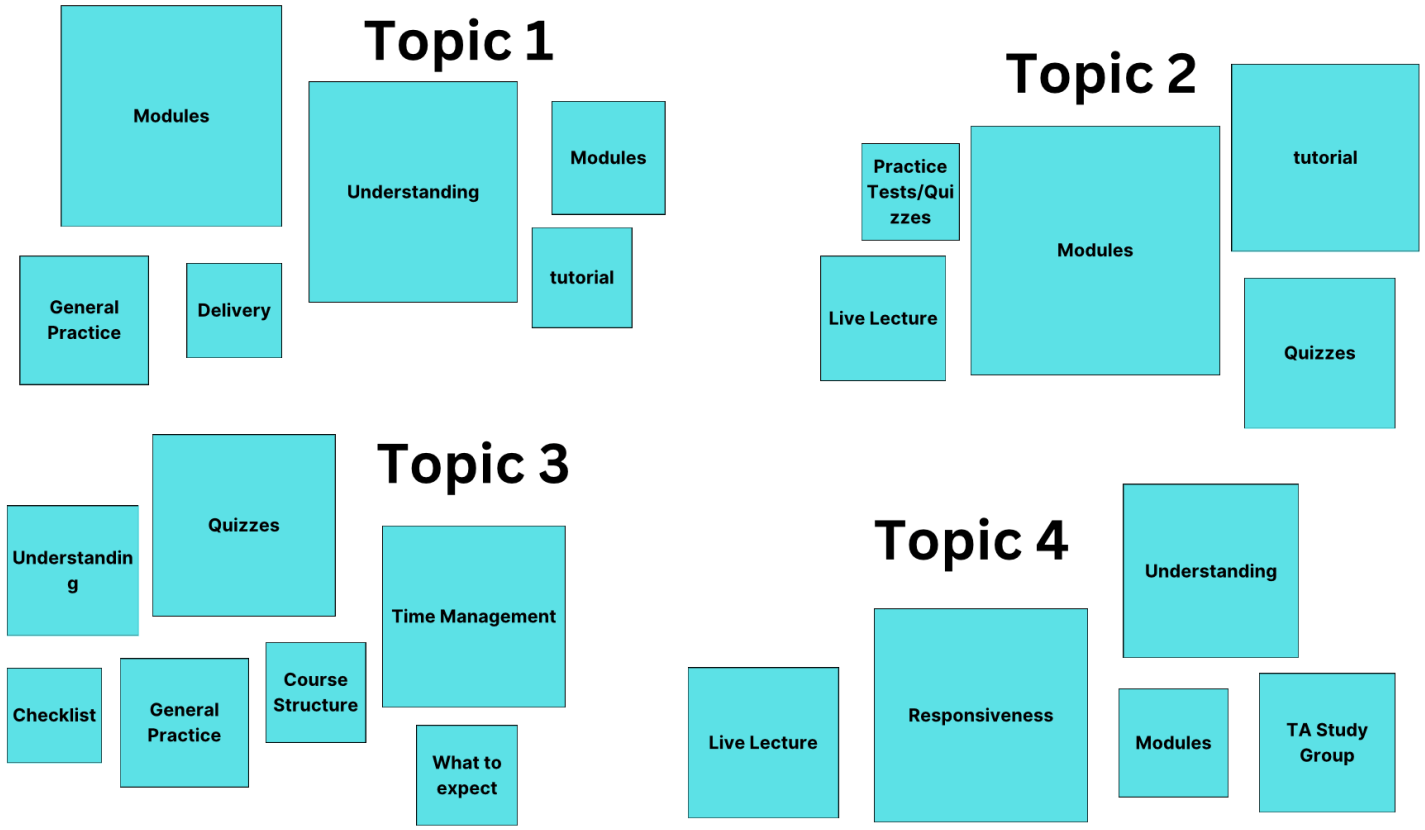
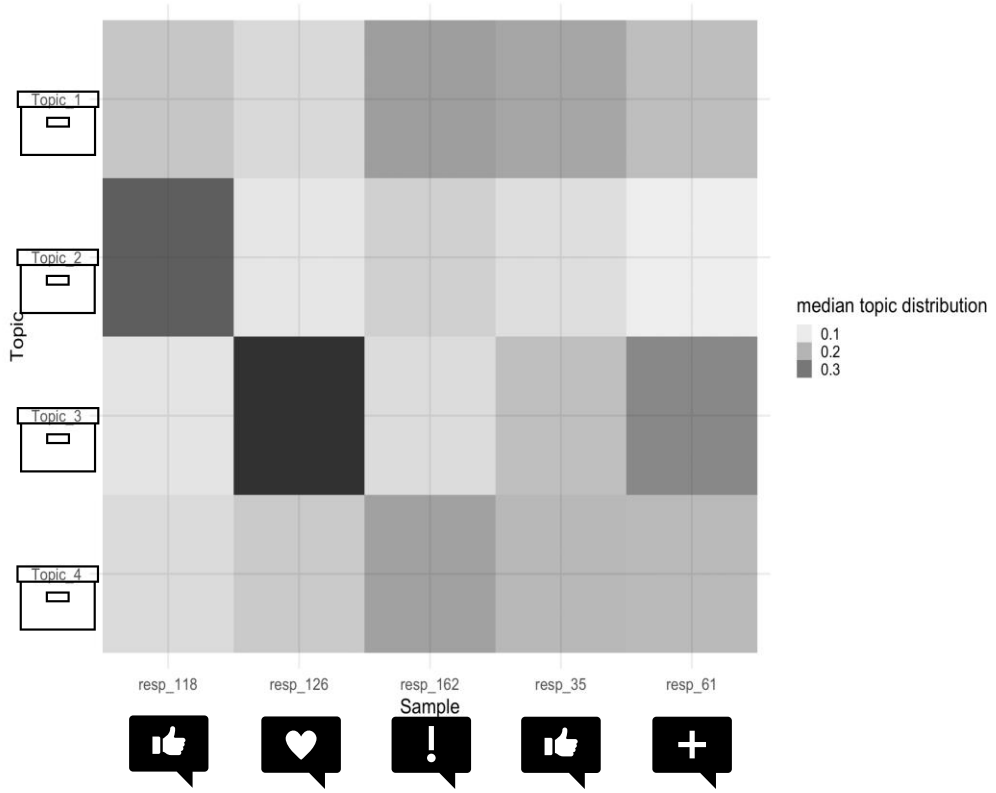
Sample topic modelling map



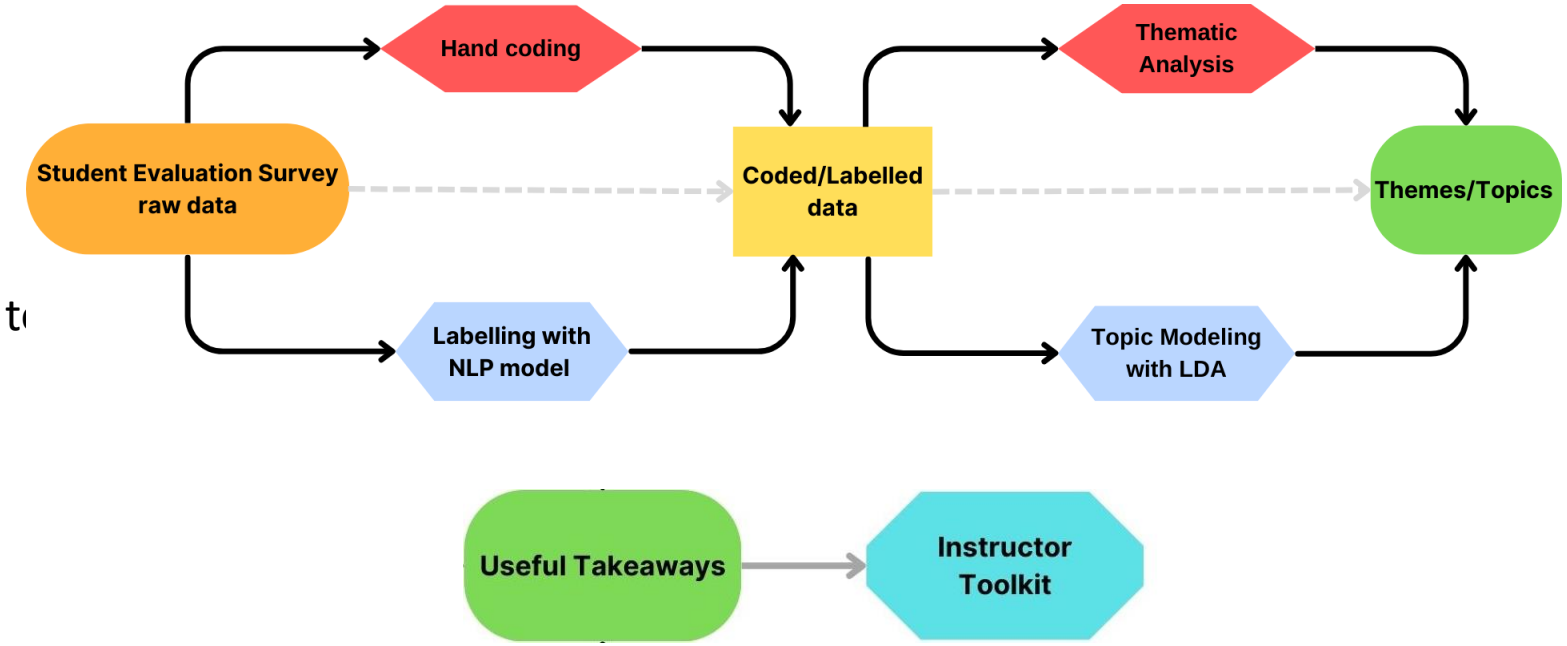
Topic distribution

- Response 126: I find the practice tests (unlimited tries) are very beneficial along with the weekly quizzes. Both of these awesome practice questions and make sure I stay caught up.
- Response 162: Having readily accessible content to which I can refer to when I am struggling in a particular topic in the course.



Next steps

- Interpret the label distribution obtained from the topic model
- Utilizing existing Natural Language Processing(NLP) models to extract the codes/labels from the student comments t replace the hand-coding process (Arman Edalatmand)
- Expand the tool to different courses to create an instructor toolkit



Why not ChatGPT?

01

Privacy

02

Deeper Understanding

03

Interpretation

Acknowledgements & Questions

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