Examining the readiness of introducing NLP* into education evaluation

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*NLP – Natural Language Processing for analysing large amount of text.

The context

1. A fast-growing NFP organisation raises **funds** to support disadvantaged schools in Australia
2. Schools **apply** for funding. Successful schools use **reporting** tools to indicate project **outcomes**
3. **Large** amount of text data collected through **several platforms**
4. The organisation wants **better questions** to collect **higher quality** data during application and reporting processes
5. External review recommends **building** a student outcome **framework**

The NLP Project

The problem – how to extract from the longitudinal text data to understand:

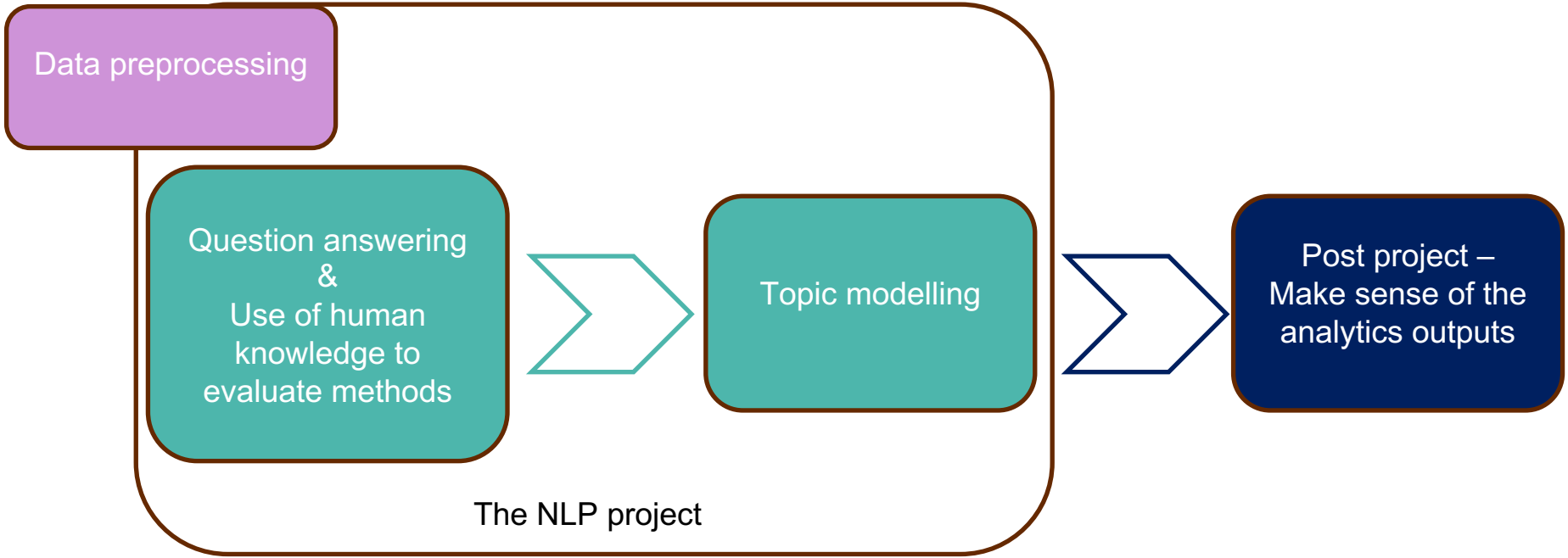
1. What are School **needs**
2. What **strategies** did these schools develop to achieve project outcomes
3. What **outcomes** did schools achieve
4. What was the **impact** of the projects on the schools

Focus areas–

- Identify the themes (in text analytics terms) that **characterise** each of the **4 questions** above

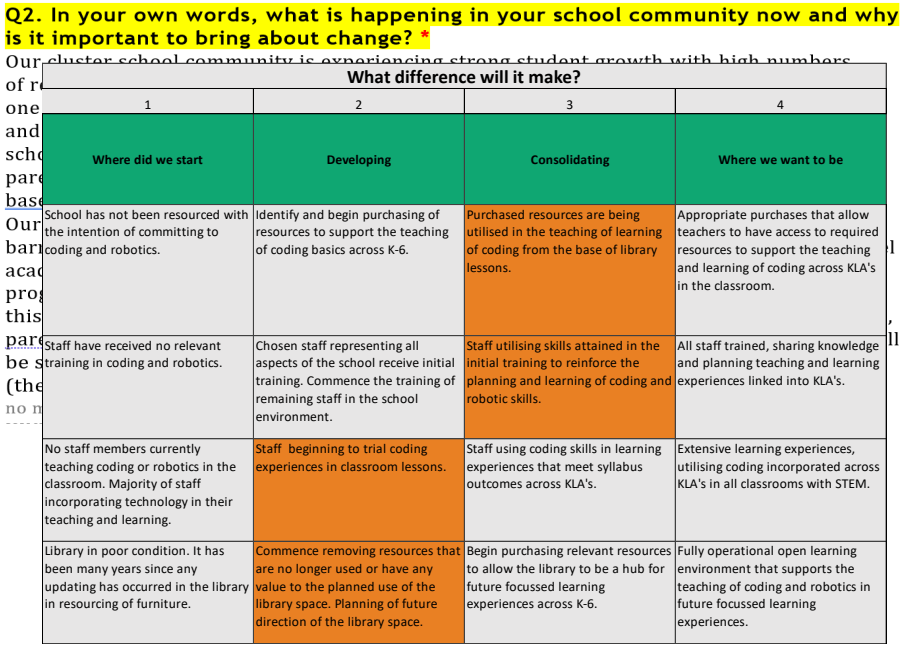
- Verify student outcomes can be classified as **academic achievement** and **student wellbeing**

Overview of the project flow



Data preprocessing – large amount and some complications

- 250 applications in Word
- 164 non-standardised rubrics in Excel
- 103 PDF final reports
- Different templates across years



Q2. In your own words, what is happening in your school community now and why is it important to bring about change? *

Our cluster school community is experiencing strong student growth with high numbers of r
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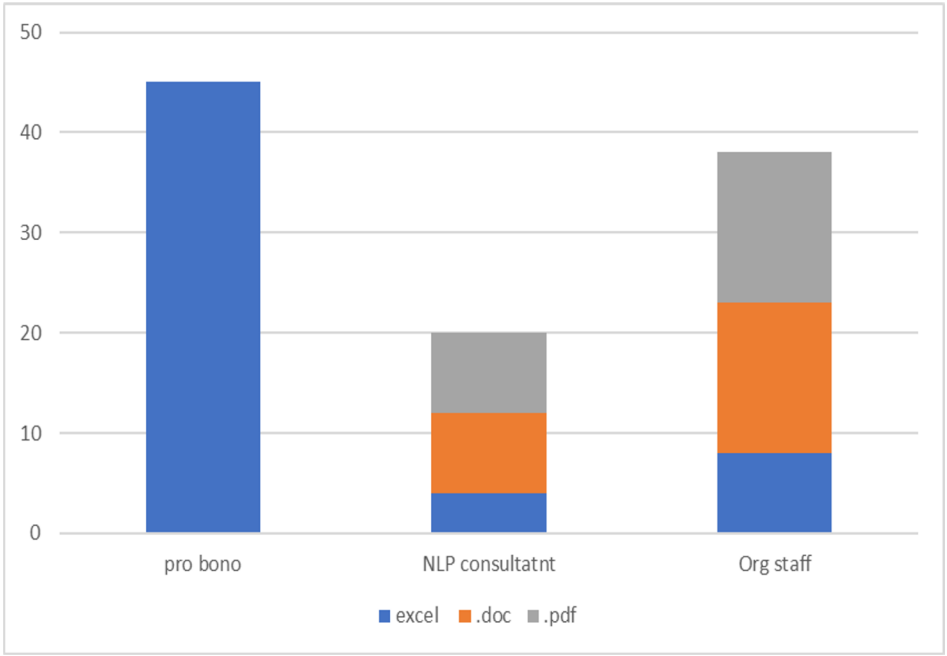
What difference will it make?			
1	2	3	4
Where did we start	**Developing**	**Consolidating**	**Where we want to be**
School has not been resourced with the intention of committing to coding and robotics.	Identify and begin purchasing of resources to support the teaching of coding basics across K-6.	Purchased resources are being utilised in the teaching of learning of coding from the base of library lessons.	Appropriate purchases that allow teachers to have access to required resources to support the teaching and learning of coding across KLA's in the classroom.
Staff have received no relevant training in coding and robotics.	Chosen staff representing all aspects of the school receive initial training. Commence the training of remaining staff in the school environment.	Staff utilising skills attained in the initial training to reinforce the planning and learning of coding and robotic skills.	All staff trained, sharing knowledge and planning teaching and learning experiences linked into KLA's.
No staff members currently teaching coding or robotics in the classroom. Majority of staff incorporating technology in their teaching and learning.	Staff beginning to trial coding experiences in classroom lessons.	Staff using coding skills in learning experiences that meet syllabus outcomes across KLA's.	Extensive learning experiences, utilising coding incorporated across KLA's in all classrooms with STEM.
Library in poor condition. It has been many years since any updating has occurred in the library in resourcing of furniture.	Commence removing resources that are no longer used or have any value to the planned use of the library space. Planning of future direction of the library space.	Begin purchasing relevant resources to allow the library to be a hub for future focussed learning experiences across K-6.	Fully operational open learning environment that supports the teaching of coding and robotics in future focussed learning experiences.

103 Hours spent on data preprocessing

Key tasks –

- Downloading & Renaming files
- File conversion
- De-identification
- De-formatting
- Question highlighting



Readiness tip – standardising data collection will reduce preprocessing time & it helps facilitate future automating data processing pipeline.

Question answering & topic modelling for characterising a concept

- **Selection of NLP methods** – Allow self-emergent topics. Methods include hugging face (text classification, information extraction, question answering, text generation) & BERT (contextual & intent)
- **Annotation activity** – Similarities and differences in how staff read and make sense of information, so we can evaluate how well the general model works in the specific context

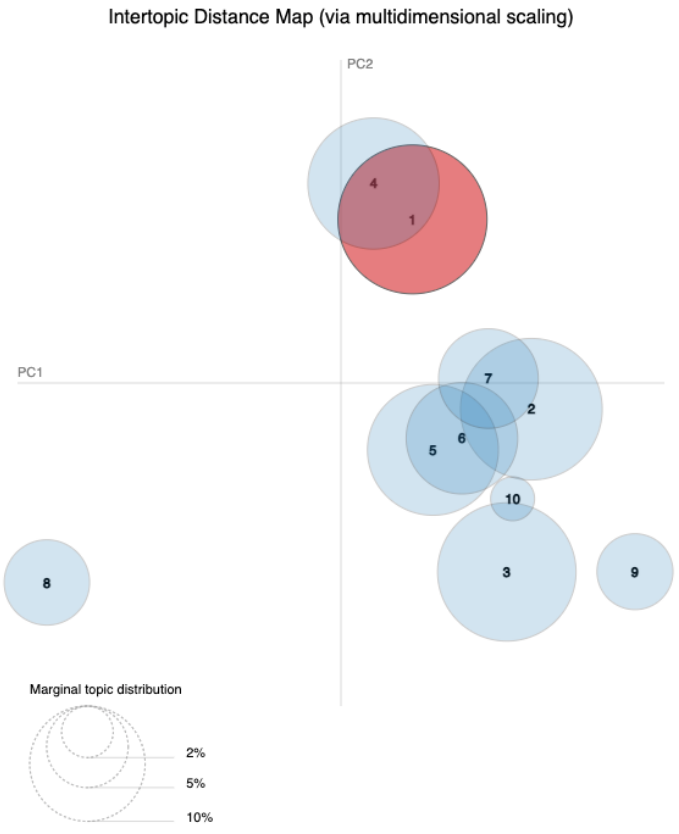
Comparing the results between NLP and human

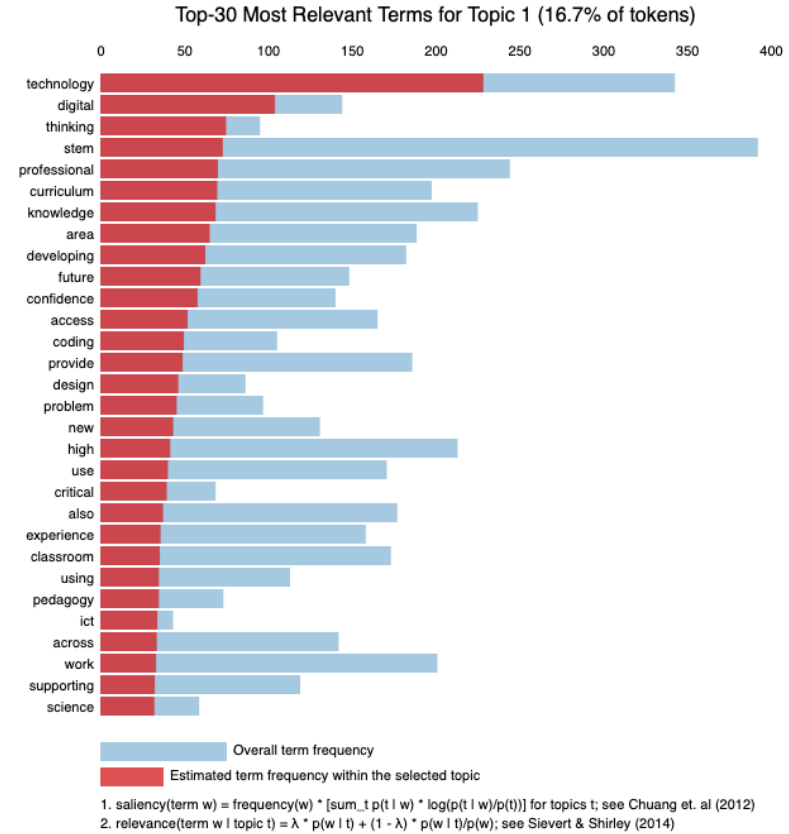
NLP Answer	Evaluator_1	Evaluator_2	Decision
students being independent learners	students being independent learners		Matched with Evaluator_1
common language and consistency of practice		consistency of practice	Matched with Evaluator_2
improving student learning outcomes	raises the quality of teaching	quality of work that students are producing	Not matched
priority needs to be placed on up - skilling teachers, enabling them to provide engaging, creative and challenging activities for students that instill a passion for learning mathematics	up-skilling teachers, enabling them to provide engaging, creative and challenging activities for students that instill a passion for learning mathematics	up-skilling teachers, enabling them to provide engaging, creative and challenging activities for students that instill a passion for learning mathematics	Matched with both evaluators

Accuracy rate 54.73%

Readiness tip - Baseline and acceptable accuracy rates are context dependent.

Topic modelling visualisation of school needs





Identify the themes/topics that characterise school needs

Topic #	School needs Topics	% of tokens
1	Technology-embedded curriculum and professional development are needed to learning for future and learning with confidence	16.7
2	Reading resources and leadership are needed to improve literacy outcomes	15.1
3	Families with trauma and behaviour problems need to access services to build parent-child wellbeing and to improve education outcomes	14.4
4	STEM-focused curriculum and resources are needed to change in-class experience and to increase subject knowledge	12.9
5	Developing a professional culture in school is needed to build capacities in leadership, teamwork for better academic outcomes	12.9

Readiness tip - Human expertise is needed to make sense of the NLP output.

Building student outcome framework

A confirmatory exercise - Verify student outcomes can be classified as academic achievement and student wellbeing

step 1 – human expertise **defined** each concept by key words
Step 2 – applied topic modelling (LDA algorithm)
Step 3 – interpreted the results

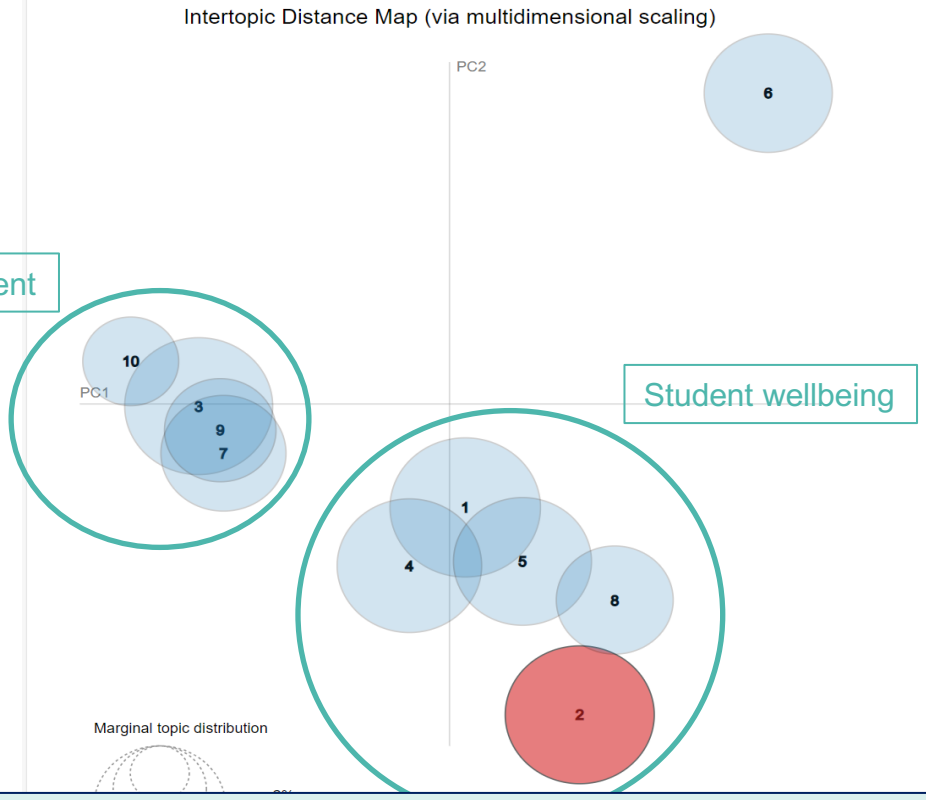
1. **Academic Achievement**

"knowledge", "skills", "understanding", "achievement", "progress", "learning areas"

2. **Student wellbeing**

"behaviour", "emotions", "confidence", "resilience", "independent learner", "self discipline", "goals", "family", "community", "learning engagement", "attendance", "communication"

Two clusters of topics confirmed the student outcome framework



Academic achievement

Student wellbeing

Readiness tip - When the concept is well defined, NLP models produce clearer results.

Summary

Learning and lessons

1. **Plan** data collection.
2. Evaluators need to be **involved** in the whole process.
3. NLP models need to be **evaluated** for accuracy.
4. NLP works best when the concepts are **well-defined**.

Future options

Using ChatGPT for summarisation could reduce consultancy involvement and reduce data processing time.

Thank you

Resources:

The data preprocessing code (in Python) is available upon request. Contact – info@data-s.com.au

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