

# Applying the Cognitive Edge Methodology in Psycho-Educational Research

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## INTRODUCTION

This paper presents a research team's experiences with the use of the Cognitive Edge (CE) methodology in a psycho-educational research project. Learning points from the experiences are also shared.

## BACKGROUND

Since 2004, the Psychological Assessment and Research Branch (PARB) of the Education Programmes Division (EPD) in MOE has been conducting research on students' perspectives on their school experiences. Data has been collected via qualitative and quantitative research methods, with most data collected via questionnaire from students of different age groups. In 2005, PARB learned about the CE methodology for collecting and analysing narratives. Since then, the team has adopted the CE methodology to complement the existing approach for data collection with these specific objectives in mind:

- (a) **To gain a deeper understanding of what contributes to students' school experience.** In particular, the team wanted to find out more about the factors that influenced students' perception of their school experience (i.e., the meaning behind the numbers captured on the questionnaire); and
- (b) **To learn from the experience of using the CE methodology and broaden the team's repertoire in research methodology.** From the onset of the project, the team was more concerned with identifying learning points to inform our own research practises. Use of the CE methodology and solving problems that arose enabled the team to better understand the strengths and limitations of the CE methodology.

## REVIEW OF THE CE METHODOLOGY AS A RESEARCH METHOD

Before the team used the CE methodology, a comparison of the methodology with existing approaches was conducted. The comparison enabled the team to determine how much more value CE methodology can add to the current repertoire of research methods.

Traditionally, there are two main approaches to research: quantitative (e.g., experiments, survey research) and qualitative (e.g., case studies, ethnographies). The quantitative approach is usually deductive in nature and aims to gather evidence to test a hypothesis by stating up-front the exact problem under investigation. In contrast, traditional qualitative approaches tend to be inductive in nature; with a focus on gathering data so as to generate hypotheses. In mixed methods, both quantitative and qualitative approaches are adopted (Creswell, 2003) so as to achieve the purpose for the study in the best possible way. **Table 1** provides a comparison between the different methodologies. The CE methodology can be considered a mixed methods approach because it uses both qualitative and quantitative methods.

The CE methodology is based on the Cynefin sense-making framework conceptualised by Kutz and Snowden (2003) that comprises five domains: knowable, known, complex, chaos and disorder. The CE methodology mainly adopts a pre-hypothesis approach as it admits up-front that the exact nature of the issue under investigation is unknown. However, hypotheses can be tested during data analyses, such as when drilling down further on specific patterns observed, to test theories on what is happening. This is unlike traditional quantitative methods, which are largely deductive in nature.

**Data Collection.** In traditional methods, data is collected via different means such as surveys and tests (for quantitative approaches), and interviews and focus group discussion (for qualitative approaches). In the CE methodology, sense-making items (SMIs) are collected. SMIs are defined as “anything that helps people make sense of the world they live in” (Cognitive Edge, 2006, p.1). SMIs can take the form of anecdotes, stories, pictures, video, and sound files. The methods used for collecting SMIs include tape recording, video recording, note taking, and collection of stories.

The CE methodology uses indirect questions to elicit stories / narratives from participants. The questions are open-ended and do not restrict the participants’

**Table 1.** Comparison of Cognitive Edge Method with Traditional Research Methods

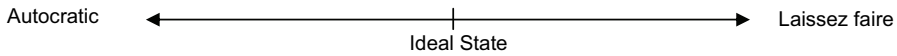
Characteristics	Cognitive Edge Methodology	Traditional Approaches
<b>A. Type of Research</b>	<ul style="list-style-type: none"> <li>• Quantitative &amp; Qualitative</li> <li>• Adopts both inductive (pre-hypothesis approach) and deductive approaches (hypothesis testing)</li> </ul>	<ul style="list-style-type: none"> <li>• Quantitative</li> <li>• Usually deductive</li> <li>• Hypothesis testing</li> </ul>
<b>B. Data Collection method</b>	<p>Examples:</p> <ul style="list-style-type: none"> <li>• Collection of Sense-making Items (SMIs) via tape recording, video cameras, note taking and collection of stories etc.</li> </ul>	<p>Examples:</p> <ul style="list-style-type: none"> <li>• Focus Group Discussions (FGDs)</li> <li>• Interviews</li> <li>• Observations</li> </ul>
<b>a. Strategies of Inquiry</b>	<p>Examples:</p> <ul style="list-style-type: none"> <li>• Narrative research</li> </ul>	<p>Examples:</p> <ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Ethnographies</li> </ul>
<b>b. Types of Questions used</b>	<ul style="list-style-type: none"> <li>• Indirect Questioning (for open ended questions)</li> <li>• Both open ended questions and close ended questions</li> </ul>	<ul style="list-style-type: none"> <li>• Usually direct questioning</li> <li>• Open-ended question</li> </ul>

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Table 1. (Continued)

Characteristics	Cognitive Edge Methodology	Traditional Approaches
<p><b>c. Types of data collected</b></p> <ul style="list-style-type: none"> <li>Quantitative (i.e., indexes)</li> <li>Qualitative: Almost anything in digital format (e.g., audio, visual, written) as long as the participants who provided the SMIs can make the data meaningful to the researchers</li> </ul>	<ul style="list-style-type: none"> <li>Quantitative (e.g., scores)</li> </ul>	<ul style="list-style-type: none"> <li>Qualitative: Could be anything (e.g., audio, visual, written) as long there is a way to code the data to make it meaningful to the researchers</li> </ul>
<p><b>d. Coding of data</b></p> <ul style="list-style-type: none"> <li>Stories are self-indexed by the participants</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>	<ul style="list-style-type: none"> <li>Usually categorised by experts/researchers (e.g., pile sorting); can be by researchers with the participants who provided the data</li> </ul>
<p><b>C. Data Analyses</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>Cognitive Edge SenseMaker™ Explorer software (for qualitative analyses)</li> <li>Traditional statistical software (e.g., STATA, SPSS) could be used for quantitative analyses</li> <li>Study patterns and look out for weak signals</li> </ul>	<p>Examples:</p> <ul style="list-style-type: none"> <li>Statistical software like STATA, SPSS, SAS are used to analyse the data.</li> </ul>	<p>Examples:</p> <ul style="list-style-type: none"> <li>Interpretation of the qualitative data to identify themes by the researchers and/or experts</li> <li>Software could be used to facilitate data analysis</li> <li>Reduction of qualitative data into quantitative data for software analyses</li> </ul>

Sources: (a) Creswell (2003) and (b) Cognitive Edge (2006).



**Figure 1.** Example of an Opposing Negative Scale.

responses to pre-determined options. In the CE methodology, stories are self-indexed by the participants who have the relevant contextual knowledge, that is, they indicate, on indexes, the extent to which their story describes a particular state. Indexes are developed prior to the study by experts or by “content experts” who are similar to the eventual participants who would produce the SMIs. Indexes are intended to capture key areas related to the topic that are of interest and/ or important to the researcher or stakeholders. Indexes are constructed by setting the ideal state in the centre with extremes, either both positive or negative at the ends. For example, in studying school climate, a researcher interested to find out if leadership in school is autocratic or laissez faire can develop an opposing negative index to capture this (see Figure 1). This is in contrast to traditional qualitative methods, where the categorisation of qualitative data into themes is carried out by researchers or experts, or by researchers with the participants.

**Data Analysis.** The Cognitive Edge SenseMaker™ Explorer software integrates and presents visually both quantitative and qualitative data to help the researcher make sense of the patterns and relationships. The software enables the use of conventional quantitative analytical approaches (e.g., correlation) to make sense of quantitative data. The developers of the software recommend that users who analyse and interpret the data have the relevant contextual knowledge and they must be trained in using the Cognitive Edge SenseMaker™ Explorer software. To analyse responses from opposing negative indexes, each index is split into two independent scales.

From the research methodology perspective, the following are the key advantages of the CE methodology:

- (a) **The Cognitive Edge SenseMaker™ Explorer software is multi-functional. It provides both quantitative and qualitative information.** Quantitative information collected through the indexes allows for meta-pattern data to be analysed, while the stories provide rich, qualitative insights into the complexities and ambiguous nature of issues involved.
- (b) **Pre-hypothesis approach allows for the detection of weak signals.** In dealing with complex situations or problems where the exact nature of the

issue under investigation is unknown, taking a discovery approach is useful as it allows one to make sense of the data and detect weak signals that could be missed if pre-conceived hypotheses were used. Weak signal is a term used by Cognitive Edge practitioners to refer to patterns that provide early indications of a future trend.

- (c) **Use of indirect questions could reduce inhibition so that participants do not feel they are under scrutiny.** By adopting a third person perspective (as one of the options in order to elicit the narratives), participants may be more willing to provide their honest opinions as inhibitions that may arise from an evaluative context may be reduced. The open-ended nature of the questioning technique may also provide the participants with more freedom to express their feelings and understanding of issues.
- (d) **Self-indexing is free from expert interpretation.** As the expert or third party may not see the deep experiences “embedded” in the data, they may overlook important insights or even misinterpret the data.

However, the CE methodology also has the following limitations:

- (a) **Pre-hypothesis approach is relatively less structured than traditional research methodology.** Hence, the analyses and interpretation of data could be challenging for users. Users may require more practise and guidance from an experienced person when they use the CE methodology in the beginning. There is a paucity of documentation on the analysis and identification of weak signals, thus users would need to be guided by the Cognitive Edge practitioners or adopt an approach based on the conceptual understanding of weak signals.
- (b) **The CE methodology assumes that participants can and are comfortable telling (writing) stories.** A possible concern is the willingness of individuals to share their thoughts and feelings through story telling. Story telling, where thoughts and feelings are expressed by the story teller to an imaginary third person may not be widely practised by the participants in their daily life. Therefore, creating stories that reflect their perceptions of a particular experience may not come naturally or easily to the participants.
- (c) **The use of opposing labels limits the types of quantitative analyses that can be used.** Due to the way the indexes are labelled, the responses are not normally distributed and this limits the types of analyses that can be

conducted. During data analysis, each index would be further split into two independent scales. Some may find the interpretation of these indexes counter-intuitive and confusing.

- (d) **Ambiguity in the opposing negative response scales used.** During trialling for another study where opposing negative response scales were used, the team noted that participants shared that they did not understand the scales used and the meaning of the midpoint of the scale in reference to the anchors. As there was no common understanding of how the response scales should be used, the quality of the data collected was affected. The team learned that CE adopts opposing negative scales to lessen the possibility of "gaming". Experts in survey research (De Leeuw, 2008) reported that there are usually three reasons for participants to distort their responses. First, participants would like to present a more positive image of themselves (also known as social desirability), to avoid disclosing information that could have detrimental impact on themselves, and to ensure they are more accurately classified by their responses (e.g., choosing the next best rather than what appears to be the best answer because the best answer may lead to incorrect classification). The strategies recommended for reducing participants' tendency to distort their responses range from providing an introduction that assures the participants of the purpose of the survey or the anonymity in their responses to designing the response alternatives in multiple choice type questions. From the team's perspective, the participants' understanding of the response scales is more critical rather than any concern about gaming.
- (e) **Participants' indexes sometimes reflect their opinions rather than their actual experiences described in the narratives.** Based on previous research studies conducted by MOE, it was found that the indexing conducted by the participants do not necessarily correspond to the content of the narratives. For example, upon reading the narratives and indexing provided by participants, researchers found that some of the narratives did not have any content that was related to the indexes used. One possible explanation was that the participants were trying to provide their opinions about the area that the index was about; they wanted to provide their opinion on those areas even though their narratives did not mention those areas. However this presents a situation where the data from the indexes would not be able to distinguish between "opinions" and ratings based on the actual experiences as stated in participants' narratives.

### CHANGES MADE TO MEET NEEDS OF THE PROJECT

Although the CE methodology had its limitations, the team proceeded to adopt the methodology with some changes to ensure that quality research was conducted (i.e., in accordance with good practises in psycho-educational research). The changes made were:

- (a) **Provide opportunities for participants to practise telling stories.** Participants were given an opportunity to practise telling stories/narratives prior to the actual data collection. The instructions for the task included what a story is and is not, components of a story is, and a sample story was provided as illustration. Provision of clearer instructions and opportunities to practise ensured that all participants have the same understanding of the task required.
- (b) **Use negative to positive scales for the indexes.** A standard negative to positive response scale was used for the indexes instead of the opposing negatives indexes. This change was made to (i) enable participants to make sense of their narratives based on concepts that the team was studying in a parallel study using the quantitative approach, and (ii) align with the positive and negative anchors in response scales that the participants were more familiar with. Providing more conventional response scales ensured that participants have a better understanding of the anchors and the midpoint on the scale.
- (c) **Provide an additional question/option to distinguish between opinions and what has been captured in the narratives.** An additional question/option was added after the participants' typed in their narratives. This additional option asked the participants to indicate what their narrative was about through the use of a checklist. Adopting a 2-step indexing approach enabled the filtering out of opinions during data analyses. As a result, there were fewer narratives surfaced for the weak signals analysis that were unrelated to the indexes.

### LEARNING POINTS FROM STUDY

Based on the team's experiences with the use of the CE methodology in an ongoing psycho-educational research project, these are the learning points:

- (a) **The CE methodology is a good complement to the existing research methods.** The narratives collected via the CE methodology provide rich and thick information about the students' school experience. As the data was

collected via an online platform, data collection was efficient and data management was simplified. The descriptive information provided insights into the findings based on the data collected via questionnaires.

- (b) **Adopting traditional qualitative data analytical approaches could further maximise the usefulness of the data collected.** In addition to the data analysis recommended for the CE methodology, the team also adopted more conventional qualitative data analysis. To ensure the findings were trustworthy (i.e., valid & reliable), the team adopted various approaches in the field such as including different forms of triangulation (e.g., different analysis teams derived the same findings from the data, different sources provide similar information) and ensuring the team remained objective (i.e., “not going native”). Thus, both the quantitative data (i.e., from the indexes) and the narratives collected were used. While the quantitative analysis provided an aggregated picture about the students’ experiences, the team found the “voice of the students” was more powerful for communications purposes as the students described what they experienced in their own words.
- (c) **Building the team’s research capacity through use of new methodology.** The team’s experiences with the use of the CE methodology enabled the branch to build its capacity to identify and monitor weak signals over time, enhanced the officers’ research repertoire and broadened the branch’s knowledge base about new research tools. In addition, the learning points from study have been translated into tools that schools could use to deepen their own understanding of their students’ school experiences.

## IMPLICATIONS FOR PRACTICE

Research is conducted to build the knowledge base on a specific research area. For research to impact policy and practise, the findings need to be translated so that practitioners could benefit from the research. The method of collecting narratives has been shared with schools through the development of tools for use by schools. However a substantial knowledge base on the study of weak signals is required before the learning points could be translated into tools for schools’ use.

The strengths of the CE methodology make it ideal for research into issues where the exact nature of the problems is unknown. Continual study of the CE methodology in appropriate research studies will deepen users’ understanding of the strengths of the CE methodology and how to overcome its limitations.

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