

## CECAN Webinar:

# Case-Based Modelling and Scenario Simulation for Ex-Post Evaluation

Tuesday 6th July 2021, 15:00 – 16:00 BST

**Presenters: Dr Corey Schimpf, Dr Brian Castellani and Dr Pete Barbrook-Johnson**

Welcome to our **CECAN Webinar**.

All participants are muted. Only the Presenters can speak. The webinar will start at **15:00 BST**.

**Corey, Brian and Pete** will speak for around 40 minutes and will answer questions at the end.

Please submit your questions at any point during the webinar via the question box in the Zoom webinar control panel.

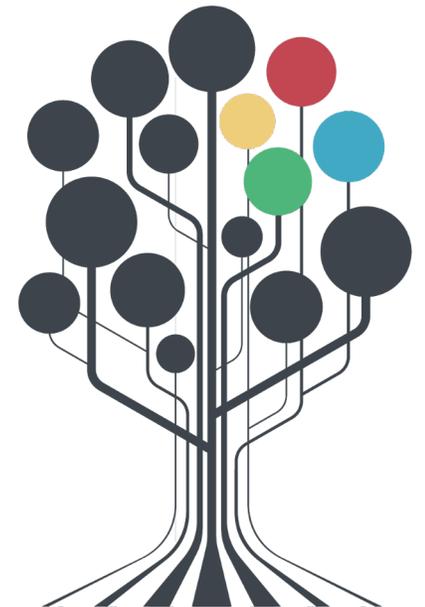
Today's webinar will be recorded and made available on the CECAN website.

E Mail: [cecan@surrey.ac.uk](mailto:cecan@surrey.ac.uk)

Web: [www.cecan.ac.uk](http://www.cecan.ac.uk)

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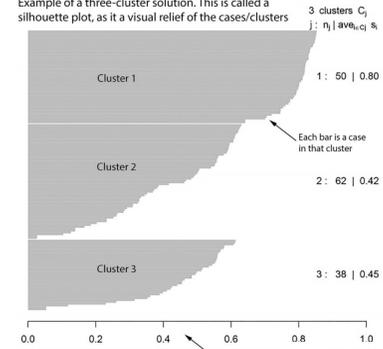
# Case-based modelling and scenario simulation for ex-post evaluation

Corey Schimpf

Pete Barbrook-Johnson

Brian Castellani

Example of a three-cluster solution. This is called a silhouette plot, as it is a visual relief of the cases/clusters



The Self-Organizing Map is unsupervised machine learning used to corroborate the k-means solution

On the SOM Map, the cases have settled onto the quadrants that have the configurational profile they are most alike.

Cases are given two labels. The first is their k-means cluster number; and the second is their case number.

Because the SOM Map is topographical, Quadrant 5 and its nearby cases are the most unlike Quadrant 21 and its neighboring cases and quadrants. The k-means are also different, which suggests the SOM settled on a similar solution

Model Setup

Run Clusters

Sensitivity

Select Cluster for Sensitivity

Cluster 1

This is the map onto which the cluster solution is projected. Users can watch how their clusters move based on different scenario simulations

MOSEL SETUP and RUN CLUSTERS are the two buttons that run the simulation.

SENSITIVITY runs the Monte Carlo sensitivity analysis.

This key provides the name and color for each of the k-means clusters in the study

Here is where the profile variables (causal conditions) for each cluster can be changed to explore a different scenario.

This table contains all of the k-means clusters, along with their scores on the profile of configurational factors being studied.

	Include	Separ.	Separ./V	Peas./V	Peas./V	Cluster	Quadrant
1	9	6.85	3.07	5.74	2.07	Cluster 1	21
2	9	5.90	2.75	4.39	1.43	Cluster 2	24
3	9	5.01	3.42	1.40	3.24	Cluster 3	5

Users can move back and forth to re-examine the changes they made to one or more clusters to compare scenarios.

# We are supported by the following:



# Overview

- Set the scene and some questions (Pete)
- Why 'case-based modelling and scenario simulation'? (Corey)
- How do I do this (easily)? (Brian)
- Examples of potential value
  - Renewable Heat Incentive (Pete)
  - Frontline Fast-Track Social work training (Corey)
- Reflections (Corey)
- Q&A / discussion (all)

# Background

- CECAN special issue of 'Evaluation'
- 'Cased-based modelling and scenario simulation for ex-post evaluation' paper
- Motivation:
  - case-based thinking + scenario analysis
  - explore our data easily but force us to think



Article

## Cased-based modelling and scenario simulation for ex-post evaluation

Evaluation  
2021, Vol. 27(1) 116–137  
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sagepub.com/journals-permissions  
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**Brian Castellani**

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### Abstract

Despite 20 years of increasing acceptance, implementing complexity-appropriate methods for ex-post evaluation remains a challenge: instead of focusing on complex interventions, methods need to help evaluators better explore how policies (no matter how simple) take place in real-world, open, dynamic systems where many intertwined factors about the cases being targeted affect outcomes in numerous ways. To assist in this advance, we developed *case-based scenario simulation*, a new visually intuitive evaluation tool grounded in a data-driven, case-based, computational modelling approach, which evaluators can use to explore counterfactuals, status-quo trends, and what-if scenarios for some potential set of real or imagined interventions. To demonstrate the value and versatility of case-based scenario simulation we explore four published evaluations that differ in design (cross sectional, longitudinal, and experimental) and purpose (learning or accountability), and present a prospective view of how case-based scenario simulation could support and enhance evaluators' efforts in these complex contexts.

### Keywords

case-based methods, computational social science, evaluation, policy, scenario analysis, social complexity

# COMPLEX-IT

- The software which you can use to do all this
- <https://www.art-sciencefactory.com/complexit.html>
- Browser-based or downloadable
- Previous webinar on this specifically: <https://www.cecan.ac.uk/videos/>



COMPLEX-IT is a web-based and downloadable software tool designed to increase your access to the tools of computational social science (i.e. artificial intelligence, micro-simulation, predictive analytics). It does this through a user friendly interface, with quick access to introductions on concepts and methods; and with directions to richer detail and information for those who want it.

The result is a seamless and visually intuitive learning environment for exploring your complex data – from data classification and visualisation to exploring simulated interventions and policy changes to data forecasting.

You don't need any technical expertise to start using COMPLEX-IT; all that is required is a data set you want to explore, and a curious mind!

**Build the Model**

1. Build Database and Import Cases
2. Cluster Cases

**Test the Model**

3. The Computer's turn
4. Compare and Visualise Results

**Extend the Model**

5. Simulate Interventions
6. Predict New Cases

**Export Results**

7. Generate Report

beta version release 2019

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**WEB VERSION**

**USER RESOURCES**

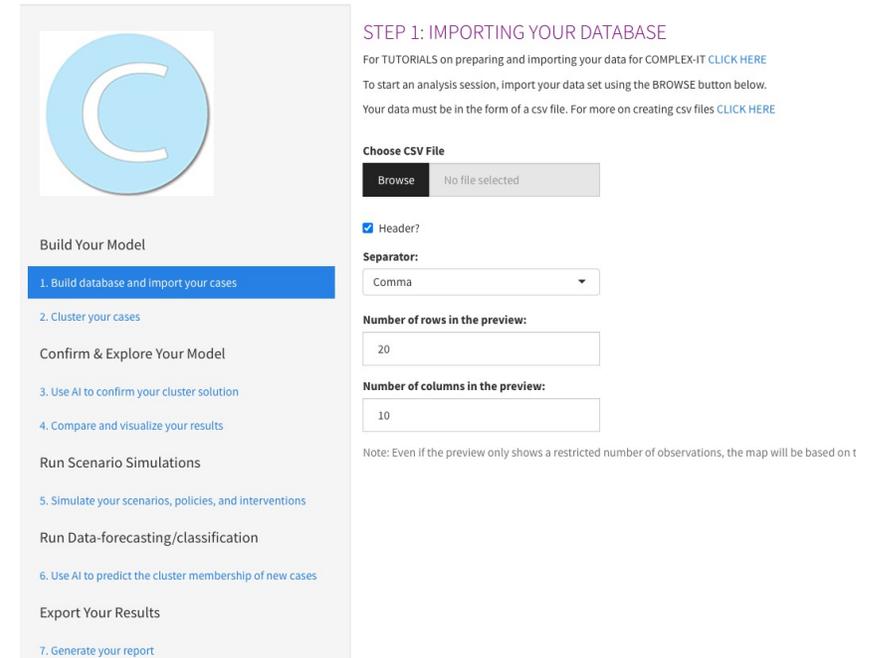
[CLICK HERE](#) for Video Tutorials  
[Step-by-step PDF user guides](#)  
[Additional Readings](#)

Watch Video COMPLEX-IT  
Article Overview COMPLEX-IT

Meet the team  
Irene Cantador, Cary Schoof, Michael Ball, Peter Barbrook-Johnson

Durham University, University at Buffalo, UNIVERSITY OF SURREY, cecan, KENT STATE UNIVERSITY

COMPLEX-IT 1.0.0 Beta - exploring complex data from a case-based perspective



**STEP 1: IMPORTING YOUR DATABASE**

For TUTORIALS on preparing and importing your data for COMPLEX-IT [CLICK HERE](#)

To start an analysis session, import your data set using the BROWSE button below.  
Your data must be in the form of a csv file. For more on creating csv files [CLICK HERE](#)

**Choose CSV File**

No file selected

Header?

**Separator:**  
Comma

**Number of rows in the preview:**  
20

**Number of columns in the preview:**  
10

Note: Even if the preview only shows a restricted number of observations, the map will be based on t

**Build Your Model**

1. Build database and import your cases
2. Cluster your cases

**Confirm & Explore Your Model**

3. Use AI to confirm your cluster solution
4. Compare and visualize your results

**Run Scenario Simulations**

5. Simulate your scenarios, policies, and interventions

**Run Data-forecasting/classification**

6. Use AI to predict the cluster membership of new cases

**Export Your Results**

7. Generate your report

# What is case-based scenario simulation?

- Case-based thinking + scenario analysis
- Both well-used in their own right
- We implement one particular way of combining them:
  - Think in cases
  - Cluster cases different ways
  - Ask, how sensitive are these clusters? what if 'this' or 'that' was different?
- Not causal modelling or forecasting

# Some questions to chew on

- What is not clear about this approach and its value?
- What areas do you think you can apply this and why?
- What are the barriers that would stop you from using this?
- **Put thoughts in the Q&A/chat as we go...**



# **Why case-based scenario simulation?**

# Why CBSS?

- Interventions happen in a complex world
- CBSS enables
  - Identification of subgroups, trajectories
  - Exploration of 'what-if' situations
- CBSS is
  - Synergistic with realist evaluation
  - Supportive of pluralistic approaches
  - An exploratory and learning platform

**How do I run a case-based  
scenario simulation (easily)?**

# How CBSS works

We wanted to make CBSS accessible to users.

We created a CBSS tab in COMPLEX-IT.

# How CBSS works.

---

CBSS does not identify underlying causal model.



It explores how various interventions might unfold for a given policy.



Exploring complex data from a case-based perspective

### Build the Model

1. Build Database and Import Cases
2. Cluster Cases

### Test the Model

3. The Computer's turn
4. Compare and Visualise Results

### Extend the Model

5. Simulate Interventions
6. Predict New Cases

### Export Results

7. Generate Report

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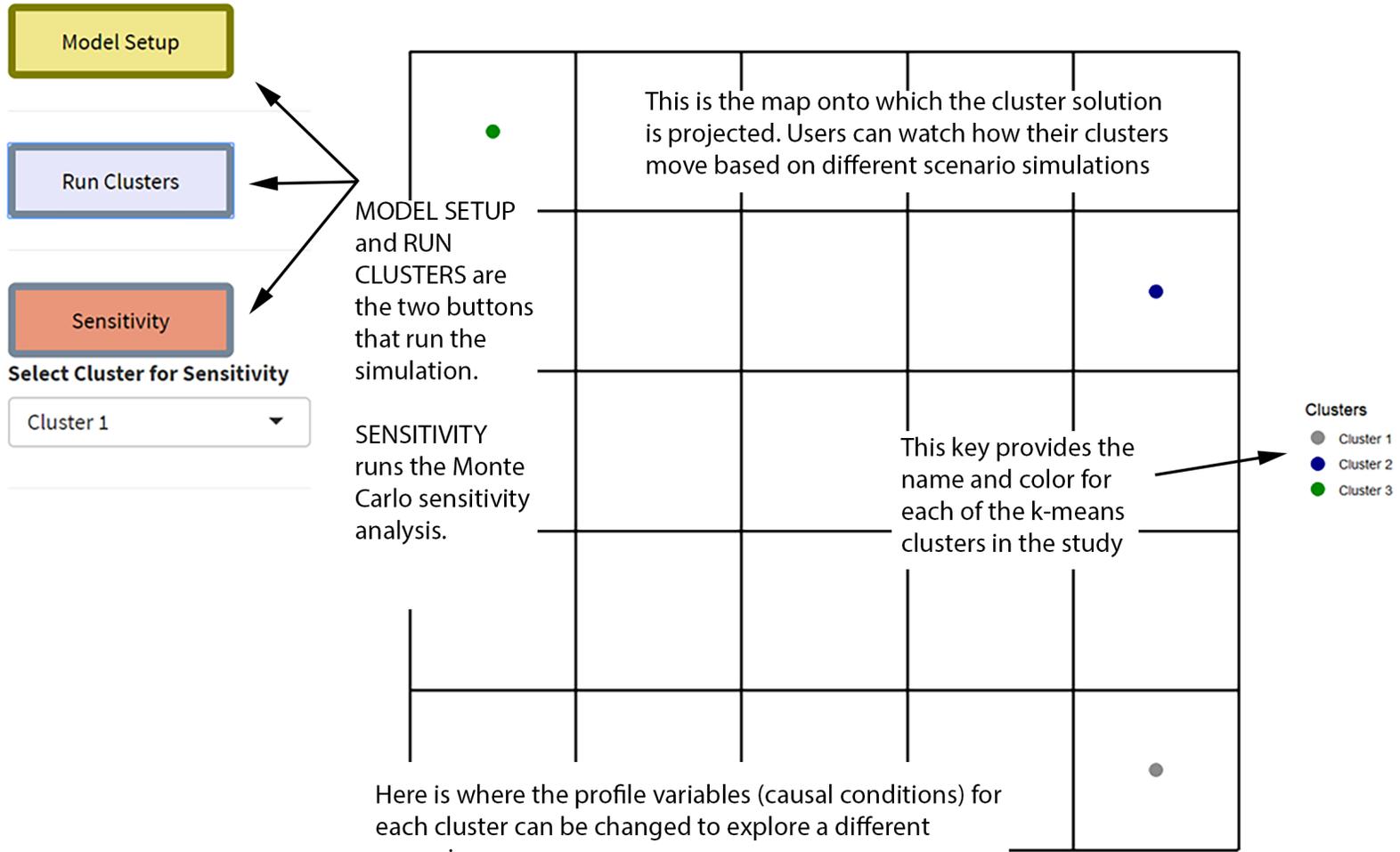
**Article Overview  
COMPLEX-IT**

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#### Meet the team





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3	<input checked="" type="checkbox"/>	5.01	3.42	1.46	0.24	Cluster 3 ▾	5



Users can move back and forth to re-examine the changes they made to one or more clusters to compare scenarios.



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 **Main  
Page**

## Video Tutorials , User Guides, & Articles

For each of the major TABS and STEPS in COMPLEX-IT, we have provided a quick video tutorial and supporting documentation.

**VIDEO** **PDF** Basic Introduction - What is Case-based modeling?

**VIDEO** **PDF** OVERVIEW OF COMPLEX-IT.  **This is the key video and article!**

**VIDEO** **PDF** Thinking about data as cases and preparing the database.



 **Tutorial Datasets**

**VIDEO** **PDF** How to run & interpret the cluster analysis tab in COMPLEX-IT.

**VIDEO** **PDF** How to run the artificial neural net in COMPLEX-IT.

**VIDEO** **PDF** Making sense of the visualisation map.

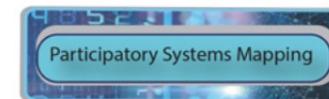
**VIDEO** **PDF** Comparing the artificial neural net to your cluster analysis.

**VIDEO** **PDF** Rerunning your cluster analysis & artificial neural net.



**VIDEO** **PDF** Participatory Systems Mapping -- **here are two software package.**

**VIDEO** **PDF** Thinking about modelling and causality



**VIDEO** **PDF** How to run a case-based scenario simulation in COMPLEX-IT.

**VIDEO** **PDF** How to run the sensitivity analysis for your simulation.

**VIDEO** **PDF** How to run the prediction/forecasting tab.

**VIDEO** **PDF** RUNNING THE SOM TO DO DATA FORECASTING!

**VIDEO** **PDF** Making sense of the REPORT provided at the end of your analyses



# **Examples of potential use**

# Examples of potential use

- Use previous published evaluations
- Consider what CBSS/COMPLEX-IT might have brought
- Mix of evaluation purposes and designs

**Table 1.** An overview of case studies used to demonstrate CBSS and COMPLEX-IT.

		Evaluation design	
		Cross-section	Longitudinal and/or quasi-experiment
Evaluation purpose	Learning and/or process evaluation	Heat Network Investments Project pilot evaluation (BEIS, 2018)	Frontline Fast-track Social work training pilot evaluation (control and intervention groups used) (DfE, 2016)
	Accountability and/or impact evaluation	Renewable Heat Incentive evaluation (BEIS, 2017)	The National Evaluation of Sure Start (DfE, 2008, 2010, 2012)

# Renewable Heat Incentive

- Payment system for renewable heating
- Domestic and non-domestic
- Running since 2011, lots of evaluation reports

Research and analysis

## RHI evaluation – synthesis report

A synthesis report based on primary research carried out as part of the Renewable Heat Incentive (RHI) evaluation.

From: [Department for Business, Energy & Industrial Strategy](#)

Published 11 February 2016

Last updated 5 September 2017 — [See all updates](#)

### Documents



#### [RHI evaluation synthesis: 2017 version](#)

PDF, 836KB, 60 pages

This file may not be suitable for users of assistive technology.

▶ [Request an accessible format.](#)

### Details

This synthesis is based on detailed primary research carried out for the Department of Energy and Climate Change (DECC), now the Department for Business, Energy and Industrial Strategy (BEIS), by Natcen, Eunomia and CSE in 2014-16.

### Related content

[MCS installer survey](#)

[Evaluation of the Renewable Heat Incentive: interim report - the non-domestic scheme](#)

[RHI evaluation evidence report: biomethane installations](#)

[Non-domestic survey](#)

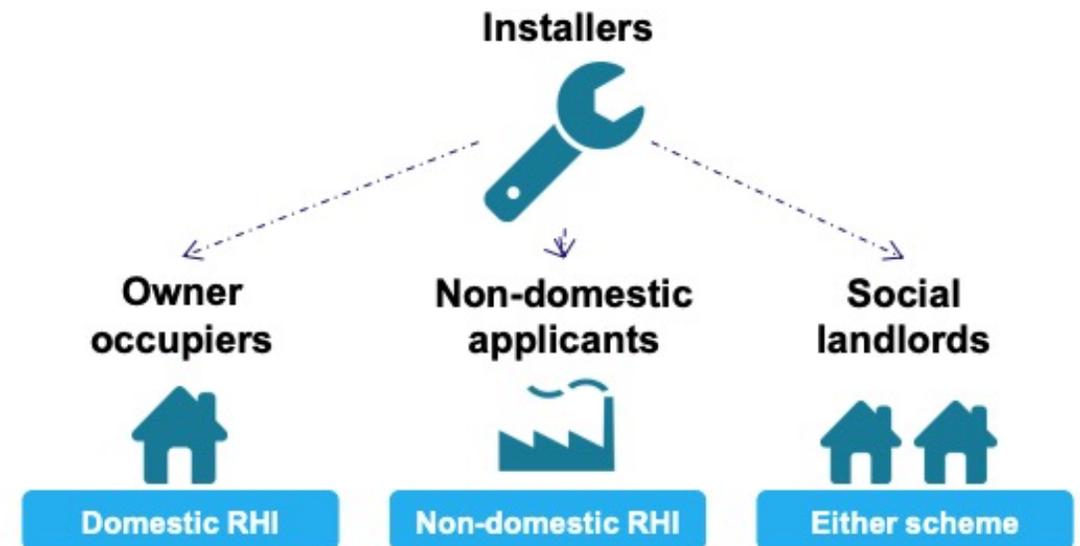
[RHI evaluation interim report: applicant reaction to reform announcements](#)

Collection

[Renewable Heat Incentive evaluation](#)

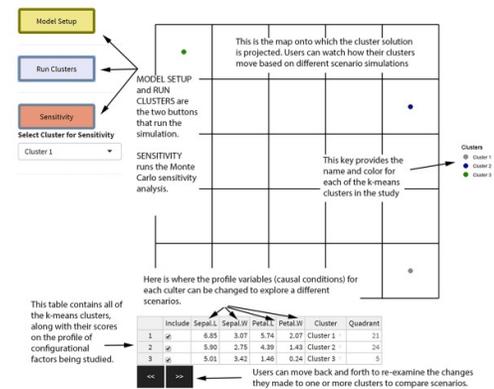
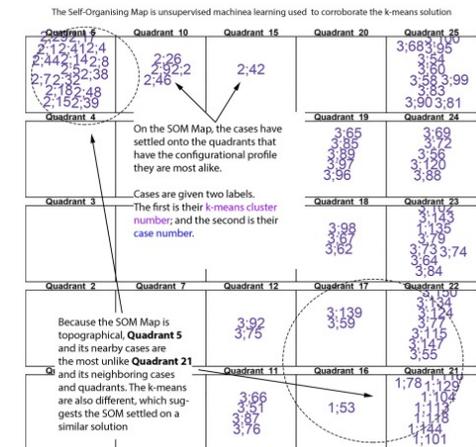
# Renewable Heat Incentive

- Evaluation focuses on
  - applicants (always broken down into subgroups)
  - installers
  - non-applicants
- Evaluation data + admin data
- Big and ongoing question about non-applicants
  - could or should they have applied?
  - why did they not?



# Renewable Heat Incentive

- What could we do?
  - Cluster applicants and non-applicants
    - Are there non-applicants that cluster 'closely' to applicants? ('nearly applicants')
  - Run scenario simulation
    - If there are 'nearly applicants' - could they really be applicants?
    - If not, how far are non-applicants from applicants?
    - What does the clustering suggest would need to change? Is this plausible?
- Complement existing customer journey research



# Frontline Fast-Track Social Work Training

- Train high performing social workers
- Emphasis on practice-based learning, helping at-risk children
- Pilot, ran between 2013-2017

## Frontline pilot: independent evaluation

An independent evaluation of the Frontline pilot, a fast-track training scheme for social workers in child protection.

From: [Department for Education](#)

Published 24 March 2016

Last updated 20 September 2016 — [See all updates](#)

Applies to: **England**

### Documents



#### [Frontline pilot: independent evaluation](#)

Ref: ISBN 978-1-78105-569-4, DFE-RR507  
PDF, 4.5MB, 161 pages

### Details

Research into the effectiveness of the [Frontline](#) pilot in attracting high-quality graduates to social work.

### Related content

['Right home' project: evaluation](#)

[Enfield family and adolescent support service](#)

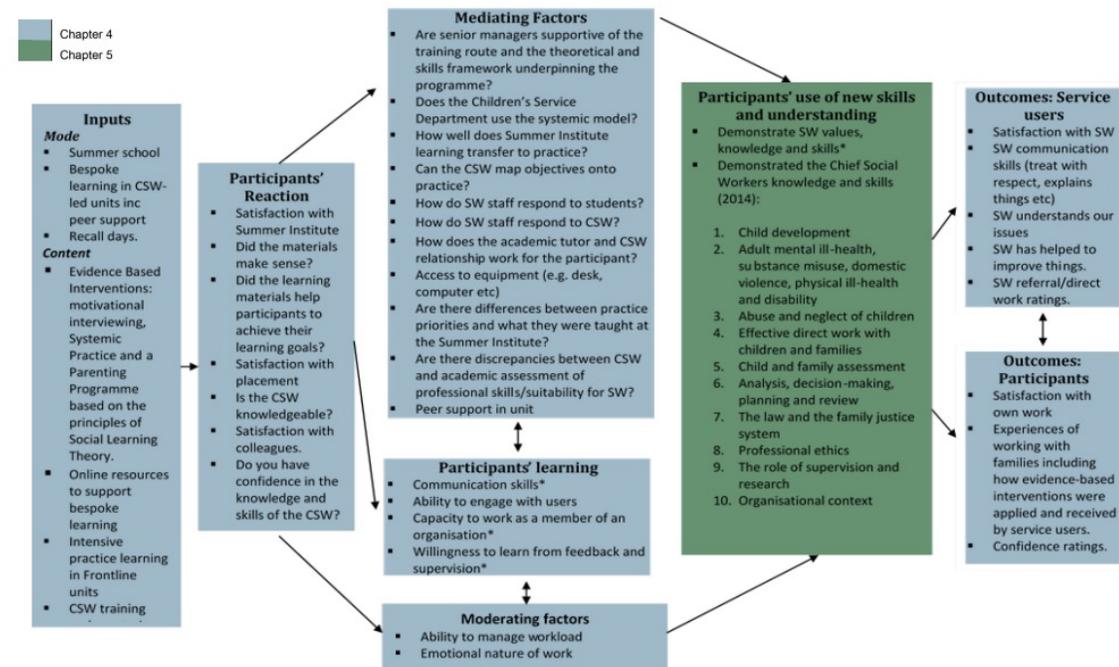
[Cornerstone adoption support programme: evaluation](#)

[Children in need: Project Crewe](#)

[Child sexual exploitation project: Wigan and Rochdale evaluation](#)

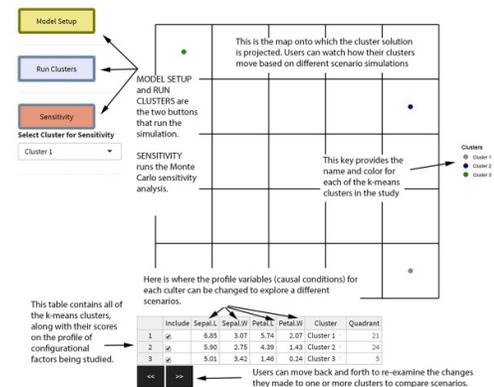
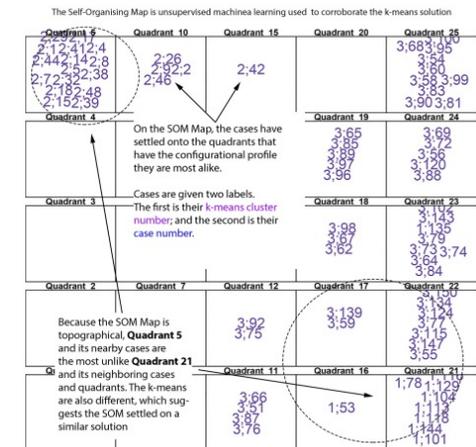
# Frontline Fast-Track Social Work Training

- Evaluation focused on
  - Students in the programme
  - Effectiveness of the programme
  - Comparison with other programmes
- Evaluation data
  - Performance assessment
  - Surveys of participants and comparison students
  - Interviews and focus groups, students, stakeholders



# Frontline Fast-Track Social Work Training

- What could we do?
  - Cluster Frontline and comparison students
    - Study looked at aggregate differences, break down performance measures into several indicators
  - Understand alternative outcomes
    - Recreate clusters focused on writing/reflection measures, less practice based more traditional academic measures
  - Run scenario simulation
    - Frontline students on average had stronger academic backgrounds – how would making an even baseline affect the frontline vs. comparison outcomes?



# Some questions to chew on

- What is not clear about this approach and its value?
- What areas do you think you can apply this and why?
- What are the barriers that would stop you from using this?



# Reflections

# Reflections

- First, in terms of technique, the clustering and scenarios techniques in CBSS showed wide-ranging potential for enabling greater exploration of the data evaluators have and for generating questions.
- Second, the cases demonstrate that CBSS is not at odds with other methods and evaluation data.

# Reflections

- Third, CBSS is more than cluster analysis. It supports:
  - richer descriptions and holistic characterizations of populations targeted by the programmes reviewed.
  - in-depth comparisons of similarities and differences across distinct groups.
  - exploring counterfactuals or ‘what if’ scenarios.
  - examining the strength of differences between clusters representing different case types.

# Reflections

- Fourth, CBSS is well aligned with a realist programme of evaluation.
- Fifth, CBSS raises two critical methodological considerations.
  - What cases should be evaluated?
  - Are cases and their profiles reasonable approximations of their real-world counterparts? The value of validity checking

# Reflections

- Sixth, a problem may arise where either the evaluator cannot find an adequate cluster representation, or a relatively stable cluster representation emerges that disagrees with other evaluation results, relevant theories or experience with the system(s) under study.
- This may also emerge when exploring the scenario simulation leads to unusual or contradictory outcomes.
- Under these circumstances, it may be that elements in the case profiles poorly capture critical causal factors that influence case dynamics and differences between cases behaviours.
- One way to address this challenge is to draw on theories of change.

# Reflections

- Seventh, there are always the issues of data quality.
- One way to address this challenge is validity checks
- The other is using other methods.

# Some questions to chew on

- What is not clear about this approach and its value?
- What areas do you think you can apply this and why?
- What are the barriers that would stop you from using this?

**Q&A**

