



**THE SUSTAINABILITY  
OF EDUCATIONAL  
INNOVATIONS**

Anne Tappel



# THE SUSTAINABILITY OF EDUCATIONAL INNOVATIONS

**Anna P.M. Tappel**

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# THE SUSTAINABILITY OF EDUCATIONAL INNOVATIONS

## **Proefschrift**

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## **door**

**Anna Petronella Maria Tappel**  
geboren op 19 december 1972  
in Borne, Nederland

**This dissertation has been approved by:**

**Promotors**      prof.dr. K. Schildkamp  
                         prof.dr. A.J. Visscher

**Co-promotor**    dr. C.L. Poortman

# CONTENTS

- **CHAPTER 1** INTRODUCTION
  
- **CHAPTER 2** HOW CAN EDUCATIONAL INNOVATIONS BECOME SUSTAINABLE?  
A REVIEW OF THE EMPIRICAL LITERATURE
  
- **CHAPTER 3** DISTINGUISHING ASPECTS OF SUSTAINABILITY
  
- **CHAPTER 4** FACTORS INFLUENCING THE SUSTAINABILITY OF A  
DATA-USE INTERVENTION
  
- **CHAPTER 5** PROMOTING SUSTAINABLE EDUCATIONAL INNOVATION USING  
THE SUSTAINABILITY METER
  
- **CHAPTER 6** CONCLUSION AND DISCUSSION
  
- **REFERENCES**
  
- **SAMENVATTING (DUTCH SUMMARY)**
  
- **APPENDIX**
  
- **PUBLICATIONS AND PRESENTATIONS**
  
- **ICO PHD DISSERTATION SERIES**
  
- **DANKWOORD (ACKNOWLEDGEMENTS)**

## THE SUSTAINABILITY OF EDUCATIONAL INNOVATIONS

Het is belangrijk dat je zo'n droom van de hoogste orde herkent zodra hij langskomt. En wanneer je jouw droom opvangt, bestaat er een grote kans dat hij er uit zal zien als iets wat niet voor jou is weggelegd. Maar je mag hem niet laten lopen. Zoveel van die dromen komen er in een mensenleven nu ook weer niet langs. En lijkt die hele droom je krankzinnig, dan is dat alleen maar goed. Het is juist de bedoeling dat het iets onvoorstelbaars is, iets wat je onhaalbaar lijkt. Alleen dan kun je je eigen ongelijk bewijzen.

*Naar: Dromen voor het leven, Arthur Japin, 2023*



# **CHAPTER 1**

## INTRODUCTION

## 1.1 Problem statement

Beginning an educational innovation can be difficult, but sustaining it in the organization is the toughest part (Hargreaves & Fink, 2012). The sustainability of educational innovations is a challenge for many schools (e.g., Askeff-Williams & Koh, 2020; Cohen & Mehta, 2017; Dufour, 2006). Many innovations implemented in schools are initially successful, but fail to become part of the schools' habits and routines (Wiltsey-Stirnam & et al., 2012). Relatively little research has followed the course of innovations in schools over a long period of time (Waslander, 2007). For one thing, when the provision of resources for working on an innovation stops, the research into it also often ends. Additionally, few reforms last long enough to be studied longitudinally (Datnow, 2005). In-depth analyses of long-term innovation processes and verified theories that explain and predict the long-term success or failure of an innovation are lacking (Cohen & Mehta, 2017; Mijs, 2007). This dissertation therefore focuses on the sustainability of educational innovations. Two of the chapters in this thesis focus on educational innovations in general, and two chapters focus on a specific educational innovation: the data-use intervention.

Schools often start funded educational innovations with the ambition to improve school quality. Some of these innovations focus on the use of data (e.g., Doolaard et al., 2013; Ros et al., 2022). Data can be defined as purposefully and systematically collected information on students, schools, school leaders, and teachers, (Schildkamp & Lai, 2013b; Vanlommel et al., 2021) and can be both qualitative and quantitative. Examples of data include assessment data, results of classroom observations, and survey results. Making educational decisions based on a broad range of types of data, with the aim of improving education and subsequently evaluating whether improvement measures have the desired effect, can be defined as data-based decision making (DBDM) (Schildkamp & Lai, 2013a). Data in that case inform teachers' and school leaders' decisions for improving student learning (e.g., Marsh & Farrell, 2015; O'Brien et al., 2022; van Geel et al., 2016). The Dutch government has emphasized this importance of data use by stating that all schools should use data to "work systematically and purposefully to maximize student achievement" (Inspectie van het Onderwijs, 2012; OC&W, 2023).

Internationally, there is also increasing awareness of the importance of data use for educational improvement (Mandinach & Gummer, 2013; Mandinach & Schildkamp, 2021; McNaughton et al., 2012). Data can be used for several purposes, including accountability, school development, and instructional improvement (Schildkamp et al., 2017). Research has shown that data use can help make school quality visible and that data can be used to improve education (Campbell & Levin, 2009; Grabarek & Kallemeyn, 2020; van Geel et al., 2016).

As setting goals, gaining insight into learning outcomes, and working in a planned and results-

oriented manner are essential for achieving the best education for all students (Inspectie van het Onderwijs, 2012), nowadays data use is expected from educators. However, educators are often not skilled in the use of data and lack data literacy, and professional development is therefore needed. To support educators to improve the quality of the education they provide through data use, a data-use professional development intervention was developed (Schildkamp et al., 2014). This data-use intervention has two main goals: improving educational quality at (part of) the school through data use, and providing professional development in data use (Schildkamp & Poortman, 2015).

The data-use intervention that was studied for this research was introduced in many schools in the Netherlands (Poortman & Schildkamp, 2016) and abroad, for example, in Sweden (Schildkamp, Smit, et al., 2017) and the USA (Jimerson et al., 2021). In this intervention, data teams are supported by an external coach, who supports the team in using data to solve educational problems. These data teams have been found to improve teachers' data literacy (Ebbeler et al., 2017; Kippers et al., 2018) as well as student achievement in a number of cases (Poortman & Schildkamp, 2016).

## 1.2 Key concepts and research question

In the following section, the main concepts of the dissertation are defined. First, we will describe the concept of sustainability. Next, a brief introduction to the data-use intervention will be given. Finally, an overview of the dissertation content is given.

### 1.2.1 Sustainability

Sustainability refers to the process of continuing and integrating the innovation's core aspects in organizational routines that are adaptive to ongoing work (Prenger et al., 2022). This definition distinguishes a number of dimensions of sustainability.

First, contrary to previous theories arguing that sustainability, the final phase of a linear change process, is when attention is paid to the continuation of the innovation (Fullan, 1992), sustainability is nowadays seen as a developmental process that should already have started in the initial stage of the change process (Fagen & Flay, 2009).

Second, the core aspects of the innovation should be continually carried out for sustainability (Coburn & Turner, 2012). Core aspects are the elements that form the basis of an innovation. They include the basic principles and related activities needed to achieve the innovation's long-term goals. Core aspects can refer to the intervention itself, such as the 8-step cyclical process in the case of the data-use intervention. Core aspects can also refer to the underlying goals of the intervention, such as setting measurable goals and taking measures based on

data to achieve these goals in the case of the data-use intervention. The long-term goal for the data-use intervention is to improve education by means of the use of data. For sustainability, these core aspects, the intervention and/or the underlying goal, must continue after removal of implementation support.

Third, to be sustainable the (core aspects of the) innovation should become an integral part of the daily organizational routines within the school (Bean et al., 2015). Organizational routines show whether and how the innovation unfolds in school practice in a repeated, recognizable pattern of interdependent actions, carried out by multiple actors (Wolthuis et al., 2022). Organizational routines also facilitate scaling-up of the results or the innovation (Dekker & Feijs, 2005; Edwards Groves & Rönnerman, 2013), which can be shown by an increasing number of teachers using the innovation and by substantive change in educational practice resulting from the innovation (Sanders, 2012). Fourth, the results achieved by means of the innovation should be maintained or further improved (e.g., Elder & Prochnow, 2016). Fifth, the innovation can be adapted over time while still adhering to the core aspects, so it can be aligned with the work in the school (e.g., Marsh, 2016).

### 1.2.2 Data-use intervention

The data-use intervention that was studied for this research is a structured, cyclical, and iterative approach in which data teams follow eight steps, ideally leading to the implementation of improvement measures based on the data collected by data-use teams. The intervention is based on several characteristics of teacher professional development that are often claimed to be decisive for effective professional development interventions (in data use), such as collaboration between school staff (Veen et al., 2010), substantial intervention duration (Veen et al., 2010), the active involvement of school leadership (Marsh, 2012), and external coaching by an expert (Marsh, 2012). A data team is a small-scale research team and consists of 6-8 teachers and school leaders who collaboratively work on solving one or more educational problems in their own school, based on data. A data team generally convenes once every 3 weeks for an average of approximately 90 minutes. The structured eight steps of the intervention are described in a manual (Schildkamp et al., 2014).

The data-use intervention starts with problem definition (Step 1) by using data to specify the problem and formulating a goal. In Step 2, the data team formulates concrete and measurable hypotheses about possible causes of the problem studied. Subsequently, in Step 3, data are collected to test these hypotheses. These can be qualitative and quantitative data, and their quality is checked during Step 4. Then, in Step 5, data analysis takes place. Based on the analysis, data-team members interpret the data and draw conclusions (Step 6). If the tested hypotheses

turn out to be false, then new hypotheses must be formulated and tested and teams return to Step 2. If the hypotheses are confirmed, then the data team proceeds to Step 7. In this step, improvement measures are designed that meet criteria such as feasibility, proven effectiveness, speed of impact and costs. An action plan is drawn up, the evaluation method is specified and the measures are communicated and implemented. In Step 8, the effects of the measures taken are evaluated.

### 1.3 Structure of the dissertation

Four studies were conducted to address the main research topic, which are presented in Chapters 2 to 5. **Chapter 2** consists of a systematic literature review with the aim of constructing a definition of sustainable educational innovation, based on previous publications on this theme. In addition, an overview of the factors that influence the process of establishing sustainable educational innovation is presented in the second chapter. The definition and influential factors found were used as a theoretical framework for the subsequent chapters in this thesis.

In the second study of this dissertation, presented in **Chapter 3**, the goal was to measure the degree of sustainability of the data-use intervention that was studied for this research in Dutch schools that were exposed to this intervention between 2012-2017. The research question underlying this study was: *How sustainable is the data-use intervention in secondary schools in the Netherlands?* Data were collected in structured telephone interviews with 1 expert per school ( $N = 29$ ). A distinction was made between sustainability of the method and sustainability of the underlying goals of the data-use intervention. The outcomes of this study led to four profiles of sustainability.

Subsequently, the study presented in **Chapter 4** describes which (combination of) factors influence the sustainability of the data-use intervention related to the four profiles distinguished in Chapter 3. The research question underlying this study was: *Which (combination of) factors explain differences in the sustainability of the data-use intervention?* Data in this study were collected from school personnel via an online questionnaire ( $N = 307$ ). The results of this study pointed to three crucial factors for sustainability.

The study presented in **Chapter 5** describes the extent to which the use of the Sustainability Meter promotes the sustainability of schools' innovations. The tool can be found here: <https://pro-u.duurzaamheidsmeter.utwente.nl>. Based on the outcomes of the literature review presented in Chapter 2 and the questionnaire as used in the third study (Chapter 4), a tool was developed to support schools in promoting the sustainability of their educational innovations in a concrete and practical way. This tool, the *Sustainability Meter*, was tested in schools and in cooperation with

practice. In this study the following questions were investigated: (1) *To what extent does the use of the Sustainability Meter lead to the conceptual use of its outcomes to promote the sustainability of a school's innovation?* (2) *To what degree does the use of the Sustainability Meter lead to the instrumental use of its outcomes to promote the sustainability of a school's innovation?* (3) *To what extent are users satisfied with the Sustainability Meter?* Data were collected with users and chairs (of dialogue groups working with the Sustainability Meter) (N=64) by means of a mixed methods approach including interviews, observations of dialogues and the analysis of action plans.

Finally, **Chapter 6** presents a summary of the findings of all the studies presented in Chapters 2, 3, 4 and 5 and a general conclusion. Then, limitations and recommendations for further research are presented.

Figure 1 gives an outline of the dissertation.

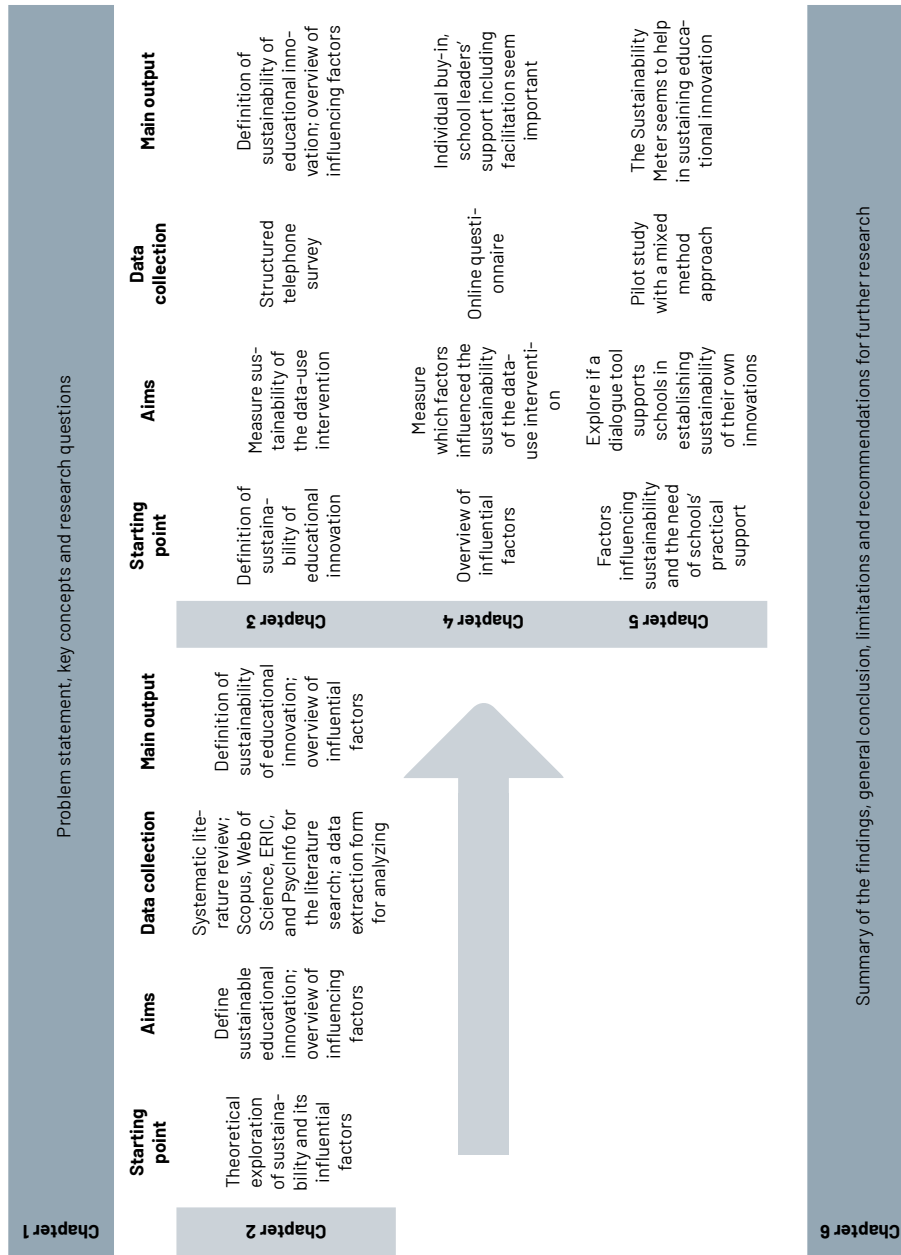


Figure 1: outline of the dissertation





## **CHAPTER 2**

HOW CAN EDUCATIONAL  
INNOVATIONS BECOME  
SUSTAINABLE?  
A REVIEW OF THE  
EMPIRICAL LITERATURE

### **This chapter is based on**

Prenger R., Tappel A.P.M., Poortman C.L. and Schildkamp K. (2022) How can educational innovations become sustainable? A review of the empirical literature. *Frontiers in Education*. 7:970715. doi: 10.3389/educ.2022.970715

#### **Abstract**

In literature there is a great variety in the definitions and identified critical features of sustainability of educational innovations. The aim of this review is to provide an overview of the entire range of factors influencing the sustainability and its core aspects. A systematic review was performed in which electronic databases were searched for peer reviewed articles, published between 2002 and 2017. Based on results of 44 publications, the following definition could be constructed: "Sustainability refers to the process of integrating the intervention's core aspects in organizational routines, which are adaptive to ongoing work, with maintenance or continuation of improved results." We found four main factors influencing sustainability of educational innovations: school organizational, innovation, individual, and context characteristics. The empirical-based model developed in this review should be validated in practice to create transparency and focus in sustainability research.

## 2.1 Introduction

Schools are faced with the challenge of implementing new practices; however, many innovations that are initially successful fail to become part of a school's organizational routines (Wiltsey Stirman et al., 2012). The hardest part of any educational innovation is not how to start, but how to sustain the innovation within the organization (Hargreaves and Fink, 2012). Moreover, sustainability is not a matter of black and white, but nuanced (Tappel et al., 2022).

Educational innovations appear to follow multiple phases to ultimately accomplish a change in education, which can be described as initiation, implementation (e.g., Fullan, 2007; West, 2012) and continuation/sustainability (Fullan, 2007). The different phases are interdependent, and later phases are influenced by decisions made in the earlier phase(s) (Ertesvåg and Vaaland, 2007; Fullan, 2007). Sustainability within education is defined in numerous ways, in which core aspects of sustainability differ across definitions. Coburn and Turner (2012), for example, emphasized the aspect of the visibility of the innovation through organizational routines. An organizational routine is a pattern within an organization of recurring actions that influence each other and require the involvement of multiple actors, in which a distinction can be made between ostensive and performative aspects (Feldman and Pentland, 2003). The ostensive aspect is defined as the perception or structure of the routine. The performative aspect is defined as the specific actions that are undertaken to perform the organizational routine. Once implemented, such routines support the initiation of coordinated actions between individuals (Spillane, 2012).

Another example of an aspect of sustainability often described in the literature is that the innovation can be operative during regular work without causing interruption of existing practices (Coburn and Turner, 2012) and should be integrated with other existing initiatives within the organization (Hargreaves and Fink, 2008). They additionally referred to sustainability as an ongoing innovation process after removal of support. Other definitions do not include the aspect of not being disruptive of existing practices or processes (Copland, 2003; Fullan, 2005; Coburn et al., 2012). Overall, there seems to be a lack of uniformity as far as exactly what sustainability is, and thus also with regard to how it can be measured to determine the effects of educational innovations over the longer term.

What is also known from the literature is that sustainability is influenced by a multitude of factors. Understanding the factors and processes involved in sustainability is at least as important as the implementation of an innovation itself (Wiltsey Stirman et al., 2012), if we want to realize sustainable school improvement.

Although an extensive body of literature is available on the sustainability of educational innovations, there is at the same time a great variety in the definitions and factors influencing sustainability. Much of this literature has a theoretical focus, and does not provide clarity about its empirical foundations. Influential factors also vary between different articles. A general model of the sustainability of educational innovations seems to be lacking thus far. Therefore, there is a need for in-depth analyses and evidence-based theories that explain the long-term success or failure of educational innovations (Cohen and Mehta, 2017). The aim of the systematic review is to create more clarity on what sustainability of educational innovation is. Moreover, as educators face the problem of sustainability in their organizations, we also aim to provide an overview of the entire range of factors influencing the sustainability of educational innovations. The research questions are:

1. How can sustainability of educational innovations be defined in terms of its core characteristics?
2. What factors influence the sustainability of educational innovations?

## 2.2 Methods

This study used a stepwise process for conducting a systematic review in the social sciences (Petticrew and Roberts, 2006). This process consisted of: (1) defining the research question; (2) defining the search terms; (3) choosing literature databases; (4) conducting the literature search; (5) formulating inclusion criteria; (6) selecting literature, using the inclusion criteria; (7) data extraction; and (8) aggregation and synthesis of the evidence. A library professional was consulted to advise on our literature search. A data extraction form was used for each relevant publication, to collect the information needed to answer the research question. Additionally, a scientific quality check of each publication ensured that only studies that met the data extraction quality criteria were selected for analysis (Petticrew and Roberts, 2006). Figure 1 shows the quorum flowchart for the selection process.

**Figure 1**

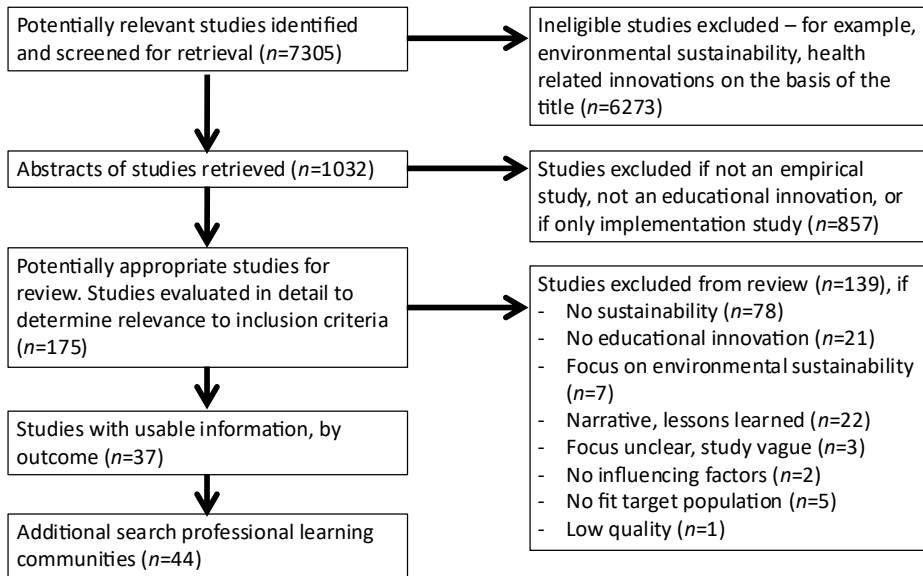


Figure 1 Flowchart quorum selection process.

### 2.2.1 Data extraction

A data-extraction form was designed for analyzing the selected publications, based on the data-extraction form used by Hoogland et al. (2016). The use of a form ensured that comparable data could be gathered from the selected publications (Petticrew and Roberts, 2006). Additionally, the data extraction form included 12 questions regarding the quality of the research.

## 2.3 Results

A total of 44 publications were found suitable for data extraction and analysis. The characteristics of the included studies are shown in Table 1

1	Alanis and Rodriguez	2008	Dual language program	Case report	10 teachers
3	Bambara et al.	2012	Positive behavior support	Case report	25 teachers
5	Benz et al.	2004	Youth transition program	Case report	120 staff and young adults
7	Deaney and Hennessy	2007	Technology- integrated pedagogical strategies	Case report	16 teacher-researchers, 6 colleagues, 5 research coordinators
9	Drits-Esser et al.	2017	Professional development program	Cross sectional	15 teachers
11	Elder and Prochnow	2016	Positive behavior support	Cross sectional	338 school staff

<b>Research method</b>	<b>Research instruments</b>	<b>Years after implementation</b>	<b>Country</b>	<b>Education</b>
Mixed methods	Site visits, observations, interviews, student achievement scores	>10 years	USA	Primary (K-5)
Qualitative	Critical incidents technique, interviews	15 years	Canada, BC	Elementary
Qualitative	Interviews	3 years	USA	Special needs
Mixed methods	Questionnaire, interviews, student achievement scores	8 years	USA	Primary
Qualitative	Interviews, field notes, document analysis	9-10 years	USA	High school, special needs
Quantitative	Questionnaires	> 3 years	USA	Primary
Qualitative	Interviews	3 years	England	Secondary
Qualitative	Interviews	1.5 years	USA	Secondary
Mixed methods	Lesson observations; questionnaire; interviews	1 year	USA	Primary
Qualitative	Interviews	6-10 years	Australia & Sweden	-
Quantitative/ qualitative	Questionnaire with open fields	1-2 years	New Zealand	Primary
Qualitative	Interviews	> 5 years	USA	Elementary, middle, high

13	Ertesvåg and Vaaland	2007	Prevention and reduction of problem behavior	Cohort-longitudinal design with adjacent cohort	'All staff' and 2655 students
15	Ferguson et al.	2011	Literacy	Cross sectional	16 teachers, 480 children
17	Gaikhorst et al.	2017	Professional learning program for beginning urban teachers	Quasi experimental	72 teachers (quantitative) 10 teachers and 9 principals (qualitative)
19	Gilad-Hai and Somec	2016	Innovation implementation: experimental schools	Quasi experimental	870 teachers, 75 principals
21	Kafyulilo et al.	2016	Teachers' technology use	Case report	12 teachers and 3 school leaders
23	Kirtman	2002	Changing teachers' professional roles	Case report	3 schools



<b>Research method</b>	<b>Research instruments</b>	<b>Years after implementation</b>	<b>Country</b>	<b>Education</b>
Quantitative	Questionnaire	2 years	Norway	Primary, secondary
Qualitative	Interviews	2.5 years	Norway	Primary, secondary
Quantitative	Questionnaire and standardized tests	1-2 years	UK/Scotland	primary
Qualitative	Case studies: document analysis, interviews, and complementary conversations	7-10 years	Israel	Junior high
Mixed methods	Questionnaire, knowledge test, interviews	1 year	The Netherlands	primary
Mixed methods	Two surveys, semi-structured interviews	2 years	USA	Middle
Quantitative	Questionnaire	5 years	Israel	-
Mixed methods	Students' test scores; focus group interviews	2, 3 & 4 years	New Zealand	Primary
Qualitative	Interviews	6-18 months	Tanzania	Secondary
Qualitative	Interviews	3 years	Republic of Ireland	Primary
Qualitative	Classroom observations, collegial interactions, governance situations, interviews and document analyses	2 years	USA	Elementary

24	Larsen and Samdal	2008	Developing social competence and preventing violence	Case report	4 case studies; 1 inspector, 3 principals and 17 teachers
26	Mathews et al.	2014	Positive behavioral innovation	Cross sectional	School personnel from 261 schools
28	Mouza	2009	Technology-focused professional development	Case report	7 teachers
30	Owston	2007	Innovative pedagogical practice in schools	Case report	59 schools
31	Payneeady and Auckloo	2012	Teachers' ability to use appropriate literacy strategies to teach languages	Case report	216 teachers
32	Peters	2011	Involvement in university/ school partnership	Cross sectional	5 coordinators and 23 mentor teachers
34	Postholm	2011	Research and development project	Phenomenological, cross sectional	40 respondents, including teacher, school leaders and team leaders

<b>Research method</b>	<b>Research instruments</b>	<b>Years after implementation</b>	<b>Country</b>	<b>Education</b>
Qualitative	Interviews	>4 years	Norway	Primary
Mixed methods	Survey, interviews, observations, and video recordings of teachers and students	2 years	UK	Primary & secondary
Quantitative	Survey	3 years	USA	Primary & secondary
Qualitative	Interviews	4 years	UK	Primary
Mixed methods	Interviews, surveys, classroom observations, collection of artifacts	3 years	USA	Primary
Mixed methods	Observations, surveys, focus groups, interviews, reflective journals	3 years	Australia	Secondary
Qualitative	On-site visits, interviews, classroom observations, document analyses	> 2 years	28 countries	Primary
Qualitative	Classroom observations, general school observations, interviews and formal conversations	5 years	Mauritius	Primary
Mixed methods	Interviews and survey	20 years	Australia	Secondary/ university
Qualitative	Open-ended questions on survey	> 5 years	USA	Elementary, middle, high
Mixed methods	Survey, interviews, focus groups	2 years	Norway	Lower secondary

35	Roffe	2010	Curriculum development for enterprise education	Case report	Multiple case studies; 30 spread equally across each sector
37	Sanders	2012	Partnership reform	Case report	Two districts, varying number of schools
39	Sandholtz and Ringstaff	2016	Professional development program on science assistance	Cross sectional	15 teachers; 5 case study schools
40	Stringfield et al.	2008	School reform	Cross sectional	About 30 school leaders, multiple teachers and districts' director of education and officials
41	Tam	2009	Changes in instructional practices	Cross sectional	1876 teachers
43	Youngs and King	2002	Professional development program	Case report	9 schools: 8-10 respondents per school + district staff, representatives from external providers of professional development

<b>Research method</b>	<b>Research instruments</b>	<b>Years after implementation</b>	<b>Country</b>	<b>Education</b>
Qualitative	Interviews and observations	10 years	Wales	Schools, further, higher education
Qualitative	Interviews, observations, field notes, project documents	3 years	Vietnam	-
Qualitative	Focus groups, interviews, observations, document analyses and site visits	> 3 years	USA	Elementary, secondary
Qualitative	Interviews, observations, document analyses and site visits	< 10 years	USA	Elementary, secondary
Qualitative	Interviews with teachers	2 & 3 years	USA	Elementary
Mixed methods	Test results and case studies: interviews, observations, site visits, and implementation questionnaires	5 years	Wales	Secondary
Quantitative	Questionnaire	2 years	Hong Kong	Secondary
Quantitative	Questionnaire	6 years	USA	Elementary, secondary
Qualitative	School visits, interviews and observations, document analyses	2 years	USA	Elementary
Qualitative	Case studies: document analyses and interview series	Up to 20 years	Austria	Teacher education

The educational contexts varied considerably between studies found in this review. The studies focused on a broad scope of innovations founded in diverse countries. This wide distribution around the world indicates that this topic is on the radar in many parts of the world. Over 40% of the studies took place in the USA compared to 32% in Europe. This should be noted when interpreting the results. The results included literature on specific innovations (e.g., experimental schools), interventions (e.g., positive behavior support), reforms (e.g., school reforms) and partnerships (e.g., involvement university in schools). These will all hereafter be referred to as “innovations,” as they all involved “the intentional introduction and application within a role, (work)group, or organization of ideas, processes, products or procedures new to the relevant unit of adoption, designed to significantly benefit the individual, the group, the organization or wider society” (West and Farr, 1990, p. 9). Most of the studies were qualitative case reports (24), 16 cross sectional studies were included and four quasi-experimental studies.

### 2.3.1 Sustainability

Most of the articles, 31 out of 44, reported no explicit definition of sustainability, but did mention important aspects of sustainability. The most frequently addressed specific (core) elements of sustainability in these papers are: (1) results continued to improve/results maintained; (2) sustained implementation of (the core elements of) the innovation; (3) integral part of daily school routines; and (4) adaptation over time. Table 2 gives an overview of articles which mentioned these elements.

**Table 2** Aspects of sustainability and corresponding article numbers.

Aspects of sustainability	Article numbers (corresponding with table 1)
Continued to improve/ results maintained	1, 3, 4, 9, 11,13, 14, 15, 18, 19, 20, 40, 41, 44
Sustained implementation (of the core elements) of te innovation	2, 3, 4, 6, 7, 8, 9, 12, 13, 16, 17, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 42, 43
Integral part of organizational routines	3, 4, 5, 11, 12, 14, 24, 40, 41
Adaption over time	5, 7, 12

#### Results continued to improve/maintained

Of the 44 articles, 14 described a core element of sustainability as maintaining or continuing improvement of results following an innovation. This element refers to the need of innovation's results to keep being visible or being improved over time. All studies measured the results of the innovations multiple years later in order to determine sustainability of results. For example, Alanis and Rodríguez (2008) measured in their case report study sustainability as students consistently

outscored their peers in the district and state for multiple years on English and mathematics achievement scores. Stringfield et al. (2008) described sustainability in their cross-sectional study as schools keep making strong academic progress 5 years after an innovation. All studies measured the results of the innovations multiple years later in order to determine sustainability of results.

### 2.3.1.1 Sustained implementation (of the core elements) of the innovation

Thirty four articles referred to the sustained implementation of the innovation as to continue with the core elements of the innovation over time, despite adjustments that possibly have to be made to integrate an innovation into the organization. Almost half of these 34 articles reported that an implementation is successfully sustained when the core aspects of the innovation are implemented over the long term. Core components refer to components of the intervention long term goal of the intervention. Core components of an intervention include the functions or principles and related activities necessary to achieve outcomes (Blase and Fixsen, 2013).

The extent to which these core aspects were specified differed across articles. Multiple articles stated that the core aspects or essential form should be adhered to (e.g., Andreou et al., 2015; Bean et al., 2015), or referred to a standard of practice (e.g., Elias, 2010), to fidelity to core program principles in a piecemeal manner (e.g., Mathews et al., 2014), to continuity of issues (Roffe, 2010), or to quality of partnership program over time (Van Voorhis and Sheldon, 2004).

### 2.3.1.2 Integral part of organizational routines

Nine studies stated that innovations are sustainable if they have become a regular part of (organizational) routines within the school or district. This means that school leaders and teachers do not perceive the innovation as something new or added to their practice, but as something that has become a routine part of their practice and they have to be involved in.

### 2.3.1.3 Adaptation over time

This element refers to the adaptability of an innovation to the organizational routines within an organization, but at the same time adhering to the core elements of an innovation. Three case report studies described the core element of a sustainable innovation as being adaptive over time (Benz et al., 2004; Deaney and Hennessy, 2007; Elias, 2010). Benz et al. (2004) focused in their study on how the program developed and changed over time. Deaney and Hennessy (2007) discussed sustainability in light of “evolution over time.” They did not consider the sustainability of the initial innovation in a static form (often referred to as fidelity), but considered that sustainability is also about a development over time, but at the same time adhering to the core aspects of the innovation. Teachers in their study described how they had integrated the

new practice into their departmental schemes of work. Deaney and Hennessy distinguished different mechanisms for accomplishing these changes: by means of trialing (experimenting to see what works) and by means of feedback from colleagues. Elias (2010) emphasized “the necessity for ongoing flexibility of practices to promote and reinforce the innovation, as opposed to the conceptualization of a set list of practices that may be prey to extinction if evolving school schedule, budget, or other requirements conflict with the practices as initially implemented” (p. 19).

Table 2 gives an overview of the aspects of sustainability and the corresponding numbers of the articles.

### 2.4 Influential factors

Multiple factors could be identified in the selected articles that influenced the sustainability of innovations. Many of these factors work both ways: their presence often fosters sustainability and their absence often hinders sustainability. In studies on educational innovations the importance of the following categories of factors is often discussed (e.g., Rikkerink, 2011; Coburn and Turner, 2012; Datnow et al., 2012; Hoogland et al., 2016): Characteristics of the school organization, leadership, individual (teacher) characteristics, and context. We used these categories to structure our findings. However, while analyzing our results we discovered a category which is often not mentioned in the literature: Characteristics of the innovation. Moreover, the type of leadership found to be important in the studies described in the review seem to move away from leadership as a personal characteristic, and describe leadership more as an organizational quality. This is also mentioned by Spillane et al. (2004). Leadership in this case is spread over several people (with formal and no formal leadership roles) in an organization (Spillane et al., 2008; Spillane, 2009). After several rounds of clustering, we concluded that overall four different categories of factors could be distinguished: characteristics of the school organization, of the innovation, of the individual, and of the context. Table 3 illustrates the division of factors into the different categories, including the frequency of the found factors and in which of the included studies.

**Table 3** Overview of division of influencing factors into categories, their frequency and corresponding articles.

Characteristic	Influencing factor	N	Article numbers corresponding with table 1
School organization	Collaboration	8	4, 5, 9, 10, 19, 33, 42, 44
	Knowledge sharing within and outside the organization	16	2, 5, 6, 7, 10, 11, 17, 23, 25, 30, 32, 35, 36, 37, 40, 44



	School culture	8	3, 5, 7, 9, 17, 20, 31, 44
	Support and feedback from colleagues	7	6,10, 17, 39,44
	Staff turnover	8	1,2,4,5,23,36,39,44
	<b>Leadership</b>		
	<i>Vision, norms and goals</i>	11	3, 4, 22, 24, 27, 2, 36, 38
	<i>Providing individualized support (including facilitation)</i>	11 (18)	2, 3, 6, 10, 13, 17, 21, 22, 23, 24, 25, 31, 33, 36, 42, 43, 44 (3, 4, 6, 11, 12, 16, 21, 22, 225, 27, 29, 31, 32, 33, 34, 35, 39, 44)
	<i>Intellectual stimulation</i>	8	2, 3, 4, 5, 21, 23, 26 ,33
	<i>Distributed leadership</i>	12	1, 10, 12, 16, 20, 22, 23, 25, 29, 31, 32, 34
	<i>Knowledgeable and modeling</i>	13	1, 5, 22, 37 & 3, 6, 18, 22, 24, 25, 38, 40, 44
	<i>Communication</i>	7	5, 24, 22, 29, 31, 32, 34
<b>Intervention</b>	Structure	13	2, 4, 10, 11, 12, 13, 14, 15, 19, 25, 32, 33, 37
	Effectiveness and efficiency	8	4, 7,11 20, 22, 33, 38, 44
	Built in positive reinforcement	8	2, 5, 6, 20, 23, 33, 37, 40
<b>Individual</b>	Attitudes and motivation	14	2, 4, 6, 7, 9, 11, 12, 18, 22, 28, 29, 31, 33, 39
	Trust and confidence	8	2, 3, 7, 22, 23, 25, 29, 36
	Knowledge and skills	2	7, 22
<b>Context</b>	Formal external support	14	7, 8, 11, 12, 13, 16, 23, 24, 25, 28, 29, 30, 31, 35
	Informal external support	11	3, 7, 11, 15, 21, 23, 25, 28, 30, 35, 42

## 2.4.1 School organizational characteristics

### 2.4.1.1 Collaboration

A total of 8 publications stressed the importance of some form of collaboration. Although we acknowledge the different forms and operationalizations of collaboration that exist in literature (e.g., Little, 2010), for this review we used the following definition: Collaboration means working together on the same shared problem and goals (Lawson, 2004). This takes place through talk, action, and reflection among individuals a community of learners emerges. Collaboration can create a space that enables us to challenge taken-for-granted ways of working together and to bring about transformation in educational practice (Goulet et al., 2003). A quasi-experimental study found that an innovation is less likely to be sustainable when the people involved work in

isolation; educators in schools (teachers, support staff and school leaders) need to collaborate to sustain innovations. When teachers struggle collectively with complicated challenges concerning the implementation and sustainability of innovations, they feel empowered and more significant (Gilad-Hai and Somech, 2016). Also, the case report study of Zehetmeier (2015) found that it is important that teachers engage in joint reflection and communication.

Multiple studies found that collaboration for sustainability is not restricted to the same team, grade or school (e.g., Bean et al., 2015; Pinkelman et al., 2015; Drits-Esser et al., 2017). References to the importance of collaboration within networks (between schools, districts, and communities) to support collaborative practice and to share the costs of, for example, expert support are often made (e.g., Benz et al., 2004; Edwards Groves and Rönnerman, 2013).

#### 2.4.1.2 Knowledge sharing within and outside the organization

Knowledge sharing influenced the sustainability of innovations according to 16 articles and can be defined as an activity through which knowledge (information, skills, materials, or expertise) is exchanged among people, communities, or organizations (e.g., Bukowitz and Williams, 1999). Knowledge sharing can also be seen as a form of collaboration (e.g., Little, 1990).

Within the school organization, multiple studies found that staff should present their findings and the results of working with the innovation to each other (e.g., Stringfield et al., 2008; Lewin et al., 2009). The quasi-experimental study of Gaikhorst et al. (2017) found that staff should be given opportunities to do so in order to sustain an innovation. Dekker and Feijs (2005) reported in their case report study on the importance of considering how ideas “travelled” and that there should be plans to disseminate ideas from the innovation. Collegial relations and communication among staff have been found important preconditions for this (Kirtman, 2002; Elder and Prochnow, 2016). Personal contacts with colleagues in meetings and informal contacts have been found to enhance sustainability (Dekker and Feijs, 2005). Case report studies of Saito et al. (2012) and Andreou et al. (2015) found that building capacity within the school by sharing knowledge with new teachers enhanced sustainability.

For optimal knowledge sharing, it is essential that this is done effectively. In the cross-sectional study by Peters (2011), for example, participants valued knowledge sharing in the form of written materials about the program, and phone-calls and emails from the coordinators; accessibility of information was most important. Multiple studies found that an example of important information that should be shared within the school is the program’s effectiveness: what is working and what needs adapting (Benz et al., 2004; Zehetmeier, 2015; Elder and Prochnow, 2016).

*Outside the organization*, networking has an important function. Exchanging ideas and information with other schools, sharing data, hearing how other school teams implement an innovation, and sharing concrete examples of practices were found to increase sustainability (Lewin et al., 2009; Andreou et al., 2015). Benz et al. (2004) found in their case report study that program effectiveness should be communicated within the network and explicit strategies for communicating these good results to school staff and administrators, parents, and community partners. Additionally, case report studies showed that integrated practices such as network monitoring, evaluation, planning, and a dissemination scheme with representation from all sectors and stakeholders are influential (Sanders, 2009; Roffe, 2010).

#### 2.4.1.3 School culture

Overall, a supportive and open school culture was found important for the sustainability of innovations in eight publications and can be defined as the historically transmitted patterns of meaning that include the norms, values, beliefs, ceremonies, rituals, traditions, and myths understood, maybe in varying degrees, by members of the school community (Stolp and Smith, 1994). Several authors found that in order for an innovation to become sustainable, all members of the community should share a common understanding of the core components of the innovation (e.g., Coffey and Horner, 2012; Zehetmeier, 2015), which means, that there should be alignment between the program goals and the school's policy (Gaikhorst et al., 2017). The absence of a supportive school culture has been found to hinder sustainability. According to the findings of the case report study of Bambara et al. (2012) this implies a general lack of knowledge or awareness of activities, and long-held conflicting beliefs, values, and practices of school personnel. Payneandy and Auckloo (2012) found in their case report study that a school culture where decisions are based on educators' intuitions and a culture of sticking to the textbooks hinders sustainability.

#### 2.4.1.4 Support and feedback from colleagues

Support and feedback from colleagues (sometimes also seen as a form of collaboration and/or knowledge sharing, e.g., Little, 1990) influenced sustainability according to six publications. Gaikhorst et al. (2017) reported that support (such as sharing ideas and resources) and feedback from colleagues during the initial program stimulated sustainability of effects over the longer term. Through their involvement, colleagues and principals became aware of the themes that were discussed, and obtained insight into the kinds of expertise that the participants had developed. Based upon this knowledge, participants received opportunities to further develop their expertise after the program ended, as they were considered as experts on the subject by the principals and their colleagues (Gaikhorst et al., 2017). Sandholtz and Ringstaff (2016) reported that cross case patterns showed that teachers with ongoing collegial support, sharing ideas

and resources were better able to sustain the instructional practices learned in professional development compared to those who did not received this. Collegiality has been found important here (Edwards Groves and Rönnerman, 2013).

### **2.4.1.5 Staff turnover**

Low teacher and principal turnover is beneficial to sustainability, according to eight articles (e.g., Alanís and Rodríguez, 2008; Sandholtz and Ringstaff, 2016). Staff turnover can diminish staff knowledge and skills in daily practice, and can reduce staff commitment and consistency according to case report studies of Kirtman(2002)and Andreou et al.(2015). Moreover, they found that staff members who had been with the program a long time had a clearer understanding of their roles and responsibilities, the unique ways in which the innovation contributed to the school's overall services to students, and the importance of disseminating this knowledge to the larger school community. These members were also more effective in developing and maintaining purposeful relationships with other professionals in the school and community in order to support students and other staff (Andreou et al., 2015). Sandholtz and Ringstaff (2016) found that in schools that had significant turnover in principals, teachers found it challenging to adjust to changing instructional expectations.

Turnovers affected the stability of school policies, and consequently the sustainability of educational innovation (Saito et al., 2012).

### **2.4.1.6 Leadership**

Numerous aspects of leadership were found to be important for sustainability. Multiple studies showed that principals are agents who can either help or hinder sustainability (e.g., Saito et al., 2012; Drits-Esser et al., 2017) or found that management and leadership are the most important and influential aspects for sustaining programs (Ng and Nicholas, 2013). Leadership can be provided by one or multiple persons. These are hereafter referred to as "leaders."

#### **2.4.1.6.1 Distributed leadership**

Distributed leadership is a form of collective agency incorporating the activities of many individuals in a school who work at mobilizing and guiding other teachers in the process of instructional change (Spillane et al., 2004). Distributed leadership is about leadership both as a practice and as interactions, and is not restricted to those with formal leadership positions, but influence and agency are shared (Spillane and Diamond, 2007; Harris and DeFlaminis, 2016; Woods and Roberts, 2016). This includes everyone who contributes to leadership practices through influencing the motivation, knowledge, or practices of colleagues (Spillane, 2006; Harris and Spillane, 2008). Twelve articles pointed to the importance of distributed leadership with as argument that decisions should not be top-down, but should be made through a democratic

process. It is therefore important to give teachers (but also parents and students, for example) ownership of and responsibility for the process (e.g., Kirtman, 2002; Jesson and Limbrick, 2014), and to collaborate closely with teachers (Payneandy and Auckloo, 2012). They should be engaged in the decision-making process by means of shared leadership (e.g., Alanis and Rodríguez, 2008; Furman Shaharabani and Tal, 2017) and should be given local autonomy (Peters, 2011; Postholm, 2011). Teachers should therefore be educated to become teacher leaders (e.g., Elias, 2010), which is necessary for a sustainable educational future (Edwards Groves and Rönnerman, 2013). This means that organizational capacity for change has to be created by the leader to enable teacher leadership (King, 2016).

#### 2.4.1.6.2 Vision, norms, and goals

Initiating and identifying a vision, norms and goals can be defined as a leader's role in contributing to building a shared vision, norms, and goals. This also includes setting priorities in the school (Moolenaar et al., 2012), and a more specific shared vision, norms, and goals for the innovation at hand. A leader's vision is another influential factor for sustainable innovations according to five articles which refers to the road to a mission, toward the goals of the organization (Fullan, 2006; Burk, 2013). The leader's demonstration of a strong philosophical stance (Bambara et al., 2012), and a continued and consistent focus has been found to influence sustainability (e.g., Bean et al., 2015). The case report study of Bambara et al. (2012) showed that this vision should be promoted, and should aim to reach sustainability. Martin et al. (2006) reported from their cross sectional study that this means that a vision needs to be formulated even before the implementation of the innovation, not only with regard to how to implement the innovation, but also with regard to how to sustain it. It is crucial that this vision is aligned with the staff's vision. A bottom-up approach to accomplishing this alignment was found to relate positively to sustainability of an innovation in a case report study (King, 2016). Moreover, the leader should be explicit to the staff about the priority of the innovation to the organization, which was found in six, mostly case report, publications (Larsen and Samdal, 2008; Bambara et al., 2012; Saito et al., 2012; Sanders, 2012; Andreou et al., 2015; Bean et al., 2015). Leadership buy-in has been found to be crucial (Bambara et al., 2012; Saito et al., 2012; Bean et al., 2015). For example, Andreou et al. (2015) described how an innovation within a district should be written into the district action plan and goals, with these goals set as a strong district priority; this ensures that the innovation is viewed as important by the schools. Larsen and Samdal (2008) found that making the program a formalized strategy, an integral part of the school's activities and the school's policy, and making it mandatory for all teachers enhanced its sustainability. Lastly, Sanders (2012) described how the use of leadership strategies in prioritizing and mediating between individual and organizational factors, such as teacher alignment and commitment, formalization within policy, allocation of sufficient resources and maintenance of focus, are important for sustainability of innovations.

### 2.4.1.6.3 Providing individualized support

Providing individualized support can be defined as leaders who try to understand, recognize, and satisfy teachers' concerns and needs (e.g., by facilitating staff), whereas at the same time treating each teacher as an unique individual (Thoonen et al., 2011). This also involves actions, such as mentoring and coaching of teachers, delegating challenging tasks to teachers, providing feedback, and recognizing and talking to teachers about their needs and concerns (Thoonen et al., 2011). Leaders need to provide this type of support to teachers in order to sustain innovations, according to 17 of the articles with varying research designs. Studies found that leaders must be involved in the innovation in order to transfer expertise to the workplace (Payneandy and Auckloo, 2012; Gaikhorst et al., 2017) and provide coaching and feedback to their staff (Larsen and Samdal, 2008; King, 2016) in order to enhance sustainability. It was found beneficial to sustainability if leaders showed appreciation for good practices, encouraged teachers to continue, and supported new ideas (e.g., Zehetmeier, 2015; Kafyulilo et al., 2016). Support enhances the interplay with teachers, and their motivation and enthusiasm. When leaders help to build capacity for change, and empower teachers to create collaborative learning cultures this increases sustainability (King, 2016). Studies showed that support from the leaders creates trust among the staff (Youngs and King, 2002), or can reduce the stress that is involved with educational innovations (Kirtman, 2002). This type of support also includes *facilitation*. Nineteen articles found that facilitation by the leader as far as providing time, money, and organizing resources enhanced sustainability, as it enabled the staff to carry out their work. In order to foster sustainability, funding needs to be appropriate and planned, and capacity has to be developed for the organization to assume some costs of the innovation without relying on external funding (e.g., Elias, 2010; Elder and Prochnow, 2016). Multiple studies also showed that facilitation needs to take the form of providing the relevant connections within appropriate networks (Lewin et al., 2009; Zehetmeier, 2015) and a safe working environment (Kafyulilo et al., 2016) in order to foster sustainability. Peters (2011) found that when issues around workload, space, planning and resource are not optimal, sustainability can be hindered.

Multiple studies found that access to external expertise or contact with a recognized researcher, consultant, or trained coach with outside information and tools, after the initial implementation phase, enhances sustainability of innovations (e.g., Mathews et al., 2014; Kafyulilo et al., 2016).

### 2.4.1.6.4 Knowledgeable and modeling leaders

Four case report studies found that it is important that leaders are knowledgeable about the innovation; they need to be well-informed about the program including procedural and conceptual knowledge of the new practice to enable sustainability (King, 2016) and, in addition, the knowledge to educate administrators about the innovation and the required transition

(Benz et al., 2004). However, just being knowledgeable is not enough. Multiple studies with varying research designs reported that leaders also need to show that they are knowledgeable by engaging in modeling behavior and be actively involved in (district and school) training with regard to the innovation in order to change their own views if necessary, or strengthen their convictions in support of the innovation, for them to be able to propagate it (e.g., Bambara et al., 2012). They should share information about good practice (Lewin et al., 2009). By following up on the process of sustainability, the leader can model the value of the innovation's success to the organization (Larsen and Samdal, 2008). The leader must convey a positive "can do" attitude through both words and actions (Bambara et al., 2012), and has to be flexible, innovative and practical (Lewin et al., 2009). This modeling behavior enhances the respect a leader receives within the school, which adds to the sustainability of an innovation (e.g., Coffey and Horner, 2012; Sanders, 2012).

#### 2.4.1.6.5 Communication

Effective communication between the leader and other key players within and outside the organization was found to be important in seven because it enhances engagement with the wider community (Benz et al., 2004; Ng and Nicholas, 2013). The leader should communicate his/her vision (Larsen and Samdal, 2008), and talk about the new practices (King, 2016). It is important to use local jargon when communicating with the different stakeholders (Payneandy and Auckloo, 2012), for example, in interactions with parents (Ng and Nicholas, 2013). Unclear expectations were found to hinder sustainability (Peters, 2011), as did tensions between directives from above and wishes from below (Postholm, 2011).

## 2.4.2 Innovation characteristics

### 2.4.2.1 Effectiveness and efficiency

Characteristics of the innovation were found to have an impact on sustainability in eight, mostly cross-sectional, publications. Issues concerning the effectiveness, the support by evidence from research, and the efficiency of the innovation are crucial for sustainable implementation. Effectiveness refers to the realization of goals following an innovation, and efficiency refers to effectiveness in relation to the costs it has taken (e.g., in terms of time, work, etc.). In particular, these should be related to the expected benefits for the pupils and their enhanced achievement.

### 2.4.2.2 Structure

Twelve studies with varying research designs found that the extent to which an innovation is structured influences its sustainability in a positive way. Moreover, focused and long-term innovations are more likely to be sustainable (e.g., Gilad-Hai and Somech, 2016). These innovations should be used routinely as an integral part of the school organization (e.g., Ferguson et al., 2011).

The continuity and consistency of the approach are therefore important (e.g., Pinkelman et al., 2015; Elder and Prochnow, 2016). Maintaining the core elements of an innovation while adapting the innovation to daily practice makes the innovation more efficient and effective (Andreou et al., 2015). It helps if an innovation fits in with other initiatives undertaken by the school board or government (Bean et al., 2015), with the curriculum (Peters, 2011), with the praxis orientation of the teachers (Edwards Groves and Rönnerman, 2013), and with the needs of the district (Sanders, 2012), and is integrated with other initiatives.

#### 2.4.2.3 Built in positive reinforcement

Positive reinforcement was found to impact an innovation's sustainability in eight studies (case reports and cross sectional studies). This could, for example, be achieved by means of data use: by having observable and measurable information to track patterns of implementation and student outcomes, and the status and goals of their schools (e.g., Sanders, 2009; Pinkelman et al., 2015). Multiple authors found that examples of good practices following the innovation provided by the school enhanced sustainability (e.g., Benz et al., 2004; Andreou et al., 2015). Kirtman (2002) emphasized that support has to be provided through an assessment/evaluation feedback loop that allows for growth, not punishment. This implies that positive reinforcement should be built into the innovation to optimize sustainability.

### 2.4.3 Characteristics of the individual

#### 2.4.3.1. Attitudes

Multiple articles (14 in total with varying research designs) reported on the importance of individual stakeholder characteristics such as attitude for sustainable innovations. According to Ajzen (1991) attitude can be defined as one's personal orientation or beliefs related to performing the desired action. Most often mentioned was teacher buy-in and a high level of involvement (e.g., Drits-Esser et al., 2017). Staff having a high level of interest (Gibson and Chase, 2002; King, 2016) and feeling positive toward the innovation and its outcomes is fostering sustainability (e.g., Mouza, 2009; Ng and Nicholas, 2013). On the other hand, resistance to change was found to hinder sustainability (Deaney and Hennessy, 2007). Also, conflicts in personal beliefs (Andreou et al., 2015) and negative feelings toward the innovation (for example the perception that activities created an extra burden for the staff) (Kirtman, 2002; Bambara et al., 2012) hindered sustained implementation of innovations.

#### 2.4.3.2 Trust

Trust or confidence among staff members was mentioned in eight publications with varying research designs. Trust can be defined as the investment in both one's own and other's reliability, predictability and good intentions (Hargreaves, 2007, p. 187) and has to be present in multiple areas. For example, in their study on ICT practices Deaney and Hennessy (2007) described two



internal factors, namely, teachers' technical confidence and their confidence in the innovation. Colleagues' trust levels were mentioned in this perspective as well, with regard to scaling up as an aspect of sustainability. Saito et al. (2012) noted that teachers should have confidence in the effectiveness of the program.

#### 2.4.3.3 Knowledge and skills

Two studies reported on the influence of knowledge and skills. King (2016) reported on the influence of deep learning on sustainability: the innovation is sustainable if teachers apply procedural and conceptual knowledge to the new practices. These new practices should also meet the needs of their students and should be in alignment with existing practices. In addition, teachers should have obtained the appropriate skills and experience to be able to sustain the innovation (Deaney and Hennessy, 2007).

### 2.4.4 Context characteristics

#### 2.4.4.1 Formal external support

Fourteen studies found *formal support*, including acknowledgment, from outside the organization to influence sustainability. School staff need ongoing training, professional development (Kirtman, 2002; Elias, 2010) and access to higher level support when an innovation does not work for students (Elder and Prochnow, 2016). Over-reliance on local creativity can take a long-term emotional toll on the most committed members (Elias, 2010). The role of training is even bigger in relation to dissemination of practices (Deaney and Hennessy, 2007). Training for staff should be readily available, preferably for longer periods (Ertesvåg and Vaaland, 2007), and the level of support should be adjusted to the different levels of needs, as followers need more support than leaders (Furman Shaharabani and Tal, 2017). Staff also need access to resources, including technical and administrative support (Mouza, 2009). External support in the form of funding also plays an important role in sustainability. When innovations are provided with start-up funds, the stronger innovations tend to survive when this funding is inevitably withdrawn (Owston, 2007). Finally, a strong lead from national policy (Lewin et al., 2009) or plans from schools and school districts (Owston, 2007) influenced sustainability (Payneandy and Auckloo, 2012). A lack of interest from the state department of education hindered sustainability (Ng and Nicholas, 2013).

#### 2.4.4.2 Informal external support

Informal external support resulted in higher levels of sustainability, according to 11 studies. Family and student involvement and motivation were found to be important (e.g., Roffe, 2010; Kafyulilo et al., 2016), as was collegial and peer support (Mouza, 2009). The existence of a network of people to support, plan and conduct family and community involvement activities supports student learning and development (Van Voorhis and Sheldon, 2004).

## 2.5 Conclusions and discussion

### 2.5.1 Core characteristics of sustainability in relation to educational innovations

The literature revealed a large variety of definitions, critical features and working processes for the concept of an educational innovation's sustainability. An innovation refers to 'The intentional introduction and application within a role (work)group, or organization of ideas, processes, products or procedures new to the relevant unit of adoption [in this paper education], designed to significantly benefit the individual, the group, the organization or wider society' (West and Farr, 1990, p. 9). Much of this literature have a theoretical focus and influential factors vary between different articles. The aim of this review is to provide an overview of the entire range of factors influencing the sustainability of educational innovations and to enable the development of an overall definition of sustainability based on empirical papers. We performed a systematic literature search of only empirical studies to identify the core elements of sustainability and the factors influencing it, to enable the development of a general model of sustainability.

Our search resulted in more than 7,000 papers, of which only 44 publications were left for analysis after applying our inclusion and exclusion criteria to the papers found.

Based on this review, we were able to formulate a definition of sustainability: *'Sustainability refers to the process of continuing and integrating the innovation's core aspects in organizational routines that are adaptive to ongoing work'*

This definition shows that sustainability entails much more than just "continuation" of (the) innovation, not only in the sense that it should become part of organizational routines, but also that adaptivity is important to promote integration into existing practices. Literature shows a shift from fidelity toward a more dynamic interpretation of sustainability focused on adaptivity and continuous adjustment based on the needs of the organization (e.g., see also Fagen and Flay, 2009; Elias, 2010) in order to increase sustainability.

Dissemination of the innovation among members of the organization was often mentioned next to the core aspects of sustainability described above. However, dissemination should not be seen as part of sustainability, but could be considered as being the next phase in the process. Fullan (1992) already described phases of a change process, in which sustainability was regarded as the final phase. Studies in the current review elaborate on the sustainability phase. Owston (2007), for example, distinguished sustainability from transferability in his article on the sustainability of innovative pedagogical practices using technology. He operationally defined sustainability as "the innovation having carried on for a period of more than 2 years without extra fiscal resources; transferability as the innovation having been adopted in its essential form by another grade in that school, schools, or school district" (p. 67). Deaney and Hennessy (2007) and Zehetmeier,

2015 described dissemination together with sustainability and made a clear distinction between both concepts. Dissemination should not be confused with knowledge sharing however, which is the process that influences the phases of implementation, sustainability and transferability of the innovation. Dekker and Feijs (2005) distinguish knowledge dissemination and upscaling whereby dissemination is the transfer to other areas and scaling up as the transfer to a larger group of people. It should be noted however, that the change process cannot be regarded as a linear process. Transferability or dissemination of results was regarded in this article as being the next phase of sustainability.

### 2.5.2 Factors influencing the sustainability of educational innovations

Both hindering and fostering factors influencing sustainability could be categorized into four main categories, in which multiple subcategories could be distinguished. Table 3 summarizes the factors we found in this review to influence the sustainability of innovations.

Much often cited literature refers in general to four main factors that are assumed to influence sustainability of educational innovations. School leadership is crucial for sustainability of educational innovations (e.g., Fullan, 2005; Robinson et al., 2008). Also, collaboration (e.g., Geijssel et al., 2009; Levin and Datnow, 2012), trust (e.g., Sherer and Spillane, 2011; Hargreaves and Fink, 2012) and knowledge sharing (e.g., Gerzon, 2015) and brokerage (e.g., Akkerman and Bruining, 2016) have often been argued to influence sustainability. These factors are mainly situated in the school organizational and the individual domain. However, it also has to be noted here that some of the factors found may slightly overlap and/or are related. For example, Little (1990) conceptualizes collaboration in such way that some of the other factors (e.g., knowledge sharing and brokerage) could also be seen as forms of collaboration.

This review confirms the importance of the factors mentioned above, but also points out additional factors in the context, school organizational and individual domains, as well as an additional category of factors to be considered (i.e., innovation). For example, much evidence has been found in this review for the influence of the organizational members' attitude toward the innovation, but also the structure and perceptions of effectiveness and efficiency of the innovation itself. This review stresses the importance of considering a broader context, instead of focusing on a limited selection of influencing factors. We want to stress here that the general model of the core elements of sustainability and its influencing factors presented in this paper cannot be generalized but should be empirically tested to be able to generalize the findings to other contexts.

## 2.6 Implications for practice

Considering *school organizational characteristics*, the most evidence was found for the importance of leadership. This is in line with previous research and theoretical articles concerning sustainability in education, in which the role of leadership is emphasized (e.g., Fullan, 2007; Hargreaves and Fink, 2012). However, in this review we were able to identify multiple specific aspects of leadership that have been found to be important.

To influence the sustainability of an innovation, school leaders also need to be knowledgeable about (the core aspect of) the innovation and engage in modeling and networking behavior. In addition, they need to prioritize the innovation, distribute leadership, communicate a clear vision with regard to the innovation and its place in the school, and facilitate teachers' participation in the innovation, for example, by providing time to participate. Sustaining an educational innovation and its results within schools is often misconceived as something that needs to be done at the end of working with an innovation (Hubers et al., 2019). School leaders should focus on sustainability even before the innovation starts, which implies, for example, that they need to think about building a shared vision even before the innovation is implemented. Or, bring more attention to implementation models in schools. The application of implementation science in education is slowly emerging (Albers and Pattuwege, 2017), but here is a gain toward sustainable educational innovation. Moreover, developers should already take into account the aspects found in this review in order to develop sustainable innovations. It should be noted that leaders can be found in multiple organizational layers. "Leaders" could refer to principals, but project leaders, coordinators, or even teacher leaders were described as taking this role in the literature.

*Collaboration and knowledge sharing* were also identified as influencing sustainability. The focus on collaboration and on knowledge sharing and brokerage within a network was notable. Collaboration in networks implies multiple advantages and actors have access to multiple and diverse types of knowledge and resources (Hubers et al., 2017; 2019). This network-related functioning was not often utilized in the included literature, and may have inhibited sustainability and knowledge dissemination in a broader context.

*Innovation characteristics* were found to contribute to the sustainability of the innovation. The literature especially pointed to the importance of structured innovations. Hoogland et al. (2016); Hubers et al. (2019) stated in this light that structures and protocols are very important, because they provide a scaffold for teachers to develop their knowledge and skills. Without structure, it is easy for teachers to miss important aspects of the innovation.

Implications considering *characteristics of the individual* aim to underline the importance of the individuals who carry out the innovations. Attitude, trust, and knowledge and skills are crucial precursors for teachers' active participation in an innovation. For practice, it is important that the members of the organization have a positive attitude toward the innovation and have trust and confidence in colleagues, their leader and their role in the innovation. In order to accomplish this it is important that teachers, for example, are given responsibility and influence at an early stage. Distribution of leadership by the school leader is a crucial aspect in keeping teachers involved with the innovation.

With regard to *context characteristics*, external (from the team) support from inside, as well as outside the organization were found to be important. It should be noted, however, that this could be very context-dependent and the form of support depends on its relevance for the innovation.

### 2.5.1 Best evidence synthesis

In order to come to factors with the "biggest influence" on sustainable school improvement, we made a best evidence synthesis to produce and defend conclusions based on the best available evidence, or to conclude that the evidence currently available does not allow for any conclusions (Slavin, 1995). These syntheses are normally used for reviews based on quantitative datasets. A systematic and transparent framework for assessing confidence in findings of systematic reviews of qualitative research was used (Lewin et al., 2018). This framework considers four components: (1) methodological limitations, (2) coherence, (3) adequacy of data, and (4) relevance. As an example we took only the articles that were affiliated with secondary education. As a result, 21 articles met the criteria of methodology, adequacy and relevance. One article was dropped due to a too low score on methodology. Sustainability is influenced by three out of the four main characteristics as elaborated in this review. Leadership is part of the school organizational characteristics, but often came up in the articles and therefore can be taken separately. Factors mentioned most for leadership were knowledgeable leader, support (internal), facilitation and vision.

School organizational factors were collaboration and professional development (support external). Teacher buy-in was a factor most mentioned as an individual characteristic and finally the effectiveness of the intervention was included within the intervention characteristics. Factors within the context were not mentioned.

Table 4 gives an overview of the factors after the best evidence synthesis for the secondary education context.

**Table 4** Influencing factors after best evidence synthesis.

Characteristic	Influencing factor
School organization	Collaboration Professional development, external support
Leadership	Providing individualized support Knowledgeable Vision Facilitation
Individual	Teacher buy-in
Intervention	Effectiveness

### 2.5.2 Limitations of the study and recommendations for further research

Although this review provides a useful overview of the concept of sustainability of educational innovations and the factors influencing sustainability, we must consider the limitations of this study. First, we were not able to find a lot of empirical studies on the sustainability of innovations. This may have to do with the fact that funding resources often stop after the innovation period, as does the funding for related research. Second, this review covered a variety of different innovations of varied duration, which made it harder to compare and contrast the different innovations and their sustainability. Third, the majority of the studies included were qualitative case report studies. There seems to be a lack of more generalizable large-scale quantitative experimental studies in this field. We found no randomized controlled trials in our studies, and the amount of quasi-experimental studies was limited. Moreover, although this review identified various influential factors, we do not claim that this list of factors is exhaustive. It is possible that there are other factors that influence sustainability that have not yet been studied empirically. In addition to factors found in the review, educational policy by country or continent will be influential as the principles and policy decisions influence the field of education, as well as the collection of laws and rules that govern the operation of educational systems.

There is no hierarchy to be found in the literature, which we would have expected. Different articles on different innovations, come up with different factors of influence. More research is needed on discriminating factors, or how the different factors influence or interact within different forms of education. Further research, for example on empirically testing the model developed in this paper, is also urgently needed. Fourth, although we conducted an extensive literature search, it is possible that we missed some relevant literature. For example, this review has not included unpublished research which may have affected the outcomes. Also, when reviewing the factors and core elements of sustainability we made no distinction between smaller and larger educational innovations. This might have implications for the impact and the kind of influential factors of sustainability.

Furthermore, to ensure that our review only included high quality publications, we focused only on peer-reviewed articles. Therefore we may have missed important information from, for example, books and chapters. Moreover, we ensured the quality of this review by employing detailed, rigorous and explicit methods, focused on two specific research questions (Sackett et al., 2000). Furthermore, we developed and used clear inclusion criteria (Sackett et al., 2000) to overcome possible author biases in selecting literature. We described the methodology used in a detailed manner (Green et al., 2006), and used a scoring system to determine the quality of each publication (Sackett et al., 2000). Because of this rigorous process (Green et al., 2006), we believe that this review can be considered to make a valuable contribution to our knowledge about the sustainability of educational innovations, on which follow-up research into the sustainability of specific innovations can be based.





**CHAPTER 3**  
DISTINGUISHING ASPECTS  
OF SUSTAINABILITY

### This chapter is based on

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#### Abstract

Many innovations that are implemented in schools are initially successful, but fail to become part of the schools' habits and routines. Relatively little research has followed innovations in schools for a long(er) time. In addition, few reforms last long enough to be studied longitudinally. In this exploratory study, the authors aim to find a way to quantitatively measure the degree of sustainability of a data-use intervention three to eight years after its initial implementation. Sustainability in this study was defined as 'the process of integrating and scaling the innovation's core aspects in organizational routines that are adaptive to ongoing work, with continuing improvement of results'. A distinction was made between sustainability of the method and sustainability of the underlying goal of the data-use intervention. A cluster analysis showed that schools can be categorized into four degrees of sustainability. A general view of the data indicated that the core components were present to varying degrees. Radar charts have been made and provided more insight. The process from organizational routines, and transfer of the intervention from the individual to the institutional level realizing organizational routines differs from school to school. The answer to the question as to whether an intervention has been sustained is not a simple yes or no. Sustainability is nuanced and can come in different forms. Measuring sustainability in a quantitative way contributes new perspectives and insights. With those insights further research can be done.

### 3.1 Introduction

Many innovations that are implemented in schools are initially successful, but fail to become part of the schools' habits and routines (Wiltsey-Stirnam et al., 2012). The toughest part of any educational innovation is not beginning it, but sustaining it in the organization (Hargreaves & Fink, 2012). The implementation of educational innovations takes a long time; however, relatively little research has followed innovations in schools for a long(er) time (Waslander, 2007). In addition, few reforms last long enough to be studied longitudinally (Datnow, 2005). Studies of educational sustainability have focused on continuity of school effectiveness based on statistical models (Creemers & Kyriakides, 2010), qualitative analysis of processes and innovation in schools (Giles & Hargreaves, 2006) and evaluations of programs and policies that seek to ensure the sustainability of results after completion of interventions (Datnow, 2005). Criteria for how schools can maintain these processes of change and improvement in student achievement over time are missing (Bellei et al., 2019) although there is a link with a strong and positive school culture (Lee & Louis, 2019). In-depth analyses of long-term innovation processes and of verified theories that explain and predict the long-term success or failure of an innovation are lacking (Cohen & Mehta, 2017; Mijs, 2007).

Data-based decision making is an example of educational innovation. Internationally, policymakers, researchers and practitioners increasingly recognize the significance of data use for school improvement (Datnow et al., 2013; Mandinach et al., 2015; Schildkamp & Kuiper, 2010; Visscher & Ehren, 2011). Data-based decision making involves collecting and using data to improve the quality of various educational processes and student learning and achievement (Van Geel et al., 2017). Studies have shown that the use of data can lead to improved student learning and achievement (Lai & McNaughton, 2016; Poortman & Schildkamp, 2016; Van Geel et al., 2016). Despite the benefits of data use, it appears that many teachers do not use data that often, or use them incorrectly (Schildkamp & Lai, 2013). One reason is that teachers have difficulties with analyzing and interpreting data (Jimerson & Wayman, 2015; Kippers et al., 2018). Several data use professional development interventions have been developed to support teachers and school leaders in using data for school improvement, which target (a combination of) student learning, teacher learning, and organizational change (Coburn & Turner, 2012; Lai & McNaughton, 2016; Van Geel et al., 2016).

The data-use intervention that was studied for this research has been introduced in over 60 schools in the Netherlands (Schildkamp et al., 2014), ranging from primary schools to institutions of higher education, but mainly in secondary education. In this intervention, teams of teachers and school leaders participate in an intensive professional development program for 1-2 years,

to learn how to use data systematically. This data-use intervention has two main goals: (1) the professional development of teachers and school leaders with regard to data use, in terms of the development of the relevant knowledge, skills and attitudes, and in terms of applying these competences in practice, (2) to improve educational quality.

Research has shown that this intervention can help improve educational quality (Ebbeler et al., 2016; Poortman & Schildkamp, 2016), but that its sustainability is a challenge (Hubers et al., 2017). Researchers have stressed that we need to understand what organizational structures and processes are required for the sustainable implementation of innovations and how these are experienced by educators (Wood, 2017). The innovation must become part of the daily organizational school routine to become sustainable. However, it appears that schools struggle to develop organizational routines for data use (Datnow & Park, 2015). The sustainability of the data-use intervention seems to differ across the schools where it has been implemented, and needs further investigation. The purpose of this study is therefore to find out how sustainable this data-use intervention is.

## **3.2 Theoretical framework**

### **3.2.1 The data-use intervention**

School staff make educational decisions every day. When they make high quality, data-based decisions instead of decisions based on their intuition and experience alone, that can improve the quality of teaching and learning in the classroom (Schildkamp & Lai, 2013; Schildkamp et al., 2016). Making informed decisions is promoted by implementing data-based decision making, defined as making educational decisions based on different types of data (Lai & Schildkamp, 2013). Data are defined as 'information that is systematically collected and organized to represent some aspect of schooling' (Lai & Schildkamp, 2013, p. 10). Examples of data are assessment results, student satisfaction questionnaire results or classroom observation results (Schildkamp & Lai, 2013).

The data-use intervention discussed in this study is one way to support teachers and school leaders in effective data use (Andreou et al., 2014). It is based on several criteria for effective teacher professional development that have been frequently mentioned in the literature, such as collaboration between colleagues (van Veen et al., 2010), active leadership (Marsh, 2012a, 2012b), support by an expert (Marsh, 2012a, 2012b), and time to learn (van Veen et al., 2010).

In this intervention, teachers and school leaders work in what are called 'data teams'. A data team is a small-scale research team of 4–6 teachers, supplemented with 1–2 members of the school management. Supported by a trained coach, they together learn to work on solving educational

problems at their own school, based on data. The data-use intervention uses a structured, practical, step-by-step approach whereby activities are undertaken at every step, as described in a manual (Schildkamp & Poortman, 2015).

This step-by-step plan consists of:

1. *Problem definition* exploration of the problem the data team wants to focus on; thus, a topic that the school considers important and where school staff wants to see improvement. At this step, data are already being collected to determine how big the problem is. One goal for improvement in the short and longer term is also formulated.
2. *Hypothesis formulation* assumption about the causes of the problem the school is working on. Hypotheses are formulated as concretely and measurably as possible, in order to be able to substantiate whether the assumed causes identified in the hypotheses are actually the causes of the problem.
3. *Data collection* determine what data are needed to be able to test the hypotheses and where these data can be found, and collect the data. This can involve both qualitative and quantitative data.
4. *Data quality check* check whether the data found are of sufficient quality to be able to draw conclusions, by using the quality criteria of reliability and validity.
5. *Data analysis* thoroughly and carefully inspecting data, displaying data clearly and transparently and then summarizing them.
6. *Interpretation and conclusions* the data are interpreted in relation to the description stated in the hypothesis, which is then accepted or rejected. In case of the rejection of the hypothesis, the data team goes back to step 2 to define a new hypothesis. If the hypothesis is accepted, the team can proceed to step 7.
7. *Implementation of improvement measures* the data team collects and chooses measures that meet criteria such as feasibility, proven effectiveness, speed of impact and costs. An action plan is drawn up, the method of evaluation is specified and the measures are communicated and implemented.
8. *Evaluation* the measures are evaluated, both for the process, by monitoring the measures taken, and for the effect(s). Whether the measure has led to the solution of the problem is checked.

Data teams are supervised by a coach for either one year or two years. Data teams coached for two years often focus on school-level problems, for example, grade repetition by students (when students do not obtain the appropriate diploma within the stipulated time). Most of the data teams that are coached for one year focus on a subject-specific problem, for example, disappointing exam results for a specific subject. After the one or two year guidance from the

coach, schools decide for themselves whether and how to proceed with data teams and the use of data for school improvement. Basic recommendations or guidelines regarding sustainability are provided to the schools in the data team manual, for example starting spin-off data teams or embedding the method in planned work.

In the Netherlands, the data-use intervention has been used in primary, secondary, and higher education since 2011 (after a 2-year pilot period). The data-use intervention has also been used in other countries, including Sweden (Schildkamp et al., 2019) and the USA (Jimerson et al., 2020). The data teams in this study were coached by an employee from the university where this method was developed.

### 3.2.2 Definition of sustainability

Research with a focus on sustainability of educational innovation has been conducted within various forms of education: primary education (Larsen & Samdal, 2008; Payneandy, 2012), secondary education (Furman Shaharabani & Tal, 2017; Kafyulilo et al., 2016), higher education (Elias, 2010; Roffe, 2010), and including several forms of education for children with special needs (Bambara et al., 2012; Benz et al., 2004). These studies focus on different units of analysis, ranging from the individual student level (Bambara et al., 2012), to program level (Ferguson et al., 2011; Furman Shaharabani & Tal, 2017), to the level of teachers (King, 2016) and their professional development (Edwards Groves & Rönnerman, 2013), school level (Andreou et al., 2014; Payneandy, 2012), school district level (Alanís & Rodríguez, 2008; Sanders, 2012) or school partnership level (Sanders, 2012; Van Voorhis & Sheldon, 2004). However, most articles dealing with sustainability do not provide an explicit definition of the concept of 'sustainability' (Gaikhorst et al., 2018; Prenger et al., 2022). A number of dimensions have been mentioned in different articles however: sustained implementation of the core components of the intervention (e.g., Andreou et al., 2015a, 2015b; Drits-Esser et al., 2017; Gaikhorst et al., 2017; Kafyulilo et al., 2016); *continuation* of the intervention on the long run, or results that are maintained or continue to improve (e.g., Bean et al., 2015; Elder & Prochnow, 2016; Ferguson et al., 2011; Stringfield et al., 2008); becoming integral part of daily school routines (e.g., Bambara et al., 2012; Bean et al., 2015; Elder & Prochnow, 2016; Tam, 2009); *scaling up* of results (e.g., Dekker & Feijs, 2005); and *adaptiveness* (Benz et al., 2004; Deaney & Hennessy, 2007a, 2007b; Elias, 2010). These elements will be discussed in order to define sustainability for this study.

The following definition of sustainability is used in this study:

Sustainability refers to the process of integrating and scaling the innovation's core aspects in organizational routines that are adaptive to ongoing work (Prenger et al., 2022)

The elements that form the definition will be discussed.

Fullan (1992) described sustainability as the final phase of a linear change process. In this final phase attention is paid to continuation of the innovation. Continuation is the first dimension of sustainability. In practice, however, change processes do not take place linearly in school organizations. Researchers have argued that sustainability is a developmental process that should start as soon as the initial stage of the change process (Fagen & Flay, 2009). The necessary conditions must already be in place during the adoption and implementation phases in order to guarantee sustainable innovation (Adams & Gaetane, 2011; Fagen & Flay, 2009; Pluye et al., 2005; Van den Boom-Muilenburg, 2021).

The second dimension of sustainability is enactment of an intervention must be visible in *the routines* within the organization (Bambara et al., 2012; Bean et al., 2015; Benz et al., 2004; Elias, 2010; Larsen & Samdal, 2008; Pluye et al., 2005). Implementation is only sustainable if people's new behavior is embedded in a daily routine (Waslander, 2007). Organizational routines are the main building blocks through which coordination, regularity and capabilities are generated in organizations (Dosi et al., 2000; Jacobs & Snijders, 2008) and 'recurrent and patterned interactions that guide engagement with data and people during ongoing work' (Coburn & Turner, 2012, p. 181), which influence each other and require the involvement of multiple actors (Jacobs & Snijders, 2008). The innovation has to become part of the daily school routine (Bambara et al., 2012; Bean et al., 2015; Benz et al., 2004; Elias, 2010; Larsen & Samdal, 2008; Pluye et al., 2005) in which new employees are also consciously included (Bambara et al., 2012).

Organizational routines can be considered as having *ostensive* and *performative* aspects (Feldman & Pentland, 2003a, 2003b) which both are important for sustainability. The ostensive aspect of an organizational routine is defined as the schematic, abstract idea of the routine (Feldman & Pentland, 2003a, 2003b), the 'ideal' version of it. This involves standard procedures and established standards (Hubers et al., 2017). The performative aspect is defined as the specific actions that are undertaken to perform the organizational routine in practice (Feldman & Pentland, 2003a, 2003b) and refers to the everyday use of specific actions, carried out by specific people, at specific moments (Hubers, 2016). Organizational routines structure work practice and stabilize it over time. Change happens in the interplay between individual agency and the structure of the routine (Sherer & Spillane, 2011). The relationship between ostensive and performative aspects of routines creates opportunities for variation, selection, and retention of new practices and patterns of action within routines and allows routines to generate a wide range of outcomes, from stability to considerable change (Feldman & Pentland, 2003a, 2003b).

New insights in organizational routines for sustainable educational innovation show a shifting focus from repetitive patterns of action, uniformity, and inertia, towards variations, adaptations, and change (Howard-Grenville et al., 2016).

Continuation of an intervention is an important dimension of sustainability, so are organizational routines. However, a critical eye for continuation of the intervention, which parts of the intervention will be retained or adapted, as well as on what scale the concept will be used remains important (Benz et al., 2004; Hargreaves & Goodson, 2006) to avoid meaningless procedures (Fullan, 2007).

A third dimension of sustainability is that working with the core components of the intervention happens during regular, ongoing work without interrupting existing practices (Coburn & Turner, 2012). The innovation is integrated with other initiatives in the organization (Hargreaves & Fink, 2000). Core components refer to components of the intervention itself or to the underlying, long term goal of the intervention. Core components of an intervention include the functions or principles and related activities necessary to achieve outcomes (Blase & Fixsen, 2013).

There is debate about the extent to which the concept guiding the original innovation must stay stable after implementation (often referred to as fidelity). In the literature, there is some tension between the flexibility and the stability of an intervention (Adams & Gaetane, 2011; Gaikhorst et al, 2018; Mitra, 2009). Sustainability is often automatically associated with the notion of stability. In traditional views, sustainable innovation is equated with the faithful implementation of the innovation (Mitra, 2009). The extent to which there is agreement between the original concept and the actual practice of the innovation is then seen as an indicator of sustainability. In this view, innovation must be introduced as faithfully as possible, with as few deviations as possible from the original plan in class and school practice (Mitra, 2009). So, the focus here is on 'continuing to do the same thing'. Recent research has criticized this traditional interpretation of sustainability (Adams & Gaetane, 2011), with a shift from stability to a more dynamic interpretation of the concept of sustainability (Fagen & Flay, 2009). Successful educational innovations are characterized in particular by the fourth dimension, *adaptiveness*: with a view to successful and sustainable innovation, continual adjustments must be made with regard to the content and design of the concept guiding the innovation (Elias, 2010; Marsh, 2016). Innovations that are adapted to the specific context and needs of the school appear to be more successful in the long term with the continuation of the innovative program (Benz et al., 2004). Sustainable innovation is therefore about the extent to which the concept guiding the innovation is being developed further, and presupposes that there is an alignment and continual adjustment between the concept and actual class or school practice. Combining the two perspectives,



sustainable innovation assumes a certain level of loyalty to the core components of the original innovation, but at the same time also incorporates the flexibility to adapt the concept guiding the innovation to (varying/changing) contexts (Gaikhorst et al., 2018). In short, the core components remain adhered to in practice (Sanders, 2012), but, where necessary, can be adapted to the environment. What is needed is a balance between fidelity of implementation of the innovation and contextual adaptation (Sanders, 2012).

Because long-time change in schools should not be restricted to only a few individuals, the use of an intervention (especially as manifested in its core components) should be noticeable within the school as a whole. Organizational routines also facilitate the fifth dimension of sustainability, *scaling up* of the results or the intervention. Scaling up has traditionally been viewed as increasing the number of teachers or classes using the intervention, or increasing the number of schools implementing the reform (Sanders, 2012), which should take place by means of planned activities (Dekker & Feijs, 2005). Scaling up also assumes substantive change in educational practice resulting from the reform achieved by knowledge dissemination (Dekker & Feijs, 2005; Edwards Groves & Rönnerman, 2013). Knowledge dissemination is the transfer of knowledge to other areas, while scaling up can be seen as the transfer to larger groups of people. In order to be able to speak of sustainable innovation, we must therefore strive to maintain and disseminate high-quality change in teachers' teaching practices and a profound change in their views and norms (Adair Breault, 2013; Coburn et al., 2012). To support innovation and capacity it is necessary to find out under what circumstances, and how an innovation has been successfully sustained and scaled to new contexts (Howard et al., 2021).

Summarizing, we could state that sustainability is formed by four specific elements. First, the core components of the approach should be (second) continually carried out. Third the approach should become an integral part of the daily school routines, meaning that the approach is not perceived as something added or new, but as part of the "fabric" of the school. Fourth, the approach can be adapted over time while adhering to the core components, so it can be fitted to the work in the school. So sustainability is achieved when the core components of the professional development approach become a self-evident and functional part of the school (or: organizational routine), which is flexible and adaptive to ongoing work.

### 3.2.3 Sustainability of the data-use intervention: Core components

The limited literature on sustainability in education mainly focuses on sustainable, often school-wide, implementation of (government-driven) way of working (Waslander, 2007; Prenger et al., 2022). There is relatively little longitudinal research, and the research available often follows pupils and rarely follows schools (Waslander, 2007). As the two main goals of the

data-use intervention are professional development by using the method and improving the school by the use of data, it is important to define the core components of the intervention to examine the sustainability of it in schools. The data-use intervention is an iterative and cyclical eight-step procedure, with a supporting manual to be used in regular meetings. The eight steps, manual and regular meetings can be considered to be the core components of the intervention's *method*. The data-use intervention is also an approach taken to achieve a larger goal in schools. Therefore, a distinction can be made between two dynamics of sustainability with regard to the intervention: the core components of the *method* and the core components of the underlying goal of the intervention. The core components of the method can also be defined as the specified components of the intervention.

The underlying goal of the data-use intervention is the use of data by teachers and school leaders to improve the quality of their schools in the longer run. The core components of the underlying goal can be characterized as the general components of the intervention. Therefore they have to transpose the systematic way of working in the small data team to working with data for school improvement. The ability to understand and use data effectively to inform decisions is termed 'data literacy' (Mandinach & Gummer, 2013). Data literacy concerns educators' ability to set a purpose, collect, analyze, and interpret data, and take instructional action (Mandinach & Gummer, 2013; Schildkamp & Poortman, 2015; van Geel et al., 2017).

During the data-use intervention's cyclical process, teachers and school leaders learn to use data systematically to improve the quality of education. Educators use these data literacy skills several times when following the eight steps of the data-use intervention (Kippers et al., 2018). Five core components of the underlying goal of the data-use intervention can be distinguished (Schildkamp & Poortman, 2015):

1. Setting clear, measurable goals;
2. Collecting data to determine whether the goals have been achieved;
3. And, if applicable, determining why goals have not been achieved;
4. Taking measures to achieve goals;
5. Evaluating the quality of education on the basis of data.

### 3.2.4 Sustainability of the data-use intervention: Routines, continuation, stability versus adaptiveness of core components, and scaling up

Performative organizational routines with regard to the sustainability of the data-use intervention refer to how people work with the data-use intervention or its underlying goal in school teams. This means that there is a form of continuation and scaling up of the (core components of the) intervention in practice. Ostensive organizational routines reflect the commitment expressed

in policy, so whether or not procedures are defined and (job) responsibilities or tasks are documented in a formal way.

Regarding sustainability of the method, continuation means that schools are still working with the data-use intervention. Regarding sustainability of the underlying goal, continuation means that schools are still systematically using data for school improvement, although no longer explicitly using the eight steps, manual or regular separate meetings to do so.

Regarding the sustainability of the core components of the method (eight steps, manual, meetings), stability refers to the extent to which these are used and adaptiveness refers to the extent to which the procedure has developed to fit into the specific school situation.

As far as the core components of the underlying goal (setting measurable goals; collecting data; analyzing and interpreting; taking measures; evaluating on the basis of data) are concerned, adaptiveness refers to the extent to which these components are used in the school organization.

For the sustainability of the overall method, scaling up refers to any increase in the number of users of the data-use intervention, for example, by starting new or spin-off data teams. For the sustainability of the underlying goal of the data-use intervention, scaling up refers to the extent to which employees in the school systematically use data to improve its educational quality. Scaling up can then be seen as a qualitative change, involving not only the number of employees who are using data, but also the systematic use of data for quality improvement. Figure 1 summarizes dimensions of sustainability of the data-use intervention.

		SUSTAINABILITY OF THE METHOD	SUSTAINABILITY OF THE UNDERLYING GOAL
PERFORMATIVE	<b>CONTINUATION</b>	Still working with the method	Systematically using data for school improvement
	<b>CORE COMPONENTS (stability towards flexibility)</b>	<ol style="list-style-type: none"> <li>1. The eight steps</li> <li>2. Use of the manual</li> <li>3. Regular meetings</li> </ol>	<ol style="list-style-type: none"> <li>1. Setting clear, measurable goals</li> <li>2. Collecting data to determine whether the goals have been achieved,</li> <li>3. And, if applicable, for what reason goals have not been achieved</li> <li>4. Take measures to achieve goals</li> <li>5. Evaluate education on the basis of data</li> </ol>
	<b>SCALING UP</b>	Quantitative increase	Qualitative change
OSTENSIVE		Job description individual	Job description general – school plan

**Figure 1** dimensions of the sustainability of the data use intervention

In this study we aimed to answer the following research question: *How sustainable is the data-use intervention in secondary schools in the Netherlands?* In answering this research question, we distinguished between the sustainability of the method and the sustainability of the underlying goal of the data-use intervention.

### 3.3 Method

#### 3.3.1 Context

We conducted this study in the context of Dutch secondary education. Dutch schools have the freedom to choose the principles (e.g., pedagogy, religion) on which the education they provide is based (Ministry of Internal Affairs, 2007). There is no national curriculum and teachers are free to develop assessments based on the curriculum determined by the school. National standardized assessments are taken only at the end of secondary education. Important data sources available within Dutch secondary schools and for the data-use intervention include external data sources such as the results of those national standardized assessments and inspection data, as well as internal data sources such as curriculum-based assessments or student satisfaction questionnaires (Schildkamp & Kuiper, 2010).

#### 3.3.2 Respondents

A total of 40 secondary schools that had been exposed to the data-use intervention between 2012 and 2017 were approached to participate in this study. Their data teams had been funded by the Dutch Ministry of Education (17 schools), large school boards (19 schools), or by schools themselves (4 schools). Purposeful sampling was used for the identification and selection of respondents within these schools (Patton, 2002). This involves identifying and selecting individuals or groups of individuals that are especially knowledgeable about or experienced with a phenomenon of interest (Cresswell & Plano Clark, 2011; Palinkas et al., 2015). For this study, this means that the degree of sustainability of the data-use intervention was investigated by consulting a specific expert within the schools, to obtain a clear picture of the sustainability of the data-use intervention. The school leader involved with the data team was approached as the starting point for selecting the core respondents. In schools in which the school leader had left the school since the implementation of the intervention, the chairman or a different member of the original data team was approached. This could be an educational quality assurance employee (who has access to school data) or a teacher within the school. A core respondent could, for example, be a member of a spin-off data team or an employee with a focus on data use within the school. Table 1 gives an overview.

**Table 1** Overview of schools and respondents

# schools   respondents	School leader	Middle school leader	Teacher	Employee quality assurance
29	14	2	10	3
10			Not responding	
1			No data team members left	

In the Netherlands, staff turnover in secondary education is about 17% of all teachers per year (Central Statistical Office). This influenced the absence of former data team members in the schools that were invited to participate. A certain number of data team members and school leaders from the original data team had left the school, in all of the schools. Overall, almost 50% of the former data team members had left the school, for example, because of retirement, or switching jobs or schools. None of the former data team members still worked at one invited school. In addition, some schools did not respond to requests for cooperation or were not willing to participate for several reasons (10 schools). In most cases, schools were not willing to participate because the former school leader had left the school, or the school had already (recently) participated in other educational research. The number of schools within which research could be carried out was therefore reduced to 29. Respondents within these schools were: 14 secondary school leaders, 2 middle school leaders, 10 teachers, and 3 quality assurance employees.

### 3.3.3 Procedure and instrument

In this explorative study, we aimed to find a way to measure the sustainability of a data-use intervention three to eight years after its initial implementation. Therefore we conducted a survey study (Floyd & Fowler, 2014) and collected data by means of a structured telephone survey in which the interviewer followed a set of questions in a predetermined order, with a limited number of response categories; the responses were recorded according a coding scheme (Denzin et al., 2013). Purpose sampling led to the choice for a telephone survey. The survey was based on the theoretical framework and included all aspects of sustainability, for both the *method* and the *underlying goal* of the method. These aspects are mentioned in the definition given and as elaborated in Fig. 1, namely, the performative organizational routine involving (1) continuation (stability vs. adaptiveness), (2) core components and (3) scaling-up of the intervention, as well as the ostensive organizational routine. The 14 questions were posed in a concrete way, to obtain a picture of the current situation in practice and to prevent socially desirable answers. For example, to examine the ostensive routine, respondents were asked whether the way of working used in

the data-use intervention was included in policy documents as an element of an employee's job description, or in the school plan. For continuation respondents were asked whether the school still works with the data-use intervention (method/specified), and to what extent measurable goals are set to improve the quality of education (underlying goal/ general). Respondents were asked per core component of the underlying goals to what extent participation in the data-use intervention has influenced this.

All respondents received the same questions in the same order, with the same answer categories. These were quantitative measurements. The answers were scored on a 4-point scale; a 'don't know' option was added (see "Appendix" for the full set of questions).

To enhance construct validity (Cohen et al., 2013), the aspects were theoretically derived from reviews on sustainability (Gaikhorst et al., 2018; Prenger et al., 2022), among other things, and clarified in the theoretical framework of this study. Operationalization took place in collaboration with two researchers who developed the data-use intervention (Schildkamp et al., 2014). To avoid researcher bias, two researchers and nine teachers and school leaders from a school were consulted to check the formulation of the questions asked. Reliability for the survey instrument calculated by means of Cronbach's  $\alpha$  was 0.97 (method) and 0.94 (underlying goal). To be able to study the connection between the data-use intervention and the use of data for school improvement, respondents were explicitly asked whether participation in the data-use intervention had influenced the use of data for school improvement.

### 3.3.4 Data analysis

To answer our research question, we conducted two types of analysis. First, to gain more insight into the data we had collected, we carried out descriptive analyses.

To gain insight into the *performative organizational routines*, we studied the continuation, stability and adaptiveness of the core components of both the method and the underlying goal, and scaling up.

- To gain insight into the number of schools continuing the data-use intervention, we calculated the percentage of schools that were indicated to be still working with the data team intervention. Then, we investigated to what extent schools *scaled up* the intervention. For that purpose, we asked respondents how many data teams had been active in the past school year.
- In order to obtain insight into position regarding *stability vs adaptiveness for both the method and the underlying goal* of the method, means were calculated.

- For stability-adaptiveness of the method, the score for the three core components (meetings, manual, eight steps) ranges from 1 (i.e., never) to 4 (i.e., always). A mean score of 4 on this newly constructed variable labeled stability-adaptiveness method means that the intervention has been implemented exactly as intended. We considered a mean score between 3 and 4 for the core components to indicate some degree of adaptiveness. That level of mean score indicates that data teams are still active, the eight steps and manual are being used on a regular basis and meetings take place at least every 8 weeks. A mean score lower than 3 was taken as indicating that the core components have not been implemented sustainably.
- For the stability-adaptiveness of the goal of the intervention, the score for the five core components of the underlying goal of the intervention (set goals, collect, analyze, and interpret data, take measures and evaluate on the basis of data) ranges from 1 (i.e., nobody) to 4 [i.e., (almost) the entire school]. We considered a school to be adaptive if there were no active data teams, but the mean score for sustainability of the underlying goal was higher than 3. In that case, not just single individuals, but, for example, teams like subject teams, work with data for school improvement. We considered the way of working then as having been scaled up, because staff members are consciously working with data for school improvement.
- To measure the *ostensive routine*, we calculated the extent and presence of different types of policy documents in which the data team way of working with data for school improvement was captured. This is shown in percentages. A distinction was made between school plans (valid for the whole school or school location, meaning a 'this is how we work' routine), plans per team or subject department (applicable for specific teams, enactment), a personal development plan (as a personal goal to learn to use data for improvement of lessons), and in a job description (data use is expected to be done).

Second, a cluster analysis was conducted in order to group observations on the basis of similar characteristics in order to visualize the underlying structures in the data set (Hair et al., 1998); in this context, this was done to explore possible and meaningful clusters related to sustainability. First, a hierarchical cluster analysis using the Wards method was conducted in order to determine the number of clusters. We added all variables as summarized in Fig. 1; the performative organizational routine, which included continuation, the core components of both the method and the underlying goal and scaling up; and the ostensive organizational routine. The values for the ostensive routine and the core components of both the method and the underlying goals of the sustainability of the data-use intervention were standardized.

The dendrogram revealed four clusters. The second step in this procedure involved the determination of the sustainability clusters by conducting a K-means cluster analysis. To obtain more insight into the resulting clusters, the mean scores of each core component for both the method and the underlying goal were compared per category and plotted in radar charts.

## 3.4 Results

### 3.4.1 Sustainability of the method

#### 3.4.1.1 Continuation and scaling up

In 14 of the schools studied (48%), the respondents indicated that school staff within their school location were still working with the data-use intervention. Nine original data teams that had started in the 2012–2017 period were still active, and spin-off data teams had started in five schools. A spin-off data team is a newly composed team including one or more original members along with new members. One school started a new data team guided by an external coach (an educational consultancy organization), in order to continue the data-use intervention way of working within the school. All former data team members at this school location had left the school because of changing jobs or changing school locations, retirement or otherwise. The new school leader embraced the use of data for school improvement and reintroduced the method.

Summarizing, in terms of scaling up, of the 14 school locations that were still working with the data-use intervention, five schools had two data teams that were still active, and nine schools had one active data team. There were no active data teams in the remaining 15 school locations.

#### 3.4.1.2 Core components, stability versus adaptiveness

Among the 14 school locations that respondents reported to be still working with the intervention, one of the 14 schools had a mean score of 4 on the three core components of the method. In this school, the data-use intervention had been implemented and was still used exactly according to the guidelines of the intervention. Five schools had a mean score of 3 or more, but less than 4, on the three core components (meetings, manual, eight steps) regarding the sustainability of the method. This means that the intervention was adapted to the school organization. In eight of the schools still working with data teams, the mean score was below 3. We consider mean scores below 3 as too far from the method to be considered to show sustainability.

A closer look at the general use of the core components (see Table 2) shows that using the eight steps had become a habit within the schools that still worked with the intervention and that this component was used in the most stable way of all three core components. The use of the manual varied, the great majority of schools (11) continued to use the manual either sometimes or regularly. Only one school had dropped it entirely.



**Table 2** Sustainability of the method: number of schools using the core components of the data-use intervention by frequency of use, of the 14 schools still working with the intervention

CORE COMPONENTS OF THE METHOD				
FREQUENCY OF USE	EIGHT STEPS	MANUAL		MEETINGS
NEVER	1	1	LESS THAN ONCE A QUARTER	2
SOMETIMES	2	6	ONCE PER QUARTER	7
REGULARLY	6	5	EVERY 8 WEEKS	3
ALWAYS	5	2	MONTHLY	2

Scheduling meetings within the school seemed to be a challenge; only two schools planned meetings as often as originally prescribed in the data-use intervention.

### 3.4.2 Sustainability of the underlying goals

#### 3.4.2.1 Continuation

Fourteen of the 29 total schools participating had a mean score of between 3 and 4 on the core components of the underlying goal of the intervention (setting goals, collecting data, analyzing and interpreting data, taking measures and evaluating on the basis of data use). Even though respondents at 15 schools reported that they did not have active data teams at the time of the telephone interview, from nine of these 15 schools respondents indicated that data were used for school improvement by using these five core components, as a result of working with data teams in the past. In the other five schools, the underlying goals of the data-use intervention were not sustainable. So in total 24 out of 29 schools appeared to use data structurally for school improvement, even if they were no longer using the data-use intervention as a method. The underlying goals of the data-use intervention therefore can be considered sustainable in these schools. These schools have a routine for using data for school improvement in a flexible way.

##### 3.4.2.1.1 Core components, stability versus adaptiveness

Frequencies were calculated for all five core components related to the underlying goal (see Fig. 1) regarding whether they were used by nobody; individuals, such as former data team members; one or two teams; or (almost) the entire school or school location. Table 3 gives an overview of the frequencies and mean scores per core component of the underlying goal. Setting goals and collecting data seemed to be the most sustainable and stable core components. These components were most widely spread within the school. Analyzing why certain goals had not been reached, taking measures and evaluating educational quality on the basis of data seemed to be applied less widely.

**Table 3** the sustainability of the core components of the underlying goal, n=29

	Setting clear, measurable goals	Collecting data to determine whether the goals have been achieved	Analyzing and interpreting data	Taking measures to achieve goals	Evaluating the quality of education on the basis of data
Mean score per core components (n=29)	3.0	3.0	2.7	2.7	2.7
	<b>Number of schools</b>				
Nobody	1	2	5	5	6
Individually	8	8	9	8	7
1 or 2 teams/ sections	9	8	5	6	6
	<b>Frequency of use</b>				
(Almost) the entire school	11	11	10	10	10

### 3.4.2.1.2 Ostensive routine

Schools were asked to what extent their policy on data use was recorded on paper. Just over half of the 29 schools (15 schools; 52%) recorded the use of data for school improvement in their school plan or location plan. About half of the schools (12; 41%) included a data use policy in the plans of educational teams or subject departments. In about 15% of the schools, on average, data use was an element of job descriptions (5; 17%) or personal development plans (3; 10%).

### 3.4.2.2 Sustainability clusters

As shown in Tables 2 and 3, the use of the core components of the data-use intervention differed within the schools studied and relationships between the core components were not visible. To determine whether the core components are interrelated, and to compare the use of these components in schools with different degrees of sustainability of the intervention, a cluster analysis was conducted. Schools were rated in terms of sustainability of the intervention. The cluster analysis resulted in four clusters of schools when it comes to sustainability of the intervention (see Table 4):

1. Cluster one can be labeled as 'intervention not sustainable' and includes seven school locations.
2. The second cluster can be called 'intervention sustainable on its method' and includes seven schools that still worked with the core components of the data-use intervention, with the

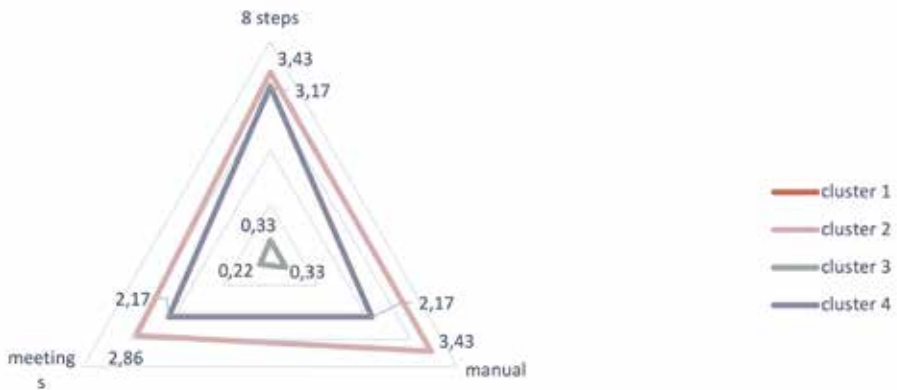
original or a new/spin-off team in which the method was used as intended. Still, only individual people worked towards the goal of the intervention (i.e., the data team members), and the ostensive routine was hardly visible in policy documents of the schools in this cluster.

3. Cluster three can be characterized as ‘intervention sustainable on its underlying goal’ and includes nine schools which only still worked with the core components of the data-use intervention sometimes at most, but which worked cyclically (in parts of the school) on educational improvement using data.
4. Cluster four includes six schools in which (up to) the entire school location worked on the underlying goal of the intervention, and data teams were still active and following the method, and therefore can be called ‘intervention sustainable on both its method and its underlying goal’. In this cluster, staff members did not use the core components of the method as strictly as described in the manual. The way of working was partially laid out in policy documents in these schools.

**Table 4** Four sustainability clusters

Cluster	Cluster 1	Cluster 2	Cluster 3	Cluster 4
<b>Classification</b>	Intervention	Intervention sustainable on its method	sustainable on its underlying goal	Intervention sustainable on both its method and its underlying goal
<b>Continuation of the data-use intervention</b>	no	yes	no	yes
<b>Scaling up</b>	no	original team - new/spin-off teams	some individuals	original team - subject or educational teams
<b>Core components method</b>	negligible	regular	never - sometimes	sometimes - regular
<b>Core components goal</b>	some individuals	individuals	1-2 educational or subject teams	1-2 educational teams up to the entire school
<b>Ostensive routine</b>	no	hardly	no	some
<b># schools</b>	7	7	9	6

The separate frequencies as shown in Table 2 provide insight into sustainability of the method. To gain more in-depth insight, these frequencies were linked to the sustainability classification and made visible in radar charts, in which the mean scores for the core components of the method in the different clusters were compared and plotted (see Fig. 2).



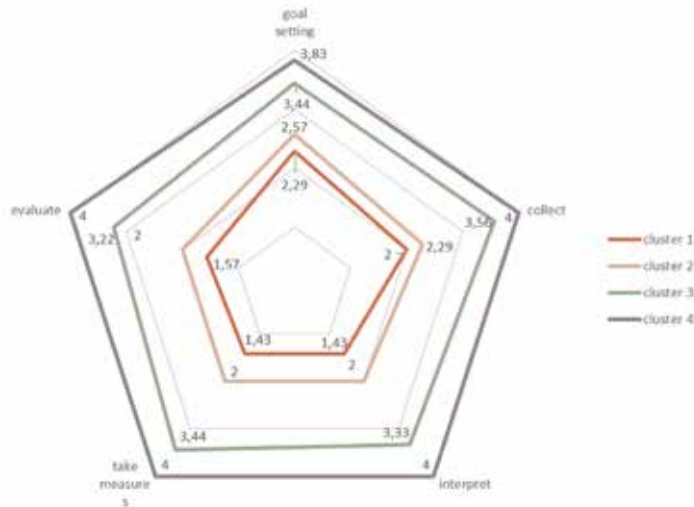
**Figure 2** Use of the core components of the method, per sustainability cluster

(Cluster 1 is not visible; the intervention’s method was not sustainable in these schools, and they therefore did not make use of the core components).

As shown in Table 2, the general use of the core components differed per component. However, by arranging the core components per cluster, more insight is gained into the sustainability of the core components of the method. As an example, in general, it can be said that the eight steps were used often in schools, but the plot shows that this was especially the case in schools in clusters two and four. School locations in cluster one (not sustainable) and cluster three (sustainable on the underlying goal), did not use, or hardly made use of the core components of the method. School locations in cluster two (sustainable on the method), made use of the three core components. School locations in cluster four also made use of the three core components, although the plot shows less frequent use of the manual and fewer meetings. It seems that the manual is used if necessary in these school locations. The results related to the meetings core component show that scheduling meetings within the school seemed to be a challenge, especially in cluster four schools.

Table 3 shows how many schools followed the five core components of the underlying goal (goal setting, collect data, interpret data, take measure and evaluate on the basis of data), broken out by breadth of use within the school. To gain more in-depth insight into sustainability, these frequencies were linked to the sustainability classification and made visible in radar charts,

in which the mean scores for the core components of the underlying goal in the different clusters were compared and plotted (see Fig. 3).



**Figure 3:** Use of the core components of the underlying goal, per sustainability cluster

Schools in cluster four, where the intervention was sustainable on both its method and its underlying goal, scored high on the use of all five core components of the underlying goal, meaning that their use was relatively widespread within the school. School locations in cluster three (where the intervention was sustainable on its underlying goal) also used the five core components widespread, but slightly less than the schools in cluster four. Schools in these two clusters made working on school improvement on the basis of data an organizational routine. In cluster two schools, where the intervention was sustainable on its method, some individuals made use of the five core components of the underlying goal, but there was no organizational routine, given the low mean score. Cluster one schools, where the intervention was not sustainable, only some individuals made only little use of the core components. So, we could state that school locations in clusters three and four made data use for school improvement an organizational routine, in order to continually improve the quality of education at their school. School locations in clusters one and two had no organizational routine for working with data for school improvement. An important question here is also whether sustainability of data use in these schools was indeed related to the implementation of the data-use intervention, or due to other initiatives within the school. We asked the respondents about this connection, and over 70% of the respondents indicated that their current data use practices were a result of participating in the data-use intervention. Respondents indicated that with the implementation of the data-use intervention they began to think about data, became familiar with the amount of (unused) data in the school, and started using data for school improvement.

The percentage of turnover of (key) school personnel did not appear to have a major influence between the clusters. The average leaving of data team members in cluster one was 41%, compared to cluster two 35%, cluster three 56% and in cluster four 37%. A closer look into clusters and starting year of the intervention shows schools that started with the data-use intervention in 2012, 2013 and 2015 had a turnover about 44% and schools started in 2016 had a lower grade of 28%. These percentages show that, despite the high staff turnover, using data for school improvement in cluster 3 schools are indeed embedded in an organizational routine.

A closer look at the relationship between the year of implementation and the clusters did not provide a deeper insight either. See Table 5.

CLUSTER/START	2012	2013	2014	2015	2016
1	2	3	0	1	0
2	3	1	1	1	1
3	5	4	0	2	2
4	0	2	0	0	1

**Table 5** Relation implementation year and cluster

### 3.5 Conclusion and discussion

In this explorative study, we aimed to find a way to measure the sustainability of a data-use intervention three to eight years after its initial implementation. Sustainability in this study was defined as *the process of integrating and scaling the innovation’s core aspects in organizational routines that are adaptive to ongoing work* (Prenger et al., 2022). A distinction was made between sustainability of the method (specified components) and sustainability of the underlying goal (general components) of the data-use intervention to get insight in sustainable use of the data-use intervention itself as well as insight in the further development to use data for school improvement. Figure 1 gives an overview of the dimensions of sustainability for the data-use intervention.

#### 3.5.1 Profiles of sustainability

After conducting a cluster analysis on the results from 29 schools, four profiles for sustainability of the data-use intervention were found.

1. *Intervention not sustainable*

The cluster consists of seven schools (24%). Seven schools could match this profile, but they

could not constitute it. Schools in this profile neither continued to use nor scaled up the use of data teams. The use of the core components of the *method* was negligible and the use of the core components of the underlying goal only applied to a few individuals, usually former data team members. No policy on data use for school improvement was documented.

2. *Intervention sustainable on its method*

Seven schools (24%) were aligned with this profile. Schools in this profile still had one or two active data teams, where the original data team was often still intact (continuation). Only a limited number of other school staff were making use of the data-use intervention (i.e., limited scaling up). Original data team members often continued in a spin-off data team, with a couple of new members. The core components of the *method* (eight steps, manual and meetings) were used on a regular basis in these spin-off data teams. One school used the method exactly as intended. Other schools showed that they made a small adaption: the intervention prescribed meetings once every 3 to 4 weeks, the schools within profile 2 met on average once every 6 weeks. Data use in the profile 2 schools was not mandated in job descriptions or personal development plans very often, but in some schools, personnel was supported in using data for school improvement, so the ostensive routine was somewhat visible. Individuals in the schools in this profile made use of the five core components of the underlying goal, but this was not yet an organizational routine.

3. *Intervention sustainable on its underlying goal*

Nine schools (31%) were aligned with this profile. Data teams were no longer active in the schools in this profile. Only some individuals in the school made use of the data-use intervention; these are former data team members. The core components of the method were only sometimes used by a few individuals, but in these schools the cycle of setting a goal, collecting and interpreting data, taking measures and evaluating on the basis of data (*underlying goal of the intervention*) was a routine within several educational or subject-level teams. However, this was not an ostensive routine. Working with the core components of the underlying goal of the intervention was not documented in policy papers.

4. *Intervention sustainable on both its method and its underlying goal*

Six schools (21%) were aligned with this profile. In these schools, data teams were active, but related work was also carried out within educational and/or subject-level teams. In terms of scaling up, more school personnel made use of the data-use intervention. Besides the original data team, educational and/or subject-level teams also worked with the intervention. Schools in this profile made use of the three core components of the *method*; however, the manual seemed to be used less often. An explanation for this could be that data team members trust their experience with working with the intervention, whether this is justified or not. There also

seemed to be fewer official data team meetings. An explanation could be working according to the data-use intervention was a routine in the school and the data team meetings were integrated in meeting cycles within the school, such as educational team meetings, subject meetings, consultation between class mentors and work groups. Therefore, meetings might not always be recognized as data team meetings. Exploratory interviews revealed this to be the case. The core components of the underlying goal (set goals, collect and analyze data, take measures, evaluate on the basis of data) were visible in profile four schools. These schools used these core components more widely; the organizational routine thus seemed to be more embedded. The ostensive routine was partially laid out in policy documents of these schools. The mandate of the use of data for school improvement was visible in a certain number of schools; half of the researched schools included a data use policy in their school plan or in plans for educational teams and subject departments.

In summary, the results of this study show that in 7 (24%) out of 29 schools included in the study, the data-use intervention was not sustainable and some form of sustainability was found in 22 (76%) schools. Schools did not automatically continue, formalize or scale up this intervention in the same way or with the same goals. The results of this study clearly show that the answer to the question as to whether an intervention has been sustained is not a simple yes or no. It is important to adopt a more nuanced view when describing sustainability, and important to realize that sustainability can come in different forms.

This research also shows that sustainability of the data-use intervention, even with quite a bit of external support, is not simple. The process from intervention to realizing organizational routines has proven to be difficult. On the basis of the number of school staff members working with the data-use intervention, we could cautiously conclude that the transfer of the intervention from the individual to the institutional level differs from school to school and often proves to be challenging, as others have found as well (Akkerman & Bakker, 2011; Collinson & Cook, 2006; Gaikhorst et al., 2018).

### **3.6 Implications for practice**

This study shows that sustainability involves more than the fidelity of implementation of an intervention, and also needs to include the underlying goal of that intervention. By making a distinction between the method and the goal, but also by distinguishing and describing these profiles of sustainability, the concept of sustainability becomes more nuanced and one becomes more aware of its various aspects. Even though in some schools the specific intervention itself was not applied anymore, its underlying goal was still maintained in terms of systematically using data. Schools reported this had been influenced by the original data-use intervention.



It is important to monitor the intervention, for example, with a checklist. A checklist can consist of points of attention (e.g., goal, knowledge sharing) before, during and after implementation of the data-use intervention. Monitoring and communication about these developments can stimulate the discussion about the added value of the intervention within the school organization (Hargreaves & Goodson, 2006).

In three out of four sustainability profiles, the data-use intervention steps of interpreting data, taking action based on data and evaluating are used less often than the steps of setting goals and collecting data. It seems that schools work with data, but do not always use data in a beneficial way, and have difficulties with the last three steps in the cycle, as other data use studies have also demonstrated (Datnow & Hubbard, 2016; Marsh, 2012a, 2012b). Paying extra attention and possibly extra training in these steps might be necessary here. In addition, previous research illustrated that data team members gain knowledge about using data for school improvement (Ebbeler et al., 2016), but they struggle with brokering their knowledge to their colleagues (Hubers et al., 2018, 2019). Some studies have shown how teachers can face boundaries within their own team (Venkat & Adler, 2008) and when working with other teacher teams (Cobb et al., 2003). In order to realize sustainability, attention needs to be paid to knowledge brokerage and boundary crossing.

The high staff turnover in schools did not appear to negatively influence the embedding of data use for school improvement in organizational routines. Explanations can be found in sharing knowledge with new teachers (Andreou et al., 2015a, 2015b; Saito et al., 2012), collegial formal and informal personal contacts (Dekker & Feijs, 2005) as well as communication among staff (Elder & Prochnow, 2016; Kirtman, 2002). School leaders play a role (van den Boom-Muilenburg, 2021), so explicit attention of school leaders in planning, organizing and providing a clear direction form the basis of involving new school personnel in ongoing implementation of interventions in schools (Homan, 2017).

### **3.7 Recommendations for further research**

This research has led to an elaboration and empirical measurement of the concept of sustainability in the context of educational innovations, which provides a basis for future research in this field. A limitation of this study is that the outcomes were based on questioning only one key person in the school, because several (original) data team members were not available in the school anymore. In order to be able to compare schools in a similar way, it was decided to administer the questionnaire to only one person at the school, even though the questionnaire is then based on self-report. To avoid social desirability, the questions were posed as concrete as possible, but this still is subjective. In order to obtain more complete insight into sustainability in schools

working with this intervention, further research could focus on actually observing sustainability in the schools.

In this study we found different sustainability profiles; we see reason for further research in the variety of these profiles. It is unclear what factors influenced the process of sustainability. The literature points to many factors that could affect sustainability, such as teacher buy-in, leadership or effectiveness of the intervention (Gaikhorst et al., 2018; Prenger et al., 2022). To determine which factors or groups of factors have the most influence on sustainability, more insight into these factors and their mutual influences is necessary (Wiltsey-Stirman et al., 2012). Further research is also needed into the concept of organizational routines and what these routines look like within the organization. Organizational routines can be approached as single routines (Kremser & Schreyögg, 2016), but complementary routines form a system in which each routine contributes a partial result to the accomplishment of a common task (Kremser & Schreyögg, 2016). By focusing on the pedagogic-curricular elements in practice within a school, as this is the decisive factor in school performance, it can be determined at that layer to what extent an organizational routine is actually a routine (Bellei et al., 2019).

In most schools, the original data team was still working on educational problems. This implies that the knowledge about data use remains with a limited group of people. Research shows that not just knowledge, expertise and skills are key, but how these circulate in schools (Coburn et al., 2012; Daly & Finnigan, 2010) is crucial as well. Schools in profile four were found to be able to make a transfer from data team members' individual knowledge to the institutional level. According to Daly and Finnigan (2010):

Social capital is an investment in the social relations in a system through which the resources of other individuals can be accessed, borrowed, or leveraged. This differentiates social capital from human capital, which refers to investments in training, development, or certifications of individuals, or physical capital that is contained in infrastructure and equipment. (p. 115)

Therefore, it might be worthwhile to further investigate social networks within schools, for example, to study the differences in social networks between schools in profile four and the other profiles. These social networks can also help us by providing more knowledge about how to scale up an innovation from a small group of people to more or all school personnel. In order to sustain or scale up interventions in schools, it seems necessary to consciously plan and implement activities (Dekker & Feijs, 2005) and to start to think about how to sustain an intervention even before its implementation (Hubers et al., 2018).

Sustainability can be viewed in different ways. Most studies on sustainability have focused on fidelity, impact or effectiveness of the intervention for student achievement (Alanís & Rodríguez, 2008; Bean et al., 2015; Edwards Groves & Rönnerman, 2013; Elias, 2010, van den Boom-Muilenburg et al., 2019; Wolthuis et al., 2020), teacher change (Drits-Esser et al., 2017; Furman Shaharabani & Tal, 2017; Gaikhorst et al., 2017) or spreading knowledge of the intervention (Deaney & Hennessy, 2007a, 2007b; Dekker & Feijs, 2005). This study further examined what sustainability looks like by distinguishing the aspects of the process of sustainability. An important scientific contribution of this study is that we have started to pick apart the aspects of sustainability as a first step to understand its process. Variability between schools and context of schools makes it difficult to draw general conclusions in education (Mcnaughton, 2021). Sustainability also turned out not to be simply a matter of black and white, but is more nuanced and takes several forms. The profiles could help schools indicating if substantive change in educational practice resulting from the reform (Sanders, 2012) has taken place.



**CHAPTER 4**  
FACTORS INFLUENCING  
THE SUSTAINABILITY OF A  
DATA-USE INTERVENTION

## This chapter is based on

Tappel, A.P.M, Poortman, C.L., Schildkamp, K., Visscher, A.J., Luyten, J.W.(2024), Factors *influencing the sustainability of a data-use intervention*. Manuscript submitted for publication

### Abstract

Research conducted on sustainable educational innovations reports many different factors potentially influencing the sustainability of innovations (e.g., Prenger et al., 2022). Our knowledge regarding the exact impact of those factors mentioned in the literature is very limited. The aim of this study is to examine to what extent the factors affecting secondary education are related to the sustainability of the data-use intervention.

Despite limitations, this study confirms that sustainability cannot be divided into sustainable versus not sustainable, but is more nuanced (Tappel et al., 2022). Three variables, in particular, may be related to the sustainability of the data-use intervention, namely, 1) teachers' attitudes, buy-in and beliefs, 2) individualized support of staff by a school leader including 3) the facilitation of data use for school improvement. Perceived levels of these variables differed between different sustainability clusters.

## 4.1 Introduction

Educators are expected to respond to societal changes while also maintaining and improving the quality of education. For these reasons, innovations are introduced in education. However, even if innovations are successful, they are not always embedded in the school (Fullan, 2015; Gannaway et al., 2013; Gilad-Hai & Somech, 2016), nor are effects of the associated interventions sustained (Gaikhorst et al., 2017). The sustainable implementation of educational innovation does not appear to be a given (Datnow, 2002; Karnopp, 2019; Sindelar et al., 2006). It is therefore important to research how the sustainability of interventions can be promoted, to support long-lasting effects on students.

Attention to data-use interventions for school improvement has increased in the last decades. This study focuses on the sustainability of one such intervention that was introduced in the Netherlands in over 40 school locations, starting in 2009 (Schildkamp et al., 2014). In this data-use intervention, teams of six to eight teachers and school leaders participated for one or two years in an intensive professional development program in which they learned how to systematically use data. The data team used data to solve an educational problem in their own school; for example, low exam grades or a high number of students switching to a lower educational track. The data-use intervention had two main goals: 1) the professional development of teachers and school leaders in data use, and 2) improvement of (an aspect of) education in a school. The effectiveness of this intervention was studied in previous research, in terms of teacher satisfaction, learning, application of new knowledge and skills by teachers, and student outcomes; these studies showed positive effects (Ebbeler et al., 2016; Poortman & Schildkamp, 2016; Schildkamp & Poortman, 2015).

All data teams were trained by a coach from the University of Twente, following an 8-step cyclical process that was described in a manual, and had regular meetings. Despite similar conditions during the implementation of the program (e.g., the same coach, the same number of meetings, manual, and procedure), the sustainability of the data-use intervention varied between schools in the years after the coach left (Tappel et al., 2022). In a previous study (Tappel et al., 2022) on the sustainability of this data-use intervention, a distinction was made between sustainability of the method (e.g., using the 8 steps) and sustainability of the underlying goal (e.g., using data to improve education). A cluster analysis was conducted and four profiles of sustainability were found: 1) intervention not sustainable; the use of data (teams) did not continue, 2) intervention sustainable on its method; schools with this profile still had one or more active data teams, 3) intervention sustainable on its underlying goal; data teams were no longer active in these schools, but educators worked with the cycle of setting a goal, collecting and interpreting data,

taking measures and evaluating on the basis of data, and 4) intervention sustainable on both its method and its underlying goal; data teams were active in these schools, and data were also used by others in the school.

In the study presented here, we investigated to what extent differences in certain (combinations of) factors are associated with differences in the sustainability of the data-use intervention in terms of each of these different sustainability clusters.

## 4.2 Sustainability

Sustainability of educational interventions is conceptualized in a number of ways in the literature. We used the definition of sustainability adopted in a recent systematic review of sustainability and the factors influencing it (Prenger et al., 2022). The sustainability of an intervention is defined as “the process of continuing and integrating the intervention’s core aspects in organizational routines that are adaptive to ongoing work” (p.14). This definition was also the starting point in previous studies concerning this data-use intervention (Tappel et al., 2022, Tappel et al., 2023).

*Core aspects* are the elements that form the basis of the intervention. The core aspects are the intervention’s long-term goals, and include the basic principles behind them and the related activities undertaken to achieve those long-term goals. Core aspects can refer to the intervention itself; for the data-use intervention, examples are the 8-step cyclical process, the manual and having data-team meetings on a regular basis. Core aspects can also refer to the underlying goals of the intervention; examples for the data-use intervention are setting measurable goals and taking measures based on data to achieve these goals. The long-term goal for the data-use intervention is to improve education by means of the use of data, that is, by setting measurable goals, collecting data, analyzing and interpreting data, taking measures to achieve the goals and evaluating on the basis of data (Tappel et al., 2022). For sustainability, these core aspects, referring to the intervention and/or the underlying goal, must continue after removing support for implementing the intervention. They need to become part of the daily school *routines*. Routines describe the way of working within the organization, both in recorded standard procedures as well as in specific actions for their practical execution (Wolthuis et al., 2022). Educational interventions are often conceptualized by means of a phase model in which sustainability is considered to be the final phase in a linear developmental process (Fullan, 1992). However, the actual nature and course of change processes in (school) organizations are often not linear and predictable. Sustainability assumes a certain level of loyalty to the original intervention, but also the adaptation of the intervention’s concept to other and changing contexts, and to the needs of the school (Elias, 2010a; Prenger et al., 2022; Quinn & Kim, 2017), for example, having less-frequent meetings than recommended in the manual so the data-team meetings fit better with the teachers’ schedule (Tappel et al., 2022).



### 4.3 Factors potentially promoting sustainable innovation

Sustainability in general can be influenced by four main categories of factors (Prenger et al., 2022): school organizational, individual, and contextual factors, and characteristics of the innovation itself. In this categorization, leadership is subsumed under the category of school organization, but it is also frequently mentioned as a separate factor (Leithwood, 2007). Below, we will explain for each main category the factors which, according to the literature (Prenger et al., 2022), influence the sustainability of innovations in the context of secondary education. Sustainability in secondary education is considered to be influenced by three out of the four main categories mentioned, namely, factors within the school organization (including leadership), the characteristics of the innovation itself and individual factors. Surprisingly, context factors such as formal and informal external support were not mentioned in the literature on factors influencing the sustainability of innovations in secondary education (Prenger et al., 2022). The influential factors within the category of school organization mentioned most are a) collaboration and b) knowledge sharing. The category of leadership includes the factors c) vision, norms and goals, d) providing individualized support, e) facilitation and f) knowledgeable leaders. Attitude (g) is mentioned within the individual category, while effectiveness is included in the innovation category (variable h).

#### 4.3.1 School organizational factors

School organizational factors can be described as factors related to the system of “meanings, relationships and structural arrangements within a school” (Little, 2012, p. 163). In a recent systematic review (Prenger et al., 2022), the school organizational factors discussed below were found to influence sustainability.

*Collaboration* can be defined as working together on the same problem and goals (Lawson, 2004). This working together involves the partners in the process doing work together, as opposed to cooperation, in which partners split the work and combine each of their partial results into the final outcome (Vangrieken et al., 2015, p. 23). This means that the whole team working on the problem is responsible for the process and outcomes, and that team members ideally complement each other in this process. By struggling collectively with and successfully overcoming complicated challenges, teachers are empowered to implement innovations sustainably (Gilad-Hai & Somech, 2016).

Knowledge sharing can be described as activities through which information, skills, and/or expertise are exchanged among educators (Bukowitz & Williams, 1999). This implies personal contact with colleagues during formal and informal moments and communication with other

educators about relevant issues regarding the intervention (Dekker & Feijs, 2005; Elder & Prochnow, 2016a; Kirtman, 2002). Specific examples are presenting findings and work to each other or discussing the innovation with colleagues during a coffee break. This provides a clearer understanding of the innovation (Benz et al., 2004).

#### 4.3.1.1 Leadership

Leadership is assumed to be crucial for successful and sustainable educational innovation (e.g., Ng & Nicholas, 2013). School leadership concerns all activities tied to the core work of the school that are designed by the school's educators to influence the motivation, knowledge, or practices of other members of the school organization and that can be carried out by different staff members (Harris & DeFlaminis, 2016; Leithwood, 2007). The following leadership characteristics, apparent for both formal and informal leaders, can influence sustainability (Prenger et al., 2022):

*Vision, norms, and goals* is about the school leader's potential role in building shared vision, norms, and goals to present a credible, yet realistic picture of the organization that inspires the participants to reach for a future goal. The leader ideally clarifies for educators the importance of the innovation for the organization, and how the innovation fits the school's vision. To achieve sustainability, a consistent focus on a shared vision and on how to achieve the chosen goals is promoted and expressed (King, 2016; Martin et al., 2006; Moolenaar et al., 2012).

*Providing individualized support* refers to leaders who act on the basis of recognizing and understanding teachers' concerns and needs (Thoonen et al., 2011). Examples are leaders who provide teachers with room to experiment, to make mistakes and to exchange expertise and experiences (Geijsel et al., 2009), offer individual coaching and feedback to their staff (King, 2016; Larsen & Samdal, 2008), and give teachers the opportunity for professional development (Andreou et al., 2015; Bean et al., 2015; Benz et al., 2004.; Kafyulilo et al., 2016; Kirtman, 2002; Pinkelman et al., 2015). Taking employees seriously and supporting them positively influences the sustainability of educational innovation.

*Facilitation* means that the leader provides resources, which enables educators to carry out their work to support implementation of the innovation (Edwards, 2012; Edwards Groves & Rönnerman, 2013; Kafyulilo et al., 2016; Thoonen et al., 2011). These resources can take the form of time and money, or of relevant connections within appropriate networks. Facilitation of the implementation of the innovation by providing such resources emphasizes the importance of the innovation to the school.

*Knowledgeable leaders* are well-informed about the innovation, know what is necessary to work successfully with it, and share good practices (King, 2016; Larsen & Samdal, 2008; Lewin et al., 2009). By having knowledge of the concepts, procedures, and progress of an innovation and by showing this when actively participating in the intervention, leaders stimulate the sustainability of the intervention.

#### 4.3.2 Innovation Factors

Characteristics of the innovation itself can also have an impact on sustainability. Prenger et al. (2022) found that only the effectiveness of the innovation has an influence on its sustainability in secondary education: *Effectiveness* in the context of an innovation can be defined as the realization of the goals set for an innovation (Bean et al., 2015; Jesson & Limbrick, 2014; Zehetmeier, 2015).

#### 4.3.3 Individual factors

*Attitude*, subsumed under individual characteristics, has been reported to have an impact on the sustainability of innovations. Innovation-related attitude can be defined as one's affective response to an innovation, which depends on personal beliefs that drive the willingness to apply the innovation (Bohner & Wänke 2002; Salas-Zapata et al., 2018), generally related to expected benefits for students (Mouza, 2009; Saito et al., 2012). A high level of confidence in the positive impact of an innovation can foster its sustainability.

### 4.4 Research aim

Research conducted on sustainable educational innovations reports many different factors potentially influencing the sustainability of innovations (e.g., Prenger et al., 2022). Our knowledge regarding the exact impact of those factors mentioned in the literature is very limited. Therefore, the aim of this study is to examine to what extent these factors are related to the sustainability of the data-use intervention.

### 4.5 Method

An online survey was used to study the factors potentially influencing the sustainability of the data-use intervention, which enabled the researchers to measure perceived levels of the potential influential factors that were identified in a systematic review (Prenger et al., 2022) in a large group ( $N = 40$ ) of secondary schools. The 40 secondary schools that had been exposed to the data-use intervention between 2012 and 2017 were approached to participate in this study, as they had also participated in a previous study regarding the sustainability of the data-use intervention (Tappel et al., 2022). In that study, these schools were distinguished according to four profiles of sustainability: 1) intervention not sustainable, 2) intervention sustainable on its

method, 3) intervention sustainable on its underlying goal, and 4) intervention sustainable on both its method and its underlying goal (Tappel et al., 2022).

#### 4.5.1 Respondents

A questionnaire was administered by means of Qualtrics to staff at 38 out of the 40 schools that had participated in the data-use intervention between 2012 and 2017 and in which the data-teams had been supported by a coach from the university involved. Two schools in profile 4 had already participated in other research and therefore did not want to participate in this study. The schools included in this study were scattered throughout the Netherlands, from cities to rural areas. School size varied between 690 and 1600 students.

The research focused on three levels of school organizations, namely, the principal, the school leader, and teachers, to evaluate the organizational routine of working with (the goals of) the data teams at multiple levels of the organization. A Dutch principal is the overall leader responsible for a school consisting of one or more locations, whereas school leaders are responsible for an educational team or a specific school site. These levels within the organization can have their own influence on sustainability (Krijgsman et al., 2022; Spillane, 2012). All staff members were the intended participants, estimated about 3000 employees, and were invited to complete the questionnaire via email with a link. The link was sent to the university's contact person at the school by the researcher. This could be a teacher or a school leader.

All contact persons in schools were similarly instructed about distributing the questionnaires among school staff; however, the response varied considerably. In 15 schools the link was not sent to the intended respondents. This most probably was because data collection took place during the COVID-19 pandemic. In 20 schools, the link was sent only to (former) data-team members from the original data team or spin-off data teams, and in 3 schools the link was sent to all staff members.

Respondents from 23 school locations completed the questionnaire. Respondents ( $N = 307$ ) were school staff, including educators or other school workers ( $n = 274$ ), principals ( $n = 9$ ) and school leaders ( $n = 24$ ). Leaders and principals made up 15% of the respondents, while 85% were teachers, which is representative of the typical proportion of teachers and school leaders within schools in the Netherlands. In schools where the link was sent to all staff members, the response rate was 43%. The response rate for all respondents who had participated in an original or spin-off data team and were still working at the school was 89% ( $n = 49$ ). However, the response rate calculated over all potential respondents was 10%. This included the data team members from 6 schools where only former data team members who had been guided by a coach from the university completed the questionnaire. A flowchart is provided in Figure 1.

40 schools participated in the data-use intervention between 2012 and 2017 and were supported by a coach from the university involved.	Not participating in this research (2 schools)		
	The link was not sent to the intended respondents (15 schools).	$n = 0$	Response rate = 0%
	The link was sent to all staff members (3 schools).	$n = 258$	Response rate $\approx 42.4\%$
	The link was sent to (former) members of a (spin off) data team (20 schools).	$n = 49$	Response rate for data-team members = 89.5%
		<b><math>N = 307</math></b>	<b>Overall response rate = 10%</b>

**Figure 1** Flowchart of response rates

Although the researcher sent two reminders to the contact person to distribute and fill out the questionnaire, the response rate for the questionnaire was much lower than expected, very likely caused by the COVID-19 pandemic.

#### 4.5.2 Questionnaire

The questionnaire was developed based on the theoretical framework (4.3) and as much as possible on existing valid instruments (Fernet, 2008; McIntosh et al., 2011; Schildkamp, Poortman, Hubers, et al., 2017; Van Gasse et al., 2017; Wayman, Cho, et al., 2017). We were, however, unable to find existing scales for two of our eight variables, and therefore developed new scales for measuring those variables (see Table 1).

The questionnaire consisted of questions with regard to the three main factors that are supposed to influence the sustainability of educational innovation in secondary schools, namely, school organizational factors (including leadership), individual factors and characteristics of the innovation itself. Respondents could express their degree of agreement with the items on a 4-point Likert scale: 1 (completely disagree) to 4 (completely agree).

All items were translated into Dutch and adapted to the context of this study. To verify the validity and to detect potential flaws in translation, a university researcher not involved in this study and a practitioner reviewed all the items. Each item was checked to determine whether it adequately reflected the construct within the Dutch educational context and whether items were unambiguously understandable. Minor changes were made to the wording of some items.

In addition, the questionnaire was administered in a pilot at two of the 38 schools.

School staff were asked to complete the questionnaire at one school site in each of these schools. An open-ended question was added asking for tips to improve the questionnaire, and the respondents could send feedback and questions per email during the pilot period. A total of eight tips were submitted and used for improving the questionnaire where possible. The tips included simply adding a “I don’t know” option (which was then included) and correcting a spelling error.

### 4.5.3 Reliability

Cronbach’s alpha indicated acceptable to good reliability for all scales (Field, 2009). For two scales, two items were deleted to improve the reliability. Table 1 presents the 8 scales as included in the research (Prenger et al., 2022).

Factor	Variable	Based on	# of items	Alpha	Example item
School organizational	Collaboration	Van Gasse et al., 2017	6	.819	We consider the intervention to be the whole team’s responsibility.
	Knowledge sharing	Newly constructed	6	.880	I talk informally (e.g., during coffee breaks) with colleagues about how the intervention works.
	Leadership				
	<i>Vision, norms and goals</i>	Krüger & van den Berg, 2011	5	.679	In our school, it is clear how we want to achieve our goals.
	<i>Providing individualized support</i>	Wayman et al., 2017	7	.785	My (school) leader is aware of the need to (continue to) develop teachers’ skills for this intervention.
	<i>Facilitation</i> *1	McIntosh et al., 2011	3	.735	Time has been allocated (to me) to work with this intervention.
	<i>Modeling leader</i> *	Newly constructed	3	.872	School leaders within my school know what is needed to work successfully with the intervention.
Intervention	Effectiveness*	Van Gasse et al., 2017	4	.838	The way we use this intervention in this school contributes to achieving student learning gains.
	Individual				
	Attitude, buy-in and beliefs*	Schildkamp, Poortman, Hubers, et al., 2017	4	.824	I believe this intervention meets the individual needs of students.

**Table 1** Characteristics of the scales used to measure the factors influencing sustainability.

<sup>1</sup>For variables marked with \*, an "I don't know" option was added

## 4.6 Data Analysis

The total number of respondents was 307. The questionnaire was unexpectedly also completed by educational support staff ( $n = 43$ ), such as (technical) teaching assistants, janitors or administrative assistants, who indicated in the comments that they could not answer most of the questions. Questionnaires that had been less than 50% completed were removed ( $n = 77$  in total). In a previous study, schools were invited to participate in identifying their sustainability profile (Tappel et al., 2022), but not all invitees responded then. Therefore, respondents who could not be linked to one of the four school-level sustainability profiles needed for the analysis in the current study were deleted ( $n = 13$ ), as well as respondents who had not indicated a school location, which made profiling impossible ( $n = 20$ ). The analyses therefore were conducted on data from 197 respondents from 19 school locations for 16 schools.

We conducted several analyses to answer the research question. First, we calculated descriptive statistics, determining the mean, standard deviation, and median of the scores on the scales, to gain more insight into the data. Subsequently, we split the data set into the four sustainability profiles found in a previous study (for the same schools) for sustainability of the data-use intervention (Tappel et al., 2023a): 1) intervention not sustainable, 2) intervention sustainable on its method, 3) intervention sustainable on its underlying goal, and 4) intervention sustainable on both its method and its underlying goal.

Second, we conducted independent samples t-tests to compare the results for levels of influential factors at sustainable schools (profiles 2, 3, 4) and not-sustainable schools (profile 1), as perceived by teachers (Field, 2009). However, as the results of our previous study showed that sustainability is more nuanced than sustainable versus not sustainable, we also wanted to compare the different clusters. Due to the low number of respondents in profile 4, these were added to respondents from profile 3, and in our third step we conducted a one-way ANOVA on the three profiles (profile 1, profile 2, profile 3&4) and the 8 scales for factors influencing sustainability. The schools in the three different sustainability profiles were expected to score differently on the influential factors.

Third, a Fisher's least significance difference (LSD) test was used as a post-hoc test to uncover specific differences between the sustainability profiles and confirm the outcomes of the ANOVA. All analyses were performed using SPSS 25.

## 4.7 Results

The descriptive statistics made it clear that the respondents were unevenly distributed across functions and sustainability profiles. The respondents were distributed as follows across the profiles, as showed in table 2:

**Table 2** Distribution of the respondents across the sustainability profiles

Profile	#respondents	#teachers	#school	#worked with(in) data team	#school locations
1. Not sustainable	64	50	14	26	6
2. Sustainable on the method	80	75	5	13	4
3. Sustainable on the underlying goal	48	41	7	27	8
4. Sustainable on both method and goal	5	3	2	5	1
<b>TOTAL</b>	<b>197</b>	<b>169</b>	<b>28</b>	<b>71</b>	<b>19</b>

We compared the means of sustainable schools (clusters 2, 3, 4) and not-sustainable schools (cluster 1). Slightly higher means were found for 6 out of the 8 variables in sustainable schools, which is in line with the possibility that these variables could be related to the sustainability of the data-use intervention (see Table 3).

Next, we conducted an independent samples t-test comparing the mean values for the 8 influential factors in sustainable schools (clusters 2, 3 and 4) versus not-sustainable schools (cluster 1), as perceived by teachers. However, the results showed no statistically significant differences. This implies that the sustainability of the educational innovation does not seem to be linked with scores on any of these factors, when simply comparing sustainable versus non-sustainable schools. The response scale went from one to four, so higher values indicate greater agreement (see table 3)



**Table 3** Means, standard deviations and statistical significance of mean comparisons per variable

Characteristic	Variable	Not sustainable		Sustainable		p
		Mean (n = 64)	SD	Mean (n = 133)	SD	
<b>School organizational</b>	Collaboration	2.57	.633	2.51	.700	.627
	Knowledge sharing	2.24	.644	2.36	.624	.537
	<b>Leadership</b>					
	<i>Vision, norms and goals</i>	2.93	.690	2.87	.631	.569
	<i>Providing individualized support</i>	2.15	.505	2.29	.477	.98
	<i>Facilitation</i>	2.24	.576	2.34	.574	.337
<b>Innovation</b>	<i>Modeling leader</i>	2.71	.477	2.80	.477	.576
	Effectiveness	3.24	1.161	3.29	.971	.765
<b>Individual stakeholders</b>	Attitude, buy-in and beliefs	2.87	.389	2.96	.405	.182

Next, we split the dataset into 3 categories, namely, “not sustainable” (profile 1), “sustainable on the method” (profile 2) and “sustainable on the underlying goal” (profiles 3 and 4) and conducted a one-way ANOVA to compare levels of the eight influential factors between these three categories. We found a statistically significant difference for *providing individualized support* between groups;  $F(2,163) = 5.853$ ,  $p = .04$ . Individualized support for teachers provided by school leaders seems to differ depending on the sustainability of the data-use intervention. Table A-1 in the Appendix shows the results of comparing mean values for the influential factors between the three profiles.

A Fisher’s least significant difference (LSD) post-hoc test was used to uncover specific differences and confirmed that teachers’ perception that school leaders provided individualized support was higher ( $p = .02$ ) for schools that were sustainable on the underlying goal compared to not-sustainable schools, as well as for schools sustainable on the underlying goal compared to schools sustainable on the method ( $p = .03$ ), and these differences were statistically significant.

The LSD post hoc test also revealed that the score for *facilitation of teachers* ( $p = .033$ ) was statistically significant for schools that were sustainable on the goal (profiles 3 and 4) compared to those sustainable on the method (profile 2). In schools sustainable on the underlying goal of the data-use intervention, teachers felt that resources were specifically allocated to educators to work on data for school improvement.

For *attitude*, statistical significance was found for sustainability of the goal comparing sustainable and not sustainable schools ( $p = .045$ ), which means that educators had a positive attitude towards data use in schools that were working with data for school improvement. All results are presented in more detail in Table A-2 in the Appendix.

## 4.8 Conclusion and discussion

In this study, we aimed to research which factors influence the sustainability of the data-use intervention. In total, 307 respondents at 23 school locations completed a questionnaire on potentially influential factors known from previous research (Prenger et al., 2022a). The outcomes were linked with four profiles for sustainability of the data-use intervention (Tappel et al., 2023a), namely, profile 1: intervention not sustainable, profile 2: the data-use intervention is sustainable on its method, profile 3: the data-use intervention is sustainable on its underlying goal, and profile 4: the data-use intervention is sustainable on both its method and its underlying goal.

### 4.8.1 Limitations of the study and suggestions for further research

We start by mentioning the limitations regarding the data collection in this study, as they most likely affected the results strongly. The first and most important limitation is the lack of representativeness of the data, especially for the most sustainable schools (cluster 4, sustainable on both the method and the underlying goal). Due to the COVID-19 pandemic and the closing of schools during data collection, the response rates were low. In addition, this topic is just a little further from daily practice (which may not have encouraged teachers to respond), and the mobility of teachers and school leaders was not helpful either. We also could not evaluate the organizational routine of working with (the goals of) the data teams at multiple levels of the organization, as the number of questionnaires completed by school leaders was too low. Moreover, a considerable number of questionnaires could not be included in our analyses, for example, because the respondent could not be linked with a school sustainability profile. Altogether, analyses were conducted on a small dataset, so chance capitalization is a lurking threat (van der Linden & Glas, 2000). Furthermore, the responses from respondents can be classified as self-reports, which can threaten the research's validity (Donaldson & Grant-Vallone, 2002). Because of COVID-19, expanding the number of respondents was not possible. We recommend replicating this study with a larger number of respondents, using the same theoretical framework and the instrument that was developed. Despite the limitations of the study, the results do point to several tentative but important conclusions, as we will explain below. Another limitation is that, although we aimed to research the influencing factors of the sustainability of the data-use intervention, with the current data set we cannot make any causal claims. We could only look into whether current perceived levels of the factors differed depending on the school's recent status regarding sustainability of the data-use intervention over the past years.

## 4.9 Conclusions

Based on the literature, it was expected that the eight variables would be aligned with the sustainability of the data-use intervention in schools. However, the results of comparing levels of the eight influential factors in sustainable schools (profiles 2, 3, 4) and in not-sustainable schools (profile 1) as perceived by teachers indicated no significant differences between sustainable and not sustainable schools.

As our previous study (Tappel et al., 2023) showed that we need to view sustainability as more nuanced than simply sustainable versus not sustainable, we also compared levels of the eight influential factors for three different sustainability profiles. Because of the small number of respondents from schools with profile 4, the responses for profiles 3 and 4 were combined.

A statistically significant difference for providing individualized support was found; the individualized support for teachers by school leaders may be related to the sustainability of the data-use intervention. Teachers seem to feel more supported by their school leaders in schools where the data-use intervention has proven to be sustainable, relative to schools where the intervention was not implemented sustainably. Support means that a school leader is aware of the need to (continue to) develop teachers' skills for the intervention and facilitates their doing so, or provides clear direction for using the innovation for educational improvement, as also seen in previous research (Carpenter, 2015; Daniel & Lemons, 2018; van den Boom-Muilenburg, 2021). It was striking that school leaders in schools sustainable on the goal seemed more likely to provide individualized support than school leaders from schools sustainable on the method. This may mean that school leaders in schools sustainable only on the method were less involved in a data team (Huijboom et al., 2023) and are not capable of providing individualized feedback due to an information backlog. School leaders in schools that are sustainable on the underlying goal, that is, where educators and school leaders both work with data for school improvement, may find it easier to support employees.

A second school leader activity that was related to sustainability seems to be the facilitation of teachers' work on the intervention, as the LSD post-hoc test revealed that this type of facilitation was statistically significant for the profile sustainable on the goal (profile 2) compared to the profile sustainable on the method (profiles 3 & 4). This may indicate that teachers agree that time is specifically designated for working on data use for school improvement in schools where there is sustained work on that goal. It seemed that in schools that are sustainable on the goal of the data-use intervention, support from school leaders and related facilitation of work towards that goal make teachers feel that working with data for school improvement is considered to be important. This may be necessary for working with data for school improvement to become an organizational routine (Wolthuis et al., 2022b).

For attitude, buy-in, and beliefs, the LSD post-hoc test found statistically significant differences between schools sustainable for the goal and those in the other two profiles. Teachers from schools in profiles 3 and 4 (sustainable on goal, and sustainable on goal and method) seem to have a more positive attitude towards data use for school improvement compared to schools in profile 1 (not sustainable) and profile 2 (sustainable only on the method). This indicates that a positive attitude ideally is present beforehand, as often argued in the literature (Mouza, 2009), but can possibly also be developed by working on an innovation, for example, when teachers have confidence in its effectiveness (Saito et al., 2012). Another explanation could be that the perceived fear of working with data can turn into a positive attitude as experiences are gained (Diamantopoulos et al., 2023).

In sum, this study confirms that sustainability cannot be divided into sustainable versus not sustainable, but is more nuanced. This points to the importance of sustainability clusters. Three variables, in particular, may be related to the sustainability of the data-use intervention, namely, 1) teachers' attitudes, buy-in and beliefs, 2) individualized support of staff by a school leader including 3) the facilitation of data use for school improvement. Perceived levels of these variables differed between the different sustainability clusters. Further research should focus on these differences.





**CHAPTER 5**  
PROMOTING SUSTAINABLE  
EDUCATIONAL  
INNOVATION USING  
THE SUSTAINABILITY METER

## This chapter is based on

Tappel, A.P.M., Poortman, C.L., Schildkamp, K., Visscher, A.J (2023), *Promoting sustainable educational innovation using the Sustainability Meter*, Journal of Professional Capital and Community, Vol.8. No.3, pp. 234-244 <https://doi.org/10.1108/JPCC-02-2023-0008>

### Abstract

Schools struggle with sustaining their educational innovations (Cohen and Mehta, 2017; Askill-Williams and Koh, 2020) and may benefit from concrete and practical guidance (Askill-Williams and Koh, 2020). A dialogue between staff within schools can be a way to promote self-evaluation regarding the innovation. Therefore, a self-evaluation tool for educators was developed: the Sustainability Meter. The purpose of the tool is to gain insight into the different perspectives and experiences of stakeholders within the school organization regarding the innovation, as a basis for improvement-directed actions to promote sustainable educational innovation. In this small-scale study, we explored conceptual and instrumental use of the Sustainability Meter in two phases, and also examined user satisfaction. In terms of conceptual use, in general participants gained better understanding of each other's perspectives and backgrounds with regard to the (sustainability of the) innovation. The dialogue also led to insights into challenges for growth toward (more) sustainable innovation. For instrumental use, the results of the analysis were incorporated in a plan of action in the majority of the participants' schools. In terms of user satisfaction, participants in all groups perceived the tool as an enjoyable support for high-quality dialogue. The results of this study further show that we could distinguish between three types of instrumental use: initial solutions, short-term measures and long-term measures. This research provides some indications that the tool might lead to more sustainable educational innovations.



## 5.1 Purpose

Schools struggle with the process of making educational innovations sustainable (Askell-Williams & Koh, 2020; Cohen & Mehta, 2017; Hubers et al., 2017). Consequently, personal and economic resources are wasted (Askell-Williams and Koh, 2020) and students do not benefit in the long term (Mulders et al., 2014). The sustainable implementation of innovations seems to be influenced by many factors (Krijgsman et al., 2022; Prenger et al., 2022). Schools may benefit from concrete and practical support (Askell-Williams and Koh, 2020) in understanding the general, innovation-specific and school-specific factors that are associated with increased likelihood of sustainability (Cooper et al., 2015; Krijgsman et al., 2022).

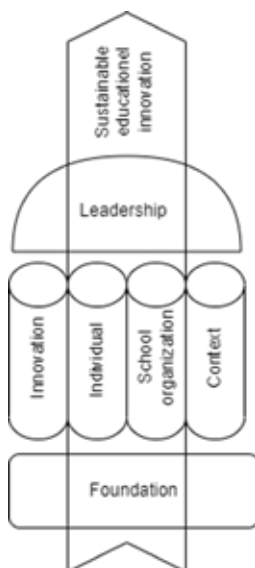
For this support, we developed a self-evaluation tool to assist educators' dialogue about sustainable innovation in their schools. The tool is called The Sustainability Meter (TSM) and was developed with the purpose of helping school staff to gain insight into the different perspectives and experiences of stakeholders within the school organization regarding the innovation, as a basis for improvement-directed actions to further promote sustainable educational innovation. The research question of this study was 'To what extent does the use of the Sustainability Meter promote the sustainability of schools' innovations?'

## 5.2 Theoretical framework

### 5.2.1 Sustainability

Sustainable implementation of educational innovations is achieved when the core components of the innovation are adapted to, integrated and scaled within the school's organizational routines (Prenger et al., 2022). The core components (Mathews et al., 2014) include the functions or principles and related activities considered necessary to achieve the outcomes of an innovation (Blase and Fixsen, 2013). Enacting these functions must be visible in organizational routines (Bambara et al., 2012; Bean et al., 2015), which are the main building blocks through which coordination, regularity and capabilities are generated in organizations (Dosi et al., 2000; Jacobs and Snijders, 2008). Organizational routines have *ostensive and performative* aspects (Feldman & Pentland, 2003; van den Boom-Muilenburg et al., 2019; Wolthuis et al., 2021a). The ostensive aspect of an organizational routine involves standard procedures and established standards. The performative aspect is defined as the specific actions that are undertaken to perform the organizational routine in practice (Feldman and Pentland, 2003; Van de Boom-Muilenburg et al., 2019). Organizational routines structure work practices and stabilize them over time. Consequently, organizational routines show whether and how the innovation unfolds in school practice in a repeated, recognizable pattern of interdependent actions, carried out by multiple actors (Wolthuis et al., 2022).

As long as the core components are maintained and based on the needs of the organization, adaptivity and continual adjustments of routines increase sustainability (Deaney and Hennessy, 2007; Elias, 2010; Prenger et al., 2022). Sustainability of an innovation is ideally considered before its implementation (Fagen and Flay, 2009; Adams and Jean-Marie, 2011). However, various factors also influence this sustainability after implementation has been planned (Prenger et al., 2022; Tappel et al., 2022; Wolthuis et al., 2021; Gaikhorst et al., 2018; Tappel et al., 2020). See Figure 1.



**Figure 1** The factors influencing sustainability of educational innovation

### 5.2.2 Influential factors

Agreement between the school's vision and policy seems important as a foundation for building sustainable educational development (Tappel et al., 2020; Wierda-Boer et al., 2020), as well as several overarching leadership features such as supporting colleagues, modeling and sharing knowledge. Four other groups of factors influencing the sustainability of innovations are also distinguished here, based on a systematic review of the literature (Prenger et al., 2022), namely the characteristics of the innovation, individual, context, and school organization.

One group of factors concerns the features of the *innovation* itself, such as its structure, its efficiency, and whether there is research evidence for its effectiveness. Characteristics of the *individual* concern the attitudes, involvement and motivation of individual stakeholders. *Context*

involves the formal and informal acknowledgement of educational innovations, for example, formal acknowledgement from a school board and informal acknowledgement by the community (e.g., parents). *School organizational* characteristics relate to how an innovation is carried out within the school. This also includes factors such as the degree of knowledge sharing within the school and the degree of collaboration between teachers (Tappel et al., 2022).

### 5.2.3 Supporting schools

Schools struggle with sustaining their innovations (e.g., (Hubers et al., 2017) and may benefit from concrete and practical support (Askill-Williams and Koh, 2020). One way to support schools is to assist them in reflecting on their progress in the process of sustainable implementation of their innovations, and one way to reflect on growth and development is through self-evaluation. Self-evaluation can be defined as ‘a cyclical process in which a school, on its own initiative and from an overarching quality assurance concept, in a systematic way describes and assesses aspects of one’s own functioning with the aim of (if necessary) school development’ (Vanhoof and van Petegem, 2022, p.31). As different personal perspectives on innovation-related work coexist within an organization (Schoenmaker, 2014; van Staveren, 2019), self-evaluation can focus on the different perspectives adopted by staff within the school (Vanhoof and van Petegem, 2022). Dialogue plays an important role in self-evaluation. A dialogue is ideally a constructive conversation in which each participant’s contribution is considered indispensable for the further development of individual participants, the group or the organization (Bohm et al., 2004). A dialogue can result in joint insights into what has been learned, productive frictions and instructive tension, and can point to what next actions should be taken to provide greater clarity about the school’s goals and how to realize those goals effectively and sustainably (Bohm et al., 2004, Lodders, 2013).

The use of a tool may help to support such dialogue between school staff that is intended to promote the sustainability of innovations (Chapman and Sammons, 2013). The tool is more likely to be successful if it was developed on the basis of valid theory, incorporates perspectives from various stakeholders, and provides a basis upon which concrete improvement-directed actions can be formulated (Andreou et al., 2014, McIntosh et al., 2011, Lodders, 2013).

## 5.3 The Sustainability Meter

To support schools in sustaining educational innovations, a self-evaluation tool that fosters dialogue between staff was developed, based on three previous studies into the sustainability of educational innovations (Alvarez and Otter, 2020; Beek et al., 2022; Prenger et al., 2022). The tool was checked in various ways during its development to promote its validity. For example, for construct validity (Baarda et al., 2018), the questions used in step 1 of the tool were derived from

existing scales (Fernet, 2008; Hubers et al., 2017; McIntosh et al., 2011; Van Gasse et al., 2017; Wayman, Shaw, et al., 2017), based on a literature review on factors influencing sustainability (Prenger et al., 2022). In a previous study (Tappel et al., 2020), the items were subjected to confirmatory factor analysis (CFA) and reliability analysis using SPSS 25, which indicated acceptable to good reliability (Field, 2009), as Cronbach's  $\alpha$  ranged from .652 to .958.

Internal validity is the degree of certainty that an established cause-and-effect relationship cannot be explained by other factors (Baarda et al., 2018), which here would be that progress toward sustainable educational development does not rely on chance or factors other than working with the Sustainability Meter. To promote this internal validity, about 20 researchers from across the world assisted by sharing ideas, piloting parts of the tool and engaging in peer review at different (inter)national conferences and workshops. Examples included anonymously rating different parts of the tool by using a padlet ([www.padlet.com](http://www.padlet.com)) and then brainstorming about how the tool could be more convenient to use, or trying out whether the tool indeed led to having a good conversation. Parts of the tool were also piloted in several workshops with about 25 teachers and school leaders. Minor adjustments were made after each session to promote clarity of the (language used in the) tool, for example, the use of identical wording rather than different words for the same concept. Lastly, the tool was piloted as a whole in one school; the dialogue was recorded to evaluate the functioning of the tool and the group that used it was interviewed. No adjustments were made in this stage.

To guide users in dealing with the complexity of sustainability, the tool is structured by the six types of influential factors (see Figure 1). These influential factors are grouped within 'pillars'. The tool supports dialogue about these pillars among school staff involved in an innovation, to help them share their perspectives and experiences on the progress of the schools' innovation, and formulate improvement-directed actions to promote its sustainability. The dialogue is meant to be initiated by a staff member, for example, a school leader, or a quality-assurance staff member, and supported by a chair. The chair can be the same person as the initiator, or an internal or external moderator (appointed as chair) and is expected to guide the dialogue.

### 5.3.1 The five-step approach

Before working with the tool, the chair invites a group of 6-10 stakeholders from different levels within the school to participate in the group dialogue. These stakeholders are involved in the innovation being reflected on, for example, teachers and school leaders, or teachers and students. A manual is provided with the tool to define a structure for conducting the dialogue, which includes its scientific basis, a guide for setting up the dialogue group and a step-by-step explanation of the tool. The Sustainability Meter tool (TSM) supports schools in sustaining their own innovation using a 5-step approach:

- 1) Stakeholders (i.e., educators who are directly involved) answer questions individually. Depending on the stage of school development (Vanhoof and van Petegem, 2022), participants focus on one pillar or a selection of pillars. Each pillar contains indicators and associated scales used and validated in previous studies on that specific group of influential factors (Tappel et al., in progress). These questions are intended to lead to a more specific understanding of how to take action to promote sustainability.
- 2) These stakeholders participate in a group dialogue: During this structured dialogue, the individual scores per pillar are compared (Chapman and Sammons, 2013), substantiated and discussed (Andreou et al., 2015; Elder and Prochnow, 2016) by the stakeholders.
- 3) Stakeholders decide on a joint score per pillar: These joint scores show the team's perceived progress towards sustainable development of the particular innovation. Possible improvement-directed actions are identified during the discussion of the differences in individual scores and what would be needed for a higher score.
- 4) Stakeholders analyze the reflection sheet with potential improvement-directed actions: All suggestions for improvement are formulated and written down on a reflection sheet to obtain a structured overview of possible next steps in terms of improvement-directed actions.
- 5) Stakeholders determine a concrete improvement goal and success criteria: On the basis of the analysis of the reflection sheet, improvement-directed actions are jointly chosen, including measurable, observable evaluation criteria and a timeframe.

### 5.3.2 Use of results

The literature on evaluation and knowledge utilization distinguishes between several purposes for use of results, for example, strategic use, symbolic use, misuse or abuse (Farley-Ripple et al., 2018). For this study, we distinguish between two types of utilization of (self-)evaluation results (Rossi & Freeman, 1993; Visscher & Coe, 2003): conceptual use and instrumental use (Weiss, 1998; Farley-Ripple et al., 2018). In conceptual use, no direct actions are taken, but the self-evaluation results influence stakeholders' thinking about issues, such as strengths and weaknesses of the innovation and possible directions for action, which may influence or initiate actions in the future (Weiss, 1998; Johnson et al., 2009). In instrumental use, the results are analyzed, and decisions and actions are based on the interpretation of these results (Weiss, 1998; Johnson et al., 2009). Taking a next step towards sustainable educational innovation requires deliberate choice of improvement-directed actions (Poortman and Schildkamp, 2012), by transforming information

into a decision (Mandinach and Gummer, 2016) that is valid for the particular use and purpose (Mandinach, 2012). TSM is intended to help teams obtain insights into the sustainability of the innovation and possible actions, based on self-evaluation results. Therefore, we focused on the conceptual and instrumental use of the tool.

Use of TSM depends on the tool's user satisfaction (Gatian, 1994). The users' perspective can be relevant for the tool's effectiveness (Gatian, 1994) and is a key predictor of intentions to continue use (Bhattacharjee, 2001). Hence, in this exploratory research we answered the following sub-questions:

1. *To what extent does the use of the Sustainability Meter lead to the conceptual use of its outcomes to promote the sustainability of a school's innovation?*
2. *To what extent does the use of the Sustainability Meter lead to the instrumental use of its outcomes to promote the sustainability of a school's innovation?*
3. *To what extent are users satisfied with the Sustainability Meter?*

## 5.4 Method

We conducted a small-scale pilot study using a mixed methods approach (Greene & Caracelli, 1997) to answer these questions about using TSM in secondary schools. With this design, we aimed to explore and describe in greater depth how the tool was used in various schools and whether schools benefitted from the support the tool offers. In order to allow others to apply the results to other situations for analytical generalization (Krathwohl, 1993), detailed illustrations were used (Poortman and Schildkamp, 2012). Data from different sources, namely, observational data, interview data and documents were collected and analyzed. They were used to confirm our findings across different approaches in order to maintain greater confidence in the conclusion. This was done for triangulation purposes to check whether measures identified in step five of the approach were consistent (Miles et al., 2014).

### 5.4.1 Procedure

The conceptual and instrumental use of the tool was studied in two phases. In phase 1, the tool was used under the guidance of the researcher (first author), who supported the chairs in taking steps before the group dialogue took place, and who then guided the dialogue itself as a moderator. Before the dialogue took place, the researcher helped with 1) choosing the innovation the dialogue would be about, 2) choosing the stakeholders involved and 3) choosing pillars, that is, the most urgent pillar given the current situation in the school, the highest (expected) return, or out of curiosity. By supporting the schools in this phase, the researcher could follow the process up close and use these observations to improve the tool or manual.

In the second phase, work with TSM was organized independently by the schools themselves, supported by the manual.

#### 5.4.2 Participants

In phase 1, five dialogue groups were formed, each including 6-10 members, for a total of 40 participants. One dialogue group was made up of quality assurance staff working at different schools under a large school board in the Netherlands<sup>1</sup>. The other groups were secondary school staff and students: one group from each of the four schools, one of which was under the large school board just mentioned. From the other three schools participants joined an interest group on sustainable school improvement via the Secondary Educational Council in The Netherlands<sup>2</sup> in which this tool was tested. They assumed the role of chair within their own school. Other participants had been invited by the chair and participated in the innovation the dialogue was about. The innovations had diverse themes; three were related to teaching or coaching students, and two had a more overarching character, such as schools' quality standards or student recruitment. The schools varied in how long they had already been working with the innovation, ranging from 6 months to 4 years, and therefore their stages of school development differed. Consequently, the tool was used in the stages of setting ambitions, analyzing the initial situation, or evaluating and indicating next steps. Participating schools were located in different parts of The Netherlands, and differed in size and the type of education they provided. In the Netherlands, students enter secondary education (on average) at the age of 12. Roughly four tracks can be distinguished. 1) Practical education takes 5 years and prepares for low-skilled work and independent living. 2) Pre-vocational education (lower level) takes 4 years and prepares for secondary vocational education. 3) Senior general secondary education (middle level) prepares students for higher professional education and takes 5 years. Senior general secondary education (higher level) prepares students for college directly and takes 6 years. Table 1 gives an overview of participating schools.

<sup>1</sup> The school board consisted of 13 schools and nearly 60 school location spread over The Netherlands.

<sup>2</sup> Originally, eight schools started in this project; five schools had to withdraw due to COVID-related problems.

**Table 1** Overview of participating schools

	School (pseudonym)	Region	Educational track*	School size (# of students)	Stage of school development**
1	Meadow View	East	1-4	1.391	c
2	Sea View	North-west	1-4	2.300	c
3	Valley View	East	2-4	1.581	c
4	Lake View	West	2-4	1.500	b
5	Forest View	Country-wide	1-4	34.169	a

\* 1 = Practical education, 2 = Pre-vocational education, 3 = Senior general secondary education (middle), 4 = Senior general secondary education (higher).

\*\* a) setting ambitions, b) analyzing the initial situation, c) evaluating and indicating next steps.

In phase 2 of the study, participants from three schools independently moderated a new dialogue group of 6-10 other school staff and/or students on the same or a related innovation, one group per school, for a total of 24 participants.

Table II gives an overview of the participants of both phase 1 and 2, their function in school, the innovation being considered, including the number of years working with it, and the pillars the dialogue was about.



**Table 2** Overview of participants, roles, innovation theme, number of years working with the innovation and chosen pillars

Group (chair's function)	Phase	# participants	Role	Innovation theme	# years working with the innovation	Pillars focused on
A (Teacher)	1	6	Teacher	Formative assessment	4	Individual School organization
B (School leader)	1	4	Student	Student elective work time	2	School organization Individual
		3	Teacher			
		1	School leader			
C (Project leader)	1	2	School leader	Student recruitment during COVID-19	1	Foundation School organization Leadership Context Intervention
		4	Teacher /			
		1	PR			
D (Quality assurance)	1	9	Teacher	Coaching mentorship	0.5	Individual Leadership
E. (Project leader)	1	9	Quality assurance employee	Quality standards	4	Foundation Context Individual Intervention
		1	Project leader			
F (Quality assurance)	2	9	School leader Head teacher	Coaching mentorship	0.5	Foundation Leadership
G (Quality assurance)	2	6	Teacher	Coaching teaching	2	Individual
		1	School leader			
H (Teacher)	2	7	Teacher	Formative assessment	4	Individual

### 5.4.3 Instruments

During steps 1 (answering questions), 2 (group dialogue) and 3 (determining joint score) of TSM's 5-step approach, data for **conceptual use** were collected in the form of observations of the dialogue, group interviews and documents generated by the participants. Based on the theoretical framework, including the possible improvement-directed actions described on the reflection sheet, the following criteria were evaluated:

- the degree to which the dialogue provided the users with new insights (including successes and weaknesses of the school's chosen innovation) as a result of working with the Sustainability Meter;
- the degree to which the dialogue led to formulating possible directions for improvement-directed actions.

During steps 4 (analyzing reflection sheet) and 5 (determining actions) of TSM, data for **instrumental use** were collected in the form recordings of group interviews, and documents generated by the participants. Based on the theoretical framework the following criteria were evaluated:

- the degree to which possible directions for improvement-directed actions on the reflection sheet were studied;
- the degree to which improvement-directed actions were based on the findings on the reflection sheet;
- the degree to which those actions were formulated and planned.

To measure **users' satisfaction** with the tool, the first level of Kirkpatrick's (1975) evaluation model was used, namely, the reaction level, in terms of participants' perceptions of their appreciation of the tool (Kirkpatrick, 1975, 1996; Craig, 1976). User satisfaction regarding the tool was particularly examined after phase 1, and participants' input was also used to improve the tool and manual before phase 2 started.

Table 3 gives an overview of the instruments used for collecting data about conceptual use, instrumental use and user satisfaction per phase.

**Table 3** Instruments per type of use and user satisfaction, per phase

	PHASE 1 Instrument		PHASE 2 Instrument	
CONCEPTUAL USE	Dialogue observation	Group interview and Group interview with chairs		Group interview with chairs
INSTRUMENTAL USE		Group interview and Group interview with chairs	Plan of action	Group interview with chairs
USER SATIS- FACTION		Group interview and Group interview with chairs		Plan of action

### 5.4.3.1 Phase 1

#### 5.4.3.1.1 Observation

Prior to the dialogue meeting, participants completed the questions for the chosen pillars. These responses formed the basis for the dialogue and were handed given to the researcher to prepare for that dialogue as a moderator. In the first phase of the study, members of the sustainable development interest group (chairs) were not part of the dialogue group, so they observed and took notes of the dialogue facilitated by the researcher. One chair was part of the dialogue group itself, as she was the project leader for the innovation being discussed. In this phase 1, the group dialogue meeting was audio- or video recorded for observation purposes (Kawulich, 2005). On the spot observations on participants' mutual interaction took place, for example, by checking whether everyone made an approximately equal contribution to the dialogue, as well as whether the input led to the formulation of potential improvement-directed actions. These improvement-directed actions were summarized on the reflection sheet. For reliability purposes, the potential improvement-directed actions and observations were also used for member checks with the chairs. The dialogue meeting lasted 60 to 120 minutes.

#### 5.4.3.1.2 Group interview

Group interviews were conducted at several moments during the process of using TSM to examine both the conceptual and instrumental use.

In phase 1, directly after the dialogue meeting, a group interview took place with all the participants who had taken part in the dialogue group to reflect on working with the tool (Baarda et al., 2018; Cohen et al., 2018). The interviews were video recorded and transcribed verbatim. For **conceptual use** the purpose of the group interviews was to reflect on the tool to gain deeper insight into what they thought and how they felt about (working with) the tool (Krueger et al., 2001; Cohen et al., 2018), for example, by asking whether the use of the tool had led to new insights and if so, which ones, or if not, what the tool was missing. Participants were also asked if they thought actions could be formulated based on the dialogue. For **user satisfaction**, participants were asked whether the tool was enjoyable to use, led to a good dialogue and how it might be improved. These group interviews lasted around 40 minutes each.

#### 5.4.3.1.3 Group interview with chairs

About six weeks after the dialogue, the chairs were interviewed online as a group to gather opinions and hear about their experiences (Gibbs, 2012; Baarda et al., 2018; Cohen et al., 2018). This group interview lasted 90 minutes. The aim of this group interview was to reflect on the process after the dialogue took place and the reflection sheet (step 4 of the 5-step approach) was completed. First, with the help of the online interactive tool Miro ([www.miro.com](http://www.miro.com)), statements in Dutch such as [translated] ‘The dialogue led to new insights about our innovation’ or ‘The sustainability meter helped us towards sustainable educational development’ were used to individually plot answers on a sliding scale between “Don’t agree” and “Agree”. Then an in-depth dialogue took place in which participants could also respond to each other. For **conceptual use**, they were asked whether they had gained insight into the successes and challenges of making the innovation sustainable. **Instrumental use** was examined by means of questions about the degree to which evaluation findings were studied and whether measures could be formulated (and eventually were implemented) on the basis of the use of the tool, as summarized on the reflection sheet. For **user satisfaction**, participants were asked if working with TSM suited their needs, if using the tool was appreciated and led to a dialogue. The protocol was assessed with a researcher colleague who is also a school leader and with a teacher. No adjustments had to be made.

#### 5.4.3.1.4 Plan of action

After the group interview had taken place, the chairs turned in a plan of action to the researcher, so that elements of instrumental use and user satisfaction could be evaluated. This document contained a blueprint of concrete measures, plans or actions formulated, based on the dialogue

**(instrumental use)**. For example, to what extent desired behavior was described at the teacher or student level, and if next actions were clear could be determined. We explicitly checked whether the measures in the plan resulted from the potential improvement-directed actions as summarized on the reflection sheet.

#### 5.4.3.2 Phase 2

In phase 2, the researcher's role was taken over by the chair, as a member of the sustainable development interest group. The chairs used the tool themselves independently with support from the manual. The researcher was not present and data collection took place by means of group interviews.

##### 5.4.3.2.1 Group interview with chairs

Afterwards, these chairs were interviewed by the researcher together as a group, to reflect on the use of the tool and the support from the manual. All schools used the tool between 2 and 10 workdays before the interview. This group interview took 90 minutes. Participants first indicated their progress on the schools' innovation with the help of 'the walking scale'<sup>3</sup>, a way of working based on the theory of progress-oriented work (Visser, 2014). This scale helps to visualize the process towards the set goals from the start, and thus to arrive at the next step in sustainable educational development. Participants started by describing their ultimate goal, including success criteria that would be scored '10'. Then they scored their starting point as 0, and subsequently scored the current situation - how far they had come since the start. This built-in reinforcement is supportive for sustainability (Kirtman, 2002; Stringfield et al., 2008) and was used before the participants reflected on the way TSM did or did not help them to identify the next step. Then further questions for in-depth insight were posed. For **conceptual use**, questions sought to find out if new insights such as strengths and opportunities were reached and if possible directions for improvement-directed actions as a result of the dialogue were recorded on the reflection sheet. For **instrumental use**, participants were asked whether after evaluation findings were studied, concrete actions for improvement based on the results had been formulated and planned. The chairs also provided suggestions for improvement to the tool so it can be used independently.

##### 5.4.3.2.2 Plan of action

In this second phase, the chairs also handed in a plan of action. The researcher determined whether concrete measures were formulated, and if these measures were based on the outcomes of the dialogue (**instrumental use**). We checked whether there was a direct link between the measures in the plan and the possible improvement-directed actions as described on the reflection sheet.

<sup>3</sup> (<https://progressiegerichtwerken.nl/de-schaalvraag>)

Figure 2 gives a timeline of the data collection indicating per phase the step of tool use after which data were collected for **conceptual use**, instrumental use and user satisfaction (see figure 2).

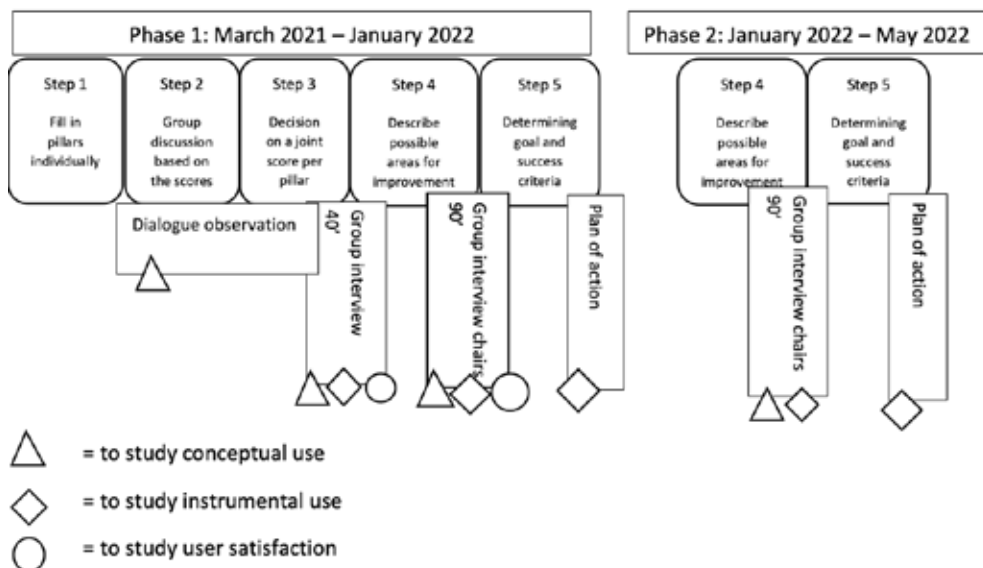


Figure 2: Timeline of data collection

### 5.5 Analysis

The analysis of the collected data in both phase 1 and phase 2 involved six steps. First, the dialogue meetings (step 1-3 of the approach) and the digital video-recordings of the discussions in the group interviews were transcribed verbatim per school. Second, with the help of a protocol, two researchers collaboratively categorized the transcripts as related to a) conceptual use, for example, statements about new insights, formulation of possible improvement-directed actions; b) instrumental use, for example, how evaluation findings were studied; and c) user satisfaction, for example, trust that the tool will lead to sustainability, trust in on-the-job performance and including suggestions for adjusting the tool.

Then, the categorization was organized in a table per school and per concept to give an overall view of the use of the tool. Fourth, conclusions were drawn about conceptual use, instrumental use and user satisfaction and substantiated with quotes from participants. Fifth, the answers

were verified by analyzing the provided plan of action for congruence, for example, if the measures indeed were based on the dialogue and whether the actions in the plan of action followed logically from the improvement-directed actions. And finally, the plan of action was checked for the concreteness and measurability of formulated and planned actions.

## 5.6 Validity and reliability

For triangulation purposes, to enhance validity, data were collected from multiple sources and collected across time (Poortman and Schildkamp, 2012). Data from phase 1 were collected between March 2021 – January 2022 and for Phase 2 between January 2022 – May 2022. Data were gathered across spaces; participants had diverse roles in a variety of schools, with diverse student populations in distinct parts of the Netherlands. The individually completed questions formed the basis for the dialogue. The data were audio/videotaped and summarized, and the reflection sheet was member-checked by the chairs to eliminate alternative causal interpretations. The dialogue was observed and the group interview supported the observations. The chosen measures were compared with the reflection sheet and checked with the schools' plan of action. Validity was supported by the structured method of analysis: transcribing dialogues and interviews verbatim, and transcribing observation notes to supply further evidence (i.e., from quotes) to illustrate the findings.

Reliability in this research means that the results of using the tool are similar under consistent conditions; it was promoted in several ways. First, the results (possible directions for improvement-directed actions) of the dialogues in two schools were formulated on the reflection sheet by the first author as well as by designated chairs who were both members of the sustainable development interest group. These chairs did not participate, but observed the schools' dialogue group. Both formulations were compared with each other and were indeed similar on content. Second, a protocol for observing the dialogue was developed and assessed by a researcher colleague, a school leader and a teacher. Third, verbal interactions (dialogues, discussions, and interviews) were recorded on video/audio. Fourth, these recorded sources were analyzed using an observation protocol. And fifth, notes and observations were used for member checks with the chairs (Poortman and Schildkamp, 2012). We corroborated the findings by using quotes from the interviews to illustrate the results.

## 5.7 Results

An overview will be provided here of the observed conceptual and instrumental use of the Sustainability Meter, and the extent to which users were satisfied with the tool, supported by quotes.

### 5.7.1 Phase 1, conceptual use

In a number of group interviews, the participants opened the conversation by saying that they liked having a structured dialogue with people involved in the innovation. The group interview results showed that most participants had gained new insights into challenges related to the innovation in their school by using the tool. This is supported by quotes such as [translated from Dutch]: *[Working with the tool] taught us something new' and 'The subject was far too broad and not everyone knew exactly what was meant [at first]. In the end, the problem became clear'*. This was mentioned a total of 20 times in all groups, both by participants and by chairs during the group interviews after working with the tool. Their own understanding of the problems they experienced in relation to the innovation were also mentioned as a result of TSM use. 'I now understand where my frustration comes from' was a reaction from teachers who had to inform parents of potential students about ongoing developments that were still subject to change.

New insights regarding successes related to the school's innovation were not highlighted with the tool. Participants from two schools referred to that as a deficiency, although at one school they indicated that the tool does provide insight into how to measure success. Interviews with the chairs showed that also having the tool help identify progress in the innovation process would add value.

To illustrate the process of the innovation towards sustainability, one of them referred to Charley Mackesy's (2019) quote: *"We have such a long way to go", sighed the boy. "Yes, but look how far we've come", said the horse"*.

According to the dialogue observations, some participants, especially teachers, stated that the tool helped them feel acknowledged in their particular struggles, for example, regarding how to provide relevant elective work time for students<sup>4</sup>: *'It is a confirmation of what I already felt, but that we never mention to each other'*.

Observations during the dialogues revealed that school leaders or project leaders assumed that the vision, stated goals and related activities were known in the organization, but they were not always recognized by others within the organization. In that respect, there was a gap between leaders and implementers of the innovation.

As far as possible improvement-directed actions are concerned, all dialogues produced a list of possible (direction for) actions. For group D, for example, who were working on the sustainability of a coaching mentorship innovation, some possible improvement-directed actions they came up with were: communicating about positive experiences in working with the innovation;



informing mentees about what teachers say about them; making the goal more concrete, including the description of the terms used; measuring implementation progress, so that it is clear to everyone what is meant, and when the goal is achieved.

### 5.7.2 Phase 1, instrumental use

All schools studied the possible directions for improvement-directed actions on the reflection sheet. This was done mostly by the chairs themselves, for example, by making a hierarchy of importance, or organizing the results by topics.

Regarding measures to be taken, it became clear that all schools formulated measures based on the results of the dialogue: *'We were able to apply all the possible measures mentioned for the shorter term directly or incorporate them into the project plan'*. As a mark of their enthusiasm, the five chairs mentioned this 13 times during the group interview, and the link between the improvement-directed actions and the reflection sheet was confirmed by document analysis. This could be a small step, such as sharing feelings with the school's management or sharing students' experiences with teachers. Based on the results of the dialogue group, for example, one improvement-directed action was that school leaders had a dialogue about the pillar 'Foundation'. After analyzing the reflection sheet, initial solutions' were often applied first. In dialogue group B, for example, this concerned the student elective worktime innovation theme: a blockage preventing students from starting to work could be removed immediately by setting up a silent work room, as suggested by the students in the dialogue group. In dialogue group D, participants indicated that teachers struggled with the online tool used to provide students with feedback. Providing a step-by-step user manual for that online tool was necessary and a quick initial solution.

After these kinds of initial solutions, concrete improvement-directed actions or directions for the short and longer term were chosen and planned. An action plan in group B concerned coaching students more in their planning and in making choices. In group C, student meetings were planned to involve them in recruiting new students. One school was not precise about the actions taken, even after deeper questioning. In four out of five groups, the results of the analysis were included in short- and long-term planning: [translated] *'[We looked at the] possible improvement-directed actions in the short, concrete term. And we have chosen and developed 4 longer-term main goals including success criteria and monitoring'*. This included how to monitor the actions and the assignment of colleagues responsible. This was also recorded in a project plan, a school/team plan or a school's agenda in three of the schools.

### 5.7.3 Phase 1, user satisfaction

The tool was experienced positively by the participants. It was perceived as an enjoyable tool to work with and helped with having a good dialogue, as mentioned 11 times during the group interviews directly after working with the tool. The combination of the individually completed questions (step 1), the dialogue about them (step 2) and the overview in the reflection sheet (step 4) was marked as especially valuable, as this was mentioned 10 times during the chair interviews, for example: [translated] *The combination of the individual questions, the dialogue and the reflection sheet lead to a step towards sustainable educational development: if I had to give a mark it would be between 8 and 9*. The tool met the needs of schools and participants from all schools suggested digitalizing the tool and sharing it on national platforms so that it could be more widely used.

Four out of five schools chose to use TSM on a sub-aspect of the school's entire innovation. For example, within the theme of increasing student ownership, the dialogue group focused on teachers providing feedback to students. In the interviews, participants implied that precisely this focus provided insight into how the challenges relate to the school's entire innovation. The group of participants who used the tool for a broader innovation such as increasing student ownership indicated that they eventually came to an understanding, but that it took longer: [translated] *The subject was far too broad and not everyone knew exactly what was meant. In the end, the problem became clear*. Observation of the dialogues showed that the broader the subject, the more chaotic the conversation was. The tool appeared to help break up the process into smaller, clearer and more feasible improvement-directed actions. In addition to general wording such as [translated] *Working with the tool taught us something new*, eight participants specifically reported gaining insight into the action steps needed to make the innovation more sustainable, such as an unambiguous way of working.

All chairs indicated that their next actions were clear: [translated] *We got very clear about where the biggest bottleneck is and how to tackle it*. They also suggested that there can be a critical point for the deployment of concrete actions: [translated] *I can imagine that there are schools that need the opportunity for collaborative thinking at the stage between the reflection sheet and formulating improvement-directed actions*. There is then particular reference to coming up with really concrete actions rather than continuing to talk about possible improvement-directed actions. In groups with students involved, the next actions were defined more concretely.

### 5.7.4 Phase 2, conceptual use

In two schools, the session was led by teachers. These teachers indicated that they were afraid to lead the conversation with their colleagues, saying that they did not have the necessary

distance to lead the dialogue about a controversial subject, and were afraid of being addressed personally or being held responsible for outcomes that would be viewed negatively by colleagues within the school. One teacher therefore dodged a new loaded topic by repeating the topic from phase 1 with other teachers within the same school. This teacher then felt more secure by being prepared for the content of the conversation. One of the teachers had a school leader, also a member of the sustainable development interest group, lead the dialogue. Quality assurance staff and school leaders did not feel this insecurity. In terms of leadership, the chairs implied that the presence of a school leader could influence the outcomes. Teachers may feel threatened, and not be completely open in their responses.

Student presence in the dialogue group made the conversation less offensively formulated and more respectful towards each other, as indicated by participants and confirmed during observations.

Regarding new insights, participants in all dialogues reported that there was an understanding of weaknesses in the intervention discussed, for example, too many teacher-driven classes within a school in which the aim was to be student-driven during part of the teaching hours. Unlike in phase 1, in this phase not mentioning successes related to the innovation at hand was not identified as a shortcoming.

According to the participants, possible improvement-directed actions were formulated, such as professional development for coaching mentorship, or organizing activities as part of student voice. One chair planned a next (third) dialogue with a new group of participants, based on the outcomes of the dialogue in phase 2.

Steps 3 and 4 of the tool's 5-step approach were completed slightly different per step by the participants in this phase. In step 3, no joint score was filled in. Two of the chairs reported that the content of the dialogue was more important than discussing the joint score. Both chairs themselves gave a score based on the dialogue and the completed pillars.

In step 4, possible improvement-directed actions were not written down on the reflection sheet. All dialogue groups used their own way of reporting the improvement-directed actions, mostly by using a note-taker who took meeting minutes of all possible improvement-directed actions per pillar as proposed during the dialogue, while respecting the privacy of the participants. In all cases, use was made of a Word document that looked similar to the reflection sheet.

### 5.7.5 Phase 2, instrumental use

In two schools, the findings were studied with the help of the reflection sheet accompanying the tool, or a similar sheet designed within the school itself. In both schools, a distinction was made between initial solutions and longer term improvement-directed actions. These improvement-directed actions were formulated based on the outcomes of the dialogue, such as on-the-job training for coaching students or organizing a new dialogue using the tool that included students' voice. The improvement-directed actions for the longer term had not yet been formulated in one school, but in the second school they had been. These planned actions were described in very concrete terms, such as [translated] *'in week 36 three videotaped student-mentor discussions will be analyzed during our team meeting in order to discuss quality standards'*. The chair from this second school also planned to use the Sustainability Meter in a cyclical manner on a yearly basis.

## 5.8 Conclusion and discussion

Schools struggle with sustaining their educational innovations (Cohen and Mehta, 2017; Askill-Williams and Koh, 2020) and may benefit from concrete and practical guidance (Askill-Williams and Koh, 2020). Dialogue between staff within schools can be a way to promote self-evaluation. Therefore The Sustainability Meter was developed, a self-evaluation tool for educators. The purpose of the tool is to gain insight into the different perspectives and experiences of stakeholders within the school organization on and with the innovation, as a basis for improvement-directed actions that can promote its sustainability. In this small-scale study, we explored conceptual and instrumental use of the Sustainability Meter in two phases, and also examined user satisfaction.

### 5.8.1 User satisfaction and conceptual use: understanding perspectives and challenges

In terms of user satisfaction, participants in all groups perceived the tool as enjoyable to use and as supporting high-quality dialogue. Answering questions individually first (step 1) was valued highly, because it was seen to deepen the dialogue that followed. Many participants indicated engaging in dialogue as an added value, because they felt heard and taken seriously and because improvement-directed actions that resulted from the dialogue were taken. It was striking that the chairs also dared to be vulnerable, choosing a pillar in which their own role was critically examined. In phase 2 of the research, in which the tool was used independently and with the help of the manual, the chair in one of the groups, a teacher, was reluctant to lead the dialogue. This was unexpected given the ease with which school leaders played their own roles in the group discussion. Personal factors, such as self-efficacy (Bandura, 2010), may have influenced this, as well as factors within the school organization. The culture of the school is important both for this (lack of) willingness and for sustainable educational development (Bambara et al., 2012). It would be interesting to explore the underlying cause, because a step in personal development can be taken through success experiences.

In terms of conceptual use, the dialogue at times confirmed participants' latent thoughts; in general, participants gained better understanding of each other's perspectives and backgrounds with regard to the (sustainability of the) innovation. Allowing the conversation to speak at the level of school culture requires not only discussing what teachers do, but also finding out about what they think and want. Culture matters in change (Vanlommel, 2021). The dialogue also led to insights into challenges for growth toward (more) sustainable innovation.

### 5.8.2 Three types of instrumental use

In the majority of the schools the results of the analysis were incorporated in a plan of action, with a short- and longer-term planning, including monitoring. Next to developing an action plan based on the results of the school, the tool also appeared to help breaking up the process in smaller, clearer and more feasible improvement-directed actions. In all schools, participants took measures based on the results. They first structured the possible improvement-directed actions by topic or by making a hierarchy of importance. Sometimes participants internally verified the outcomes with other educators. The results of this study further show that we could distinguish between three types of instrumental use.

1. Initial solutions: All schools first applied 'initial solutions'; simple practical adjustments that can be made and realized quickly, such as clarifying a format used or setting up a quiet room for students. These actions were mostly proposed during the dialogue by teachers or students. These initial solutions make it easier to work with the innovation, but also strengthen user engagement (Drits-Esser et al., 2017). The advantage of initial solutions is that there is immediate success within the organization, which positively affects morale. The disadvantage is that these solutions are mostly administrative measures at the micro-level, and may not be robust enough to affect the meso- (network within the school) and macro- (school context) levels to promote sustainability (Krijgsman et al., 2022). A danger is that after implementing initial solutions, attention may not return to understanding the underlying reason for ineffectiveness (Stoll and Myers, 1998), which does not promote sustainable educational innovation.
2. Short-term measures: These are specifically defined actions that require coordination within the organization, but that can be deployed in the short term.
3. Longer term measures: These are complex and will affect multiple innovations or layers within the organization. Often a time period of several months or even years is needed to concretize or achieve the exact goal.

The improvement-directed actions in this research often were a combination of initial solutions, short-term and longer-term measures. For example, for group D, which addressed coaching mentorship, an initial solution included the creation of a manual for using the online tool for providing feedback to students. The short-term measure was about explaining the how and why of this innovation to teachers, students and parents, including scheduling moments to plan such conversations based on the feedback provided. But then this measure required a longer-term action, namely, practice and exchange with each other to achieve a high-quality standard for providing feedback to students, coaching the student to turn feedback into action and having conversations about it with mentor and parents. One school was vague in explaining the exact improvement-directed actions taken. This might have been due to time management, as indicated by the chair, but may also have had to do with (the fear of asking for) individualized support from a school leader (Thoonen et al., 2011), as no school leader was involved in the dialogue in phases 1 and 2. Involved leadership is key in implementing and sustaining educational innovation (Krijgsman et al., 2022; van den Boom-Muilenburg, 2021; Tappel et al., 2022; Prenger et al., 2022). A third reason could be that this process was too dependent on one catalyst. Such processes can be organized by involving different formal and informal leaders in a school when making decisions (LaPointe-McEwan et al., 2017; Hubbard and Datnow, 2020), because shared decision-making may increase human capacity in an organization and because those involved feel empowered to innovate in their context (Park and Datnow, 2009).

### 5.8.3 Sustainable implementation

As elaborated in the theoretical framework, for sustainable implementation of innovations, the core components must be adapted to, integrated within, and scaled for organizational routines (Prenger et al., 2022). As the number of years working with the innovation varies prior to the dialogue, the extent of presence of organizational routines where of varying degrees in schools as well.

The Sustainability Meter helps to tighten or fine-tune routines. For example, scaling up the innovation was a main theme in group A. Dialogue H was held in the same school, with other participants. By focusing on the pillar 'Individual', it became more clear what is needed to scale up the innovation in the school. In group H, it appeared that the knowledge gained about formative assessment needed to be applied in practice. Adoption of coaching mentorship was a focus in school D. It turned out that school leaders from different departments were not sending out equal messages, adoption proved difficult. As a result of the dialogue in this group, a new dialogue was organized with school leaders (Group F) to promote adoption.

This also applies to the further integration of the core components in organizational routines, as in Groups B and E, where procedures and actions had to be sharpened. Both ostensive and performative organizational routines were being worked on in the groups studied.

#### 5.8.4 Leaders and implementers of an innovation.

During the dialogues, the expected alignment between vision, goals and activities in their schools were not always recognized and experienced by participants. There appeared to be a gap between leaders and implementers of the innovation. According to insights from the educational change literature, poor results are seen with a top-down approach where the director of a change conceives of, implements, and evaluates the change (Fullan, 2011; Verbiest, 2014).

School leaders should maintain an overview of leadership activities, and tasks and responsibilities should be distributed (Harris & DeFlaminis, 2016). Through distributed leadership, support and ownership is created (Supovitz et al., 2019).

In the second phase of the study, it became clear that the group's moderator needs leadership skills to be able to guide the dialogue with appropriate distance and self-confidence. Teachers were particularly afraid of a lack of reciprocal respect, which is an important condition for leading a dialogue (Adams et al., 2019), in addition to skills such as active listening and avoiding judgment.

In one school, no school leader was involved in the dialogue. The school works with self-managing teams, with teachers leading and the school leader acting as facilitator. This resulted in a conversation with very involved teachers, but new teachers were not always informed about the background of the developments, and it was unclear who would take the lead in the next step. In another school, a quality assurance employee was the chair. In the first conversation, she and a school leader were the audience; in Phase 2, she led the conversation among a group of school leaders. From these examples, we can tentatively conclude that leadership qualities or interference from leaders are important for the follow-up process.

We can draw a comparison between improving and renewing learning: improving involves practical, short-term adjustments to current ways of working to achieve existing goals. From this perspective, the shorter-term focus is to stay on course (Moolenaar et al., 2012). For renewal, current visions of education are questioned, and new goals are formulated (and evaluated and adjusted) through reflection and research. Change requires long-term vision (Bean et al., 2015) and focus.

## 5.9 Practical implications

Stakeholders were enthusiastic about the tool and made some suggestions for improvement and scaling up. Most of the suggestions were technical adjustments, such as digitalizing the tool and recommendations regarding its accessibility and findability. Other suggestions could be categorized as clarifications of the manual for the tool, for example, tips for setting up the dialogue group. All recommendations were added to the manual and/or digital version of the tool.

While working with the tool, participants experienced the dialogue as more important than the determination of a joint score per pillar. In most dialogues in phase 1, the determination of the joint score was less appreciated because it distracted from the dialogue. In phase 2, the joint score was not always determined for that reason. Nevertheless, determining a score monitors the progress of the innovation's sustainability (Saito et al., 2012; King, 2016). This score can also be seen as reflecting the innovation's successes when the tool is used cyclically. Scores can therefore be determined afterwards, and the digital version of the tool gives average scores for the answers.

The reflection sheet gave an overview of possible improvement-directed actions and also encouraged taking action, but in phase 2, the reflection sheet was replaced by a way of working that suited the school organization. This flexibility, provided that all possible points for improvement have been identified, can be seen as a specific element of the definition of sustainability (Prenger et al., 2022; Deaney and Hennessy, 2007; Elias, 2010).

The line of reasoning in this study is that schools can be supported in making the innovations they are implementing sustainable by having them reflect on that process through self-evaluation. One characteristic of self-evaluation is its cyclical nature. Apart from the systematic one-time examination of functioning, TSM can also be used cyclically. However, the danger of one-time use is present. As with following up on the chosen long-term measures, a school leader or employee should pay attention to medium- and long-term quality and incorporate use of the tool cyclically. One strength of TSM is the dialogue from different perspectives. The composition of the dialogue group is important in this regard, as noted in the TSM manual.



### 5.9 Limitations and suggestions for further research

We acknowledge several limitations of this study. First, this was a small-scale exploratory study. The results indicate how TSM might support the innovation process, and that (future) users might trust that the tool will help to sustain their educational innovation. Second, we did not study whether planned actions were actually implemented after phase 2, so we cannot claim that the tool is helpful in making educational innovations more sustainable. Third, some of the participants volunteered to join an interest group on sustainable school improvement and therefore might have been more motivated to explore the tool.

Although this research provides some indications that the tool might lead to sustainable educational innovations, we do not know whether planned actions were actually implemented and whether these results are representative of larger-scale use under different conditions. For clearer evidence, longer term research into the use of the tool is recommended to determine whether the Sustainability Meter indeed leads to sustainable educational innovation.



**CHAPTER 6**  
CONCLUSION  
AND DISCUSSION

## **6.1 Introduction**

Longitudinal studies of innovation processes and the sustainability of these innovations are very scarce; as a result, we do not have validated theories of what it takes to innovate successfully and sustainably in education (Cohen & Mehta, 2017; Datnow, 2005; Mijs, 2007).

The four studies in this dissertation were undertaken to learn more about the sustainability of educational innovations. In two of the four studies, we zoomed in on one specific intervention: the data-use intervention.

In this final chapter of this dissertation, the results of the four studies are summarized and discussed (6.2), a general conclusion is presented (6.3), and, lastly, some limitations and recommendations for further research are presented (6.4).

## 6.2 Summary of the findings

### 6.2.1 Study 1: How can educational innovations become sustainable? A review of the empirical literature

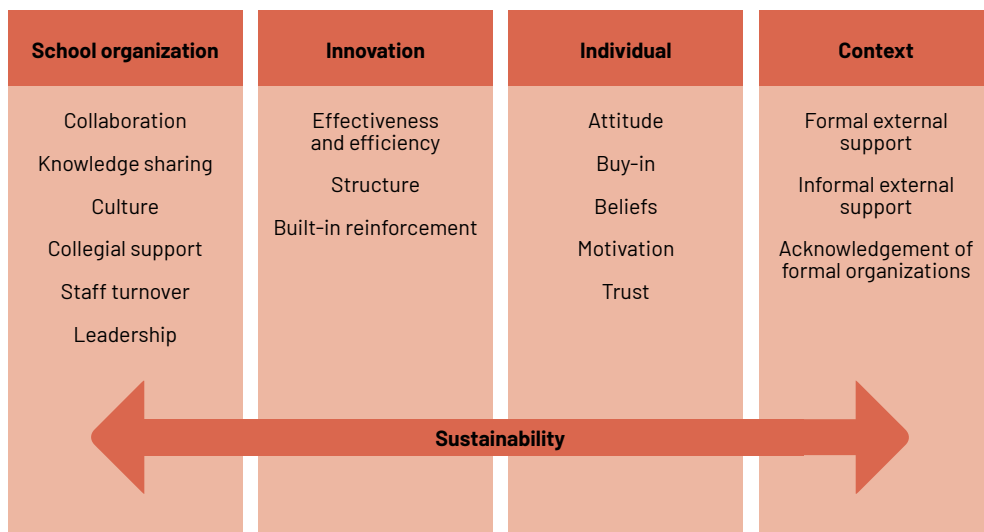
In the first study, a systematic review of empirical literature was conducted to provide a definition of sustainability and to give an overview of the factors influencing the sustainability of innovations.

Based on the literature review, the following definition of sustainable educational innovation was formulated: *Sustainability refers to the process of continuing and integrating the innovation's core aspects in organizational routines that are adaptive to ongoing work.*

This definition of sustainability of an innovation emphasizes several key aspects. First, sustainability is viewed as a developmental process starting from the initial stage of change (Fagen & Flay, 2009), rather than a final phase (Fullan, 1992). Second, the core aspects of the innovation must be continued. Third, for sustainability, these core aspects should be integrated into the daily organizational routines of the school (Wolthuis et al., 2021a). Fourth, the results achieved should be maintained or improved (Elder & Prochnow, 2016a). And fifth, the innovation should be adaptable over time to align with the school's needs, while adhering to its core components (Elias, 2010b; Quinn & Kim, 2017).

Multiple factors that may influence the sustainability of educational innovations could be identified in diverse, mainly qualitative, studies. We used an often-used categorization of factors influencing sustainability (Hoogland et al., 2016; Rikkerink et al., 2016) to structure the findings: characteristics of the school organization (including leadership), individual characteristics and context characteristics. Based on the review's findings, a new category was added to this structure, namely, characteristics of the innovation itself.

Figure 1 gives an overview of the factors that were identified in the literature as possibly influencing the sustainability of educational innovation. For a detailed description of each of these factors, see Chapter 2.



**Figure 1** Overview of factors influencing sustainability

The recommendations for further research based on this review’s findings led to the three other studies reported in this dissertation: 1. a study on measuring the degree of sustainability of a specific intervention, the data-use intervention, 2. a study into the factors influencing the sustainability of the data-use intervention, and 3. an investigation of the use of a tool we developed, the Sustainability Meter, to support schools in sustaining their educational innovations.

### 6.2.2 Study 2: Distinguishing aspects of sustainability

In the second study of this dissertation (Chapter 3) we focused on measuring the sustainability of a data-use intervention. For that purpose, we used the core components of the definition of sustainability as found in the systematic literature review.

The research question was ‘How sustainable is the data-use intervention in secondary schools in the Netherlands?’. Data were collected in structured telephone interviews (1 expert per school, N = 29 school locations). A distinction was made between sustainability of the method and sustainability of the underlying goals of the data-use intervention. The outcomes of this study led to four school sustainability profiles, namely:

- 1) The intervention is not sustainable (24%). Schools with this profile neither continued to use nor scaled up the use of data teams.

- 2) The intervention is sustainable on its method (24%). Schools in this profile still had one or two active data teams, and the original data team was often still intact. The use of the data-team intervention had scaled up to a limited extent. The core components of the method were regularly carried out and most schools made slight adaptations to these core components
- 3) The intervention is sustainable on its underlying goal (31%). No data teams were active. Instead, some individuals made use of the data-team approach. The cycle of setting a goal, collecting and interpreting data, taking measures and evaluating on the basis of data (the underlying goal of the intervention) was a routine within several educational or subject-level teams.
- 4) The intervention is sustainable on both its method and its underlying goal (21%). Data teams remained active, and schools with this profile showcased a wider use of the underlying goal's core aspects, suggesting a more ingrained organizational routine.

The conclusion that the concept of sustainability is nuanced and can take several forms was warranted. More research was needed into which factors can foster the sustainability of data-use interventions, a topic which we addressed in Chapter 4.

### 6.2.3 Study 3: Factors influencing the sustainability of a data-use intervention

The research on sustainable educational innovation reports many different, potentially influential factors (Krijgsman et al., 2022; März et al., 2018; Prenger et al., 2022<sup>5</sup>). The outcomes of the systematic literature review in Study 1 (Prenger et al., 2022) pointed to different groups of factors that may influence the sustainability of educational innovations. In Study 2 (Chapter 3) we found four profiles of sustainability of the data-use intervention. The research in Study 3 (Chapter 4) combined the perspectives from these two studies: *Which (combination of) factors explain differences in the sustainability of the data-use intervention?*

For data collection we used an online survey for school personnel ( $N = 307$ ), based on the theoretical framework in Chapter 2 and on existing valid instruments. Although this study was highly affected by COVID-19 in terms of low response rates, some tentative conclusions could be drawn. Just as in Study 2, this study also points to the importance of a nuanced picture of sustainability. Furthermore, three important factors influencing the sustainability of the data-use intervention were found, in particular for schools that are sustainable on the underlying goal of the data-use intervention.

First, support from a school leader may influence sustainability, at schools sustainable on the method and at schools sustainable on the underlying goal. Support here means that school

<sup>5</sup> Prenger and Tappel shared first authorship.

leaders are aware of the need to (continue to) develop teachers' skills for the innovation, and provide a clear direction for using the innovation for educational improvement (Daniel & Lemons, 2018; van den Boom-Muilenburg, 2021). School leaders in schools sustainable on the underlying goal appear more inclined to offer personalized support.

One of the sub-factors within support from school leaders is the second important factor, namely, facilitation to work with data for school improvement. When teachers experienced that resources were specifically allocated to educators to work on data for school improvement, they felt that this work was considered important.

Third, the individual attitudes of teachers towards the innovation seems to influence sustainability of educational innovation. A positive attitude is typically considered to exist beforehand (Mouza, 2009). However, a positive attitude can possibly also be developed by working on an innovation, for example, when teachers have confidence in its effectiveness (Saito et al., 2012) or the perceived fear of working with data can turn into a positive attitude as experiences are gained (Diamantopoulos et al., 2023).

#### 6.2.4 Study 4: Promoting sustainable educational innovation using the Sustainability Meter

Schools struggle with sustaining their educational innovations (Askill-Williams & Koh, 2020; Cohen & Mehta, 2017) and may benefit from practical guidance (Askill-Williams & Koh, 2020). One way to assist them is by facilitating reflection on the sustainable implementation of innovations through self-evaluation. Self-evaluation is 'a cyclical process where a school systematically describes and assesses aspects of one's own functioning with the aim of (if necessary) school development' (Vanhoof & Petegem, 2022, p. 31). Given diverse perspectives within an organization (Schoenmaker, 2014; van Staveren, 2019), self-evaluation can focus on staff's different views (Vanhoof & Petegem, 2022). Dialogue, seen as a constructive conversation (Bohm et al., 2004), fosters joint insights, productive frictions, and instructive tension, guiding actions for clarity on school goals and effective, sustainable innovation (Bohm et al., 2004; Lodders, 2013). Therefore, a self-evaluation tool for educators was developed: The Sustainability Meter (TSM). The purpose of the tool is to gain insight into the different perspectives and experiences of stakeholders within the school organization regarding the innovation, as a basis for improvement-directed actions and to promote sustainable educational innovation.

The three research questions for this study were:

- (1) To what extent does the use of the Sustainability Meter lead to conceptual use of its outcomes to promote the sustainability of a school's innovation?



(2) To what extent does the use of the Sustainability Meter lead to instrumental use of its outcomes to promote the sustainability of a school's innovation?

(3) To what extent are users satisfied with the Sustainability Meter?

A small-scale study with a mixed-methods approach was conducted. The conceptual and instrumental use of the Sustainability Meter was explored in two phases with 5 schools, and user satisfaction with the tool was also explored. In Phase 1, the tool was used by a schools' dialogue group under the guidance of the researcher. A dialogue group consisted of 6-10 stakeholders from different levels within the school involved in the innovation being reflected on. In Phase 2, schools worked independently with TSM, supported by a manual. Data were collected by means of observations of the dialogue, group interviews and documents generated by the participants.

In terms of conceptual use, participants gained a better understanding of their own or each other's perspectives and backgrounds with regard to the (sustainability of the) innovation, for example, why the innovation was started or what skills gap the educators had with regard to the innovation. The dialogue about the schools' innovation also led to insights into challenges for sustainable innovation, such as being able to determine a next step.

For instrumental use, three types of instrumental use could be distinguished in the findings. All schools first applied initial solutions: simple practical adjustments that can be realized quickly with immediate success within the organization, such as setting up a needed quiet workspace for students in a school that was working on the student elective worktime innovation. Next came short-term measures: specifically defined actions that require coordination within the organization, but that can be deployed in the short term. An example of such a measure was the planning of student meetings to involve them in recruiting new students, in a school that was working on student recruitment during COVID-19. Finally, there were longer term measures: complex measures that affect multiple innovations and/or layers within the organization. An example of such a measure in a school working on innovation about student ownership was choosing and developing a longer term main goal based on the school's vision, including concrete success criteria and the way of monitoring.

In terms of user satisfaction, participants in all groups perceived TSM as a valuable support for high-quality dialogue. This research provides some indications that the tool might lead to more sustainable educational innovations.

## 6.3 General discussion

The four studies in this dissertation were undertaken to learn more about the sustainability of educational innovations. In the general discussion, we will discuss and reflect on three important outcomes of this thesis: the different profiles of sustainability for the data-use intervention that were found, the factors that might promote sustainability, and supporting schools in sustainable innovation.

### 6.3.1 Profiles of sustainability

The first general finding of this dissertation is the profiles of sustainability that were found. An important conclusion from our studies is that when studying the sustainability of an intervention, it is important to differentiate between sustainability of the method and sustainability of the underlying long-term goal. By making this distinction, four profiles of sustainability of the data-use intervention could be distinguished: 1) The data-use intervention is not sustainable; 2) the data-use intervention is sustainable on its method; 3) the data-use intervention is sustainable on its underlying goal and 4) the data-use intervention is sustainable on both its method and its underlying goal. Therefore, we suggest adding this distinction to the earlier presented definition of sustainability, and defining sustainability as: 'the process of continuing and integrating the innovation's core aspects in terms of both the method and goal(s) of the innovation in organizational routines that are adaptive to ongoing work'. An important scientific contribution of our research is that it made clear that distinguishing between different profiles of sustainability can be a first step to further understanding the process of sustainability. The profiles could help schools in investigating where substantive change in educational practice resulting from an innovation (Sanders, 2012) has taken place, and where it has not.

### 6.3.2 Factors influencing sustainability

The literature on a wide range of educational innovations points to various potentially influential factors (Gaikhorst et al., 2018; Krijgsman et al., 2022; Prenger et al., 2022). Based on our systematic literature review, we tried to find out which of the factors in the framework are the most important in explaining differences between schools in accomplishing sustainable innovation. We investigated to what extent differences in certain (combinations of) factors are associated with differences in the sustainability of the data-use intervention (in terms of each of the sustainability profiles). Three main factors emerged: 1) individualized support from the school leader including 2) facilitation, and 3) teachers' individual attitudes towards the innovation. However, these factors need to be examined further.

### 6.3.2.1 Individualized support from a school leader

Providing individualized support to staff and the facilitation of teachers' work on the intervention seemed to be the features most associated with sustainable data use in schools with Profiles 2 and 3&4. Providing individualized support in leadership involves leaders who recognize and understand teachers' concerns and needs (Thoonen et al., 2011). This support can be manifested through various actions, such as allowing teachers to experiment and make mistakes, fostering the exchange of expertise and experiences (Geijsel et al., 2009), and offering individual coaching and feedback (King, 2016). School leaders in schools sustainable on the data-use intervention's underlying goal appear more inclined to offer personalized support compared to school leaders from schools that are only sustainable on the method. In schools where data use has become a routine in the entire school, more teachers are using data, and perhaps therefore also more support is needed.

### 6.3.2.2 Facilitation

Facilitation seemed important in schools sustainable on the method as well as in school sustainable on the underlying goals. In most schools in which data teams are active, the work of data team members is facilitated by having a fixed spot in their schedule for data team meetings, extra time to perform tasks arising from the data team and opportunity to meet members of data teams from other schools (Schildkamp et al., 2019; Schildkamp, Poortman, Luyten, et al., 2017; van den Boom-Muilenburg et al., 2019). In schools that are sustainable on the underlying goals, educators experience having their data-team work be facilitated, even if it is not visible in a schedule. In these schools, the use of data for school improvement seems to be important (Schenke & Meijer, 2018), and its priority and time are especially designated in an annual schedule. Because facilitation is so important for sustaining innovations, it is important to consider facilitation of staff's work even before the implementation phase, especially if the innovation is supported by means of funding in the form of a grant (Fagen & Flay, 2009; van den Boom-Muilenburg et al., 2019).

### 6.3.2.3 Teachers' individual attitudes

The third factor that seems to influence the sustainability of the data-use intervention is teachers' individual attitudes, in Profiles 3&4. A positive attitude is typically considered to exist beforehand (Mouza, 2009; Ng & Nicholas, 2013), as a positive feeling towards the innovation and its outcomes for students (Ng & Nicholas, 2013) promotes sustainability. On the other hand, resistance to change (Deaney & Hennessy, 2007) and negative feelings towards the innovation (Bambara et al., 2012) hinder sustainability. However, it seems that teachers' individual positive attitudes need not necessarily be present beforehand, but can be developed by experiencing positive effects of an intervention, which then can influence the sustainability of the intervention.

With the implementation of the data-use intervention, school staff began to think about data, became familiar with the amount of (unused) data in the school, and started using data for school improvement (Ebbeler et al., 2017; Gelderblom, 2018). The perceived fear of working with data can turn into a positive attitude as positive experiences are gained (Diamantopoulos et al., 2023). In our research we found that educators in schools sustainable on the underlying goal of the data-use intervention had developed a positive attitude. Therefore, we tentatively conclude that attitude could be considered a mediating variable, as the intervention may influence attitude, which may influence sustainability.

### 6.3.3 Supporting schools on sustainable educational innovation

Schools may benefit from concrete and practical guidance on sustaining their educational innovation (Askeff-Williams & Koh, 2020). Dialogue between staff within schools can be a way to promote self-evaluation. Therefore, a self-evaluation tool was developed, The Sustainability Meter (TSM). Important components of this instrument were: (1) self-evaluation, (2) dialogue between different stakeholders, and (3) a systematic process to reflect on all the aspects that may influence sustainability based on our review discussed in Study 2 and the questionnaire as used in the third study. The Sustainability Meter appeared to foster an in-depth dialogue between staff to promote the sustainability of innovations.

Moreover, TSM seemed to support schools in making their innovations more sustainable. Three types of measures resulted from working with TSM. First, initial solutions were developed based on TSM, simple practical adjustments that can be made and realized quickly, such as clarifying a format used. These initial solutions make it easier to work with the innovation, but also strengthen user engagement (Drits-Esser et al., 2017). The advantage of initial solutions is that there is immediate success within the organization, which positively affects morale. Next, short-term measures were identified and implemented, actions that require coordination within the organization, but that can be deployed in the short term. An example here is explaining the how and why of an innovation to all stakeholders. Finally, longer term measures were identified. These are complex and will affect multiple innovations or layers within the organization. Often a time period of several months or even years is needed to concretize or achieve the exact goal. An example of such a measure in a school working on innovation about student ownership was choosing and developing a longer term main goal based on the school's vision, including concrete success criteria and the way of monitoring.

### 6.4 Limitations of the research and recommendations for further research

As all studies do, our studies also come with certain limitations, some of which we will discuss below.

In Study 1, we conducted a systematic literature review on how educational innovations can become sustainable. We focused on peer-reviewed articles, and therefore may have missed important information from, for example, policy and professional publications, books and chapters (Krijgsman et al., 2022). Moreover, most of the studies were qualitative studies, and we were not able to find many longitudinal and/or experimental studies.

In Studies 2, 3 and 4 we made use of data based on self-reports. A known risk of self-reports is that the respondents overestimate or underestimate themselves. A well-known effect in literature is, for example, the Dunning-Kruger effect (Kruger & Dunning, 1999), where poor performers often overestimate their own performance. We tried to prevent bias as much as possible, for example, by discussing the questions used in our instruments with experts and with practitioners, by using existing and validated instruments, by pre-testing our instruments, and by triangulating the collected data. However, we do need to acknowledge here that a certain amount of bias may still exist in our data. Further studies into sustainability of innovations could try to investigate sustainability by making less use of self-report, for example, by observing the process of an innovation in a school over a longer period of time.

A third limitation involves low participant response rates in some of the studies. In Study 2, the (original) data team members were not always available in the school anymore. Therefore, the questioning took place with only one key person in the school, which indirectly determined the schools' sustainability on the data-use intervention. For Study 3, due to the COVID-19 pandemic, we had too little data to draw strong conclusions. The COVID-19 pandemic also influenced the data collection for Study 4. As a result, only a limited number of schools participated in this study. Therefore, we also recommend replicating the studies (2, 3 and 4) in this thesis, for example, with larger samples, different educational innovations, and in different contexts. Replication can be defined as "the purposeful repetition of previous research to corroborate or disconfirm the previous results" (Makel & Plucker, 2014, p. 2). In order to develop a robust knowledge base on what works in education and the conditions under which it works, replication studies are urgently needed, as argued, for example, by Granger and Maynard (2015). This can help us to develop a robust knowledge base about the sustainability of educational innovations (Leithwood & Jantzi, 2000; Makel & Plucker, 2014; Tian et al., 2024).

After Study 4, we did not follow the schools which used The Sustainability Meter for a longer period of time. It is of interest to research whether planned actions based on the dialogue supported with The Sustainability Meter were actually implemented and what the results were, and ultimately, if the Sustainability Meter actually enhanced sustainability.



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# **SAMENVATTING (DUTCH SUMMARY)**

Het starten van een onderwijsinnovatie is lastig, maar het volhouden ervan is nog moeilijker. Voor veel scholen vormt de duurzaamheid van onderwijsinnovaties een uitdaging. Zelfs innovaties die aanvankelijk succesvol zijn, slagen er niet in om een onderdeel te worden van de routines in scholen. Het verloop van innovaties over een lagere periode is relatief weinig onderzocht. Een van de redenen hiervoor is dat het onderzoek stopt op het moment dat de bekostiging voor het werken aan een innovatie eindigt. Bovendien gaan maar weinig innovaties lang genoeg door om longitudinaal te worden bestudeerd. Er is gebrek aan diepgaande analyses van langduriger innovatieprocessen en geverifieerde theorieën die het succes of falen van een innovatie op de lange termijn kunnen verklaren en voorspellen.

Scholen beginnen vaak met onderwijsinnovaties om de kwaliteit van het onderwijs te verbeteren. Sommige van deze innovaties richten zich op het gebruik van data. De Nederlandse overheid heeft het belang van datagebruik benadrukt door te stellen dat alle scholen data moeten gebruiken om “systematisch en doelgericht te werken aan het maximaliseren van leerprestaties”. Ook internationaal is er steeds meer bewustwording van het belang van datagebruik voor onderwijsverbetering. Onderzoek heeft aangetoond dat datagebruik de zichtbaarheid van de onderwijskwaliteit kan vergroten en dat data kunnen worden gebruikt om het onderwijs te verbeteren.

Data kunnen worden gedefinieerd als doelbewust en systematisch verzamelde informatie over leerlingen, scholen, schoolleiders en docenten en kunnen zowel kwalitatief als kwantitatief zijn. Voorbeelden van data zijn toetsresultaten, opbrengsten van klasobservaties en enquêteresultaten. Het nemen van onderwijsbeslissingen op basis van een breed scala aan data, met als doel het onderwijs te verbeteren en vervolgens te evalueren of verbeteringsmaatregelen het gewenste effect hebben, kan worden gedefinieerd als data geïnformeerd werken. Data informeren in dat geval de beslissingen van docenten en schoolleiders om het leren van leerlingen te verbeteren. Omdat het stellen van doelen, inzicht krijgen in leerresultaten en systematisch en resultaatgericht werken essentieel zijn voor het bereiken van het beste onderwijs voor alle leerlingen, wordt tegenwoordig verwacht dat docenten data gebruiken. Echter, docenten zijn vaak niet bedreven in het gebruik van data. Het ontbreekt hen aan datageletterdheid waarvoor professionele ontwikkeling nodig is. Om docenten te ondersteunen bij het verbeteren van de kwaliteit van het onderwijs door middel van datagebruik, is een interventie ontwikkeld. Deze interventie heeft twee hoofddoelen: het verbeteren van de onderwijskwaliteit op (een deel van) de school door middel van datagebruik, en professionele ontwikkeling in datagebruik.

Het onderwerp van dit onderzoek is een interventie voor datagebruik. Deze interventie kent een gestructureerde, cyclische, en iteratieve aanpak waarbij datateams acht stappen volgen. Het doel

is verbetermaatregelen te implementeren op basis van de door datateams verzamelde data. De interventie is gebaseerd op verschillende kenmerken van effectieve ontwikkelingsinterventies voor docentprofessionalisering (bij gebruik van data), zoals samenwerking tussen personeel, aanzienlijke interventieduur, actieve betrokkenheid van schoolleiderschap en externe begeleiding door een expert.

Een datateam is in feite een kleinschalig onderzoeksteam bestaande uit 4-6 docenten en 1-2 schoolleiders. Samen werken zij aan het oplossen van een of meer onderwijsproblemen binnen hun eigen school, op basis van data. Normaliter komt een datateam ongeveer eens in de 3 weken 90 minuten bijeen. De gestructureerde acht stappen van de interventie worden beschreven in een handleiding.

De methode van werken begint met het opstellen van een probleemdefinitie (Stap 1) door data te gebruiken om het probleem nauwkeurig te specificeren en een doel te formuleren. In Stap 2 formuleert het datateam concrete en meetbare hypothesen over mogelijke oorzaken van het bestudeerde probleem. Vervolgens worden in Stap 3 data verzameld om deze hypothesen te testen. Deze gegevens kunnen zowel kwalitatief als kwantitatief zijn, en hun kwaliteit wordt gecontroleerd tijdens Stap 4. In Stap 5 vindt gegevensanalyse plaats. Op basis van de analyse interpreteren de teamleden de gegevens en trekken ze conclusies (Stap 6). Als de geteste hypothesen onwaar blijken te zijn, moeten nieuwe hypothesen worden geformuleerd en getest, en keren de teams terug naar Stap 2. Als de hypothesen bevestigd zijn, gaat het datateam verder naar Stap 7.

In Stap 7 worden verbetermaatregelen ontworpen die voldoen aan criteria zoals haalbaarheid, bewezen effectiviteit, snelheid van impact en kosten. Er wordt een actieplan opgesteld, de evaluatiemethode wordt gespecificeerd en de maatregelen worden gecommuniceerd en geïmplementeerd. Tenslotte, in Stap 8, worden de effecten van de genomen maatregelen geëvalueerd.

Deze interventie voor datagebruik is geïntroduceerd in veel scholen in zowel Nederland als het buitenland, bijvoorbeeld in Zweden en de Verenigde Staten. De datateams worden ondersteund door een externe coach, die het team helpt bij het gebruik van data om een eigen onderwijskundig probleem op te lossen. Datateams blijken de datageletterdheid van docenten te verbeteren en in sommige gevallen ook de leerprestaties van leerlingen te verbeteren.

Hoewel de interventie lijkt te leiden tot positieve resultaten, blijft de duurzaamheid ervan onduidelijk. Er is weinig bekend over de factoren die bijdragen aan de duurzaamheid van de

methode, zowel op de korte als de lange termijn. Het is belangrijk om te begrijpen waarom sommige scholen doorgaan met het gebruik van data aan het einde van de implementatie, terwijl andere scholen dit niet doen. Inzicht in deze factoren kan scholen, beleidsmakers en onderzoekers helpen om effectievere interventies te ontwerpen die leiden tot een blijvend gebruik van data op scholen.

De vier studies in dit proefschrift zijn uitgevoerd om meer te weten te komen over de duurzaamheid van onderwijsinnovaties. In twee van de vier studies hebben we ingezoomd op de hierboven genoemde specifieke interventie voor datagebruik.

In de eerste studie werd een systematische review van empirische literatuur uitgevoerd om te komen tot een definitie van duurzaamheid en een overzicht te geven van de factoren die de duurzaamheid van innovaties beïnvloeden.

Op basis van het literatuuronderzoek werd de volgende definitie van duurzame onderwijsinnovatie geformuleerd: *Duurzaamheid verwijst naar het proces van voortzetting en integratie van de kernaspecten van de innovatie in organisatorische routines die adaptief zijn aan het lopende werk.*

Deze definitie van duurzaamheid benadrukt verschillende belangrijke aspecten. Ten eerste wordt duurzaamheid gezien als een ontwikkelingsproces vanaf de eerste fase van verandering, in plaats van een eindfase. Ten tweede moeten de kernaspecten van de innovatie worden voortgezet. Vervolgens moeten deze kernaspecten worden geïntegreerd in de dagelijkse organisatorische routines van de school. Daarnaast moeten de behaalde resultaten behouden blijven of verbeterd worden. En tot slot moet de innovatie in de loop van de tijd kunnen worden aangepast aan de behoeften van de school, terwijl de kerncomponenten behouden blijven.

Meerdere factoren die de duurzaamheid van onderwijsinnovaties kunnen beïnvloeden, konden worden geïdentificeerd in diverse, voornamelijk kwalitatieve, studies. We gebruikten een vaak gebruikte categorisering van factoren die duurzaamheid beïnvloeden om de bevindingen te structureren: kenmerken van de schoolorganisatie (inclusief leiderschap), individuele kenmerken en contextkenmerken. Op basis van de bevindingen van de review werd een nieuwe categorie aan deze structuur toegevoegd, namelijk kenmerken van de innovatie zelf.

De bevindingen van deze review hebben geleid tot de drie andere studies waarover in dit proefschrift wordt gerapporteerd:

1. een onderzoek naar het meten van de mate van duurzaamheid van een specifieke interventie voor datagebruik,
2. een onderzoek naar de factoren die de duurzaamheid van deze methode beïnvloeden, en
3. een onderzoek naar het gebruik van een door ons ontwikkeld instrument, de Duurzaamheidsmeter, om scholen te ondersteunen bij het verduurzamen van hun onderwijsinnovaties.

In de tweede studie van dit proefschrift (Hoofdstuk 3) richtten we ons op het meten van de duurzaamheid van een interventie voor datagebruik. Daarvoor gebruikten we de kerncomponenten van de definitie van duurzaamheid zoals gevonden in de systematische literatuurstudie. De onderzoeksvraag was *'Hoe duurzaam is de interventie voor datagebruik op middelbare scholen in Nederland?'.* De gegevens werden verzameld door middel van gestructureerde telefonische interviews (1 expert per school,  $N = 29$  schoollocaties). Er werd onderscheid gemaakt tussen duurzaamheid van de methode zelf en duurzaamheid van de onderliggende doelen van de interventie. De uitkomsten van dit onderzoek leidden tot vier duurzaamheidsprofielen voor scholen, namelijk:

- 1) De interventie is niet duurzaam (24%). Scholen met dit profiel zijn de datateams niet blijven gebruiken en hebben het gebruik ervan ook niet opgeschaald.
- 2) De interventie is duurzaam op de methode (24%). Scholen met dit profiel hadden nog steeds één of twee actieve datateams en het oorspronkelijke datateam was vaak nog intact. Het gebruik van de interventie was in beperkte mate opgeschaald. De kernonderdelen van de methode werden regelmatig uitgevoerd en de meeste scholen pasten deze kernonderdelen licht aan.
- 3) De interventie is duurzaam op het onderliggende doel (31%). Er waren geen datateams actief. In plaats daarvan maakten individuen gebruik van de datateam aanpak. De cyclus van het stellen van een doel, het verzamelen en interpreteren van gegevens, het nemen van maatregelen en het evalueren op basis van de gegevens (het onderliggende doel van de interventie) was routine binnen verschillende onderwijsteams of secties.
- 4) De interventie is duurzaam op zowel de methode als het onderliggende doel (21%). De datateams bleven actief en scholen met dit profiel lieten een breder gebruik van de kernaspecten van het onderliggende doel zien, wat duidt op een meer ingesleten organisatorische routine.

De conclusie uit dit onderzoek is dat het concept van duurzaamheid genuanceerd is en verschillende vormen kan aannemen.

De uitkomsten van de systematische literatuurstudie in Studie 1 wezen op verschillende groepen factoren die de duurzaamheid van onderwijsinnovaties kunnen beïnvloeden. In onderzoek 2 (hoofdstuk 3) vonden we vier profielen van duurzaamheid van de interventie voor datagebruik. Het onderzoek in studie 3 (hoofdstuk 4) combineerde de perspectieven uit deze twee studies en kende als onderzoeksvraag: *Welke (combinatie van) factoren verklaren verschillen in de duurzaamheid van de interventie voor datagebruik?*

Voor de dataverzameling gebruikten we een online enquête voor schoolpersoneel ( $N = 307$ ), gebaseerd op het theoretisch kader in hoofdstuk 2 en op bestaande valide instrumenten. Hoewel deze studie sterk beïnvloed werd door COVID-19 in termen van lage responspercentages, konden er enkele voorzichtige conclusies worden getrokken. Net als in studie 2 wijst ook deze studie op het belang van een genuanceerd beeld van duurzaamheid. Verder werden er drie belangrijke factoren gevonden die van invloed zijn op de duurzaamheid van de interventie voor datagebruik, in het bijzonder voor scholen die het onderliggende doel van deze interventie duurzaam nastreven.

Ten eerste kan steun van een schoolleider van invloed zijn op de duurzaamheid, zowel bij scholen die duurzaam zijn op de methode als bij scholen die duurzaam zijn op het onderliggende doel. Ondersteuning betekent hier dat schoolleiders zich bewust zijn van de noodzaak om de vaardigheden van docenten voor de innovatie te (blijven) ontwikkelen, en een duidelijke richting geven voor het gebruik van de innovatie voor onderwijsverbetering. Schoolleiders in scholen die duurzaam zijn in het onderliggende doel blijken meer geneigd om gepersonaliseerde ondersteuning te bieden.

Een van de sub factoren binnen ondersteuning door schoolleiders is de tweede belangrijke factor, namelijk facilitering om met data voor schoolverbetering te werken. Wanneer docenten ervoeren dat er specifiek middelen werden toegewezen om te werken met data voor schoolverbetering, voelden ze dat dit werk als belangrijk werd beschouwd.

Ten derde lijkt de individuele houding van docenten ten opzichte van de innovatie de duurzaamheid te beïnvloeden. Een positieve houding wordt meestal geacht op voorhand te bestaan. Het lijkt er echter op dat deze niet noodzakelijkerwijs van tevoren aanwezig hoeft te zijn, maar ontwikkeld kan worden door het ervaren van positieve effecten van een interventie, die vervolgens van invloed kunnen zijn op de duurzaamheid van de interventie. Bijvoorbeeld wanneer docenten vertrouwen hebben in de effectiviteit ervan of de gepercipieerde angst voor het werken met data kan omslaan in een positieve houding naarmate ervaringen worden opgedaan.

In hoofdstuk 5 van dit proefschrift, omschrijven we hoe we hebben geprobeerd scholen te ondersteunen in het verduurzamen van hun onderwijsinnovaties. Scholen worstelen hier immers mee en kunnen baat kunnen hebben bij praktische begeleiding. Een manier om hen te ondersteunen is door het faciliteren van reflectie op de duurzame implementatie door middel van zelfevaluatie. Zelfevaluatie kan zich richten op diverse perspectieven die binnen een organisatie bestaan. Dialoog tussen medewerkers met die verschillende perspectieven bevordert gezamenlijke inzichten, productieve fricties en leerzame spanningen. Deze geven vervolgens richting aan acties voor effectieve, duurzame innovatie. Daarom werd een zelfevaluatie-instrument ontwikkeld: De Duurzaamheidsmeter. Het doel van dit instrument is om inzicht te krijgen in de verschillende perspectieven en ervaringen van belanghebbenden binnen de schoolorganisatie met betrekking tot de innovatie, als basis voor verbeteringsgerichte acties en om duurzame onderwijsinnovatie te bevorderen.

De drie onderzoeksvragen voor dit onderzoek waren:

- (1) In hoeverre leidt het gebruik van de Duurzaamheidsmeter tot conceptueel gebruik van de uitkomsten ervan om de duurzaamheid van de innovatie van een school te bevorderen?
- (2) In hoeverre leidt het gebruik van de Duurzaamheidsmeter tot instrumenteel gebruik van de uitkomsten om de duurzaamheid van de innovatie van een school te bevorderen?
- (3) In hoeverre zijn gebruikers tevreden over de Duurzaamheidsmeter?

Er is een kleinschalig onderzoek met een mixed-methods aanpak uitgevoerd. Het conceptuele en instrumentele gebruik van de Duurzaamheidsmeter werd in twee fasen met 5 scholen onderzocht, inclusief de tevredenheid van de gebruikers over het instrument. In fase 1 werd het instrument gebruikt door een dialooggroep van scholen onder begeleiding van de onderzoeker. Een dialooggroep bestond uit 6-10 belanghebbenden van verschillende niveaus binnen de school die betrokken waren bij de innovatie waarop werd gereflecteerd. In fase 2 werkten scholen zelfstandig met de Duurzaamheidsmeter, ondersteund door een handleiding. Gegevens werden verzameld door middel van observaties van de dialoog, groepsinterviews en documenten die door de deelnemers werden gegenereerd.

In termen van conceptueel gebruik kregen de deelnemers een beter begrip van hun eigen of elkaars perspectieven en achtergronden met betrekking tot de (duurzaamheid van de) innovatie, bijvoorbeeld waarom de innovatie was gestart of welke vaardigheidskloof de medewerkers hadden met betrekking tot de innovatie. De dialoog over de innovatie van de scholen leidde ook

tot inzichten in uitdagingen voor duurzame innovatie, zoals het kunnen bepalen van een volgende stap.

Voor instrumenteel gebruik konden in de bevindingen drie typen worden onderscheiden. Alle scholen pasten eerst *initiële oplossingen* toe: eenvoudige praktische aanpassingen die snel gerealiseerd kunnen worden met direct succes binnen de organisatie, zoals het inrichten van een benodigde stille werkplek voor leerlingen in een school die bezig was keuzewerktijd. Daarna kwamen de *kortetermijnmaatregelen*: specifiek gedefinieerde acties die coördinatie vereisen binnen de organisatie, maar die op korte termijn kunnen worden ingezet. Een voorbeeld van zo'n maatregel was het plannen van studentenbijeenkomsten om hen te betrekken bij het werven van nieuwe leerlingen, op een school die tijdens COVID-19 werkte aan leerlingwerving. Tot slot waren er *maatregelen voor de langere termijn*: complexe maatregelen die invloed hadden op meerdere innovaties en/of lagen binnen de organisatie. Een voorbeeld van zo'n maatregel in een school die werkte aan de innovatie rond eigenaarschap van leerlingen, was het kiezen en ontwikkelen van een hoofddoel voor de langere termijn op basis van de visie van de school, inclusief concrete succescriteria en de manier van monitoren.

In termen van gebruikerstevredenheid beschouwden de deelnemers in alle groepen de Duurzaamheidsmeter als een waardevolle ondersteuning voor een dialoog van hoge kwaliteit. Dit onderzoek geeft enkele aanwijzingen dat de tool zou kunnen leiden tot meer duurzame onderwijsinnovaties.

De eerste algemene bevinding van dit proefschrift betreft de gevonden duurzaamheidsprofielen. Een belangrijke conclusie van dit onderzoek is dat het bij het bestuderen van de duurzaamheid van een interventie belangrijk is om onderscheid te maken tussen duurzaamheid van de methode en duurzaamheid van het onderliggende lange termijn doel. Daarom stellen we voor dit onderscheid toe te voegen aan de eerder gepresenteerde definitie van duurzaamheid, en duurzaamheid te definiëren als: 'het proces van voortzetting en integratie van de kernaspecten van de innovatie *in termen van zowel de methode als de doelstelling(en) van de innovatie* in organisatorische routines die zich aanpassen aan het lopende werk'.

De literatuur over een breed scala aan onderwijsinnovaties wijst op verschillende potentieel invloedrijke factoren. Op basis van onze systematische literatuurstudie probeerden we te achterhalen welke van de factoren in het raamwerk het belangrijkste zijn in het verklaren van verschillen tussen scholen in het bereiken van duurzame innovatie. We onderzochten in hoeverre verschillen in bepaalde (combinaties van) factoren samenhangen met verschillen in de duurzaamheid van de interventie voor datagebruik (in termen van elk van de



duurzaamheidsprofielen). Drie belangrijke factoren kwamen naar voren: 1) geïndividualiseerde ondersteuning door de schoolleider, waaronder 2) facilitering; en 3) de individuele houding van docenten ten opzichte van de innovatie. Deze factoren moeten echter verder onderzocht worden.

Scholen kunnen baat hebben bij concrete en praktische begeleiding bij het verduurzamen van hun onderwijsinnovatie. Daarom werd een zelfevaluatie-instrument ontwikkeld, de Duurzaamheidsmeter. Belangrijke onderdelen van dit instrument waren: (1) zelfevaluatie, (2) dialoog tussen verschillende belanghebbenden, en (3) een systematisch proces om na te denken over alle aspecten die duurzaamheid kunnen beïnvloeden op basis van onze evaluatie besproken in Studie 2.

De Duurzaamheidsmeter bleek een diepgaande dialoog tussen het personeel te stimuleren om de duurzaamheid van innovaties te bevorderen. Bovendien leek de Duurzaamheidsmeter scholen te ondersteunen bij het verduurzamen van hun innovaties. Daarvoor lijken drie soorten maatregelen nodig te zijn. Ten eerste werden er initiële oplossingen ontwikkeld op basis van de uitkomsten van de Duurzaamheidsmeter, eenvoudige praktische aanpassingen die snel gemaakt en gerealiseerd kunnen worden, zoals het verduidelijken van een gebruikt format. Deze initiële oplossingen maken het makkelijker om met de innovatie te werken, maar versterken ook de betrokkenheid van gebruikers. Het voordeel van eerste oplossingen is dat er direct succes is binnen de organisatie, wat het moreel positief beïnvloedt. Vervolgens werden kortetermijnmaatregelen geïdentificeerd en geïmplementeerd: acties die coördinatie vereisen binnen de organisatie, maar die op korte termijn kunnen worden ingezet. Een voorbeeld hiervan is het uitleggen van het hoe en waarom van een innovatie aan alle belanghebbenden. Tot slot werden maatregelen voor de langere termijn geïdentificeerd. Deze zijn complex en hebben invloed op meerdere innovaties of lagen binnen de organisatie. Vaak is een periode van enkele maanden of zelfs jaren nodig om het exacte doel te concretiseren of te bereiken.

Deze dissertatie kende een aantal beperkingen.

Ten eerste hebben we in studie 1 een systematisch literatuuronderzoek uitgevoerd naar hoe onderwijsinnovaties duurzaam ingebed kunnen worden. We hebben ons gericht op peer-reviewed artikelen, en hebben daardoor mogelijk belangrijke informatie gemist uit bijvoorbeeld beleids- en vakpublicaties, boeken en hoofdstukken.

Ten tweede hebben we in Studie 2, 3 en 4 gebruik gemaakt van gegevens op basis van zelfrapportages. Een bekend risico van zelfrapportages is dat de respondenten zichzelf

overschatten of onderschatten. Ondanks maatregelen om dit zoveel mogelijk te voorkomen, moeten we erkennen dat er nog steeds een zekere mate van vertekening in onze gegevens kan zitten.

Een derde beperking betreft de lage responspercentages van deelnemers in sommige onderzoeken. In Studie 2 waren door personeelsverloop de (oorspronkelijke) datateamleden niet altijd meer beschikbaar in de school. Daarom vonden de ondervragingen plaats met slechts één sleutelfiguur in de school, wat indirect bepalend was voor het duurzaamheidsprofiel van de school voor deze interventie. Voor Studie 3 hadden we door de COVID-19 pandemie te weinig gegevens om sterke conclusies te trekken. De COVID-19 pandemie beïnvloedde ook de gegevensverzameling voor Studie 4. Als gevolg daarvan nam slechts een beperkt aantal scholen deel aan deze studie.

Op basis van de onderzoeksresultaten zoals in deze dissertatie beschreven en de beperkingen van het onderzoek komen we tot de volgende aanbevelingen.

- 1) Het is aan te bevelen dat verdere studies naar duurzaamheid minder gebruik maken van zelfrapportage, bijvoorbeeld door het proces van een innovatie in een school over een langere periode te observeren.
- 2) Replicatiestudies zijn dringend nodig om een robuuste kennisbasis te ontwikkelen over wat werkt in het onderwijs, de omstandigheden waaronder het werkt en duurzaamheid van onderwijsinnovaties. Replicatie van de Studies 2, 3 en 4 van dit proefschrift, bijvoorbeeld met grotere steekproeven, andere onderwijsinnovaties en in andere contexten is hier van toepassing.
- 3) Na studie 4 hebben we de scholen die De Duurzaamheidsmeter gebruikten niet langer gevolgd. Het is interessant om te onderzoeken of geplande acties gebaseerd op de dialoog ondersteund met De Duurzaamheidsmeter daadwerkelijk werden uitgevoerd en wat de resultaten waren, en uiteindelijk of de Duurzaamheidsmeter daadwerkelijk duurzaamheid van de betreffende onderwijsinnovatie heeft verbeterd.
- 4) Om de duurzaamheid van onderwijsevaluaties verder te bestuderen, raden we de uitvoering van longitudinale studies aan, in een combinatie van diepte- versus breedteonderzoek. In termen van diepte vereist het bestuderen van de duurzaamheid van onderwijsinnovatie een diepgaand, gecontextualiseerd begrip. Voor onderzoek naar de diepgang van duurzame onderwijsinnovatie kan in scholen bijvoorbeeld intensief worden geobserveerd.

Breedteonderzoek, om te bestuderen hoe een innovatie een organisatorische routine wordt, vereist grootschalige onderzoeken op meerdere scholen, op meerdere verschillende momenten. Het kan waardevol zijn om onderscheid te maken tussen de methode en het lange-termijndoel, zoals we ook voorstellen in onze definitie van duurzaamheid. Dit kan meer inzicht geven in het proces van duurzaamheid, wat nuttig kan zijn om te begrijpen waarom interventies wel of niet duurzaam worden.

- 5) Onze laatste aanbeveling omvat het aannemen van een systeemperspectief op duurzaamheid. Een meer systemisch perspectief waarin de stemmen van verschillende actoren worden meegenomen, kan meer inzicht geven in hoe individuele leraren, leerlingen, (in)formele leiders en schoolbesturen en landelijke leiders kunnen bijdragen aan het grotere geheel en daarmee aan duurzame onderwijsinnovaties.



# **APPENDIX**

## Appendix A Survey questions, mapped in dimensions of sustainability, response options, and scoring system for sustainability

### Response coder

<b>Name</b>		Anne
		Cindy
		Kim
		Rilana
<b>Date</b>	-	- 2017

Naam / functie/ school

Jaar van invoering

Organisatie-routine	Aspecten duurzaamheid	Sub aspecten	Vraag	schaal				Weet ik niet
Performatieve routine	Continue		Werken jullie nog steeds met de datateam methode?	Ja/ nee				
Core components inhoud interventie	Op-schaling	kwantitatief	Hoeveel datateams waren er afgelopen schooljaar actief?					
			Wie werken er met de datateam methode?	Originele datateam	Nieuw of spin-off dt	Vakgroepen of teams	Deze schoollocatie	
	Stabiliteit Flexibiliteit	8 stappen	In hoeverre werken jullie nog steeds volgens alle 8 stappen van de datateam methode?	nooit	soms	regelmatig	regelmatig	
		handleiding	In hoeverre wordt er gebruik gemaakt van de handleiding?					
	Regelmatig samenkomsten	Hoe vaak komt het datateam samen?	Minder dan eens per kwartaal	1x per kwartaal	2-maandelijks	maandelijks		
Core components Doel dtm: via een professionaliserings-interventie datagebruik voor onderwijsverbetering bewerkstelligen waardoor schoolontwikkeling plaatsvindt.	continue	Stellen van meetbare doelen	In hoeverre worden meetbare doelen gesteld om het onderwijs te verbeteren?	niemand	individueel	1 of 2 Sectie/team	(bijna) hele school	
			Deelname aan de dtm heeft hier invloed op gehad	Helemaal oneens	oneens	eens	Helemaal eens	
	Data verzameling		In hoeverre worden data verzameld om te bepalen of de gestelde doelen al dan niet bereikt zijn?	niemand	individueel	1 of 2 Sectie/team	(bijna) hele school	
			Deelname aan de dtm heeft hier invloed op gehad	Helemaal oneens	oneens	eens	Helemaal eens	

	analyse en interpretatie	In hoeverre worden data gebruikt om te bepalen waarom doelen wel/niet behaald zijn?	niemand	individu	1 of 2 Sectie/ team	(bijna) hele school	
		Deelname aan de dtm heeft hier invloed op gehad	Helemaal oneens	oneens	eens	Helemaal eens	
	maatregelen	In hoeverre worden op deze data gebaseerde maatregelen getroffen om doelen te bereiken	niemand	individu	1 of 2 Sectie/ team	(bijna) hele school	
		Deelname aan de dtm heeft hier invloed op gehad	Helemaal oneens	oneens	eens	Helemaal eens	
	evaluatie	Het oorspronkelijke probleem waar het dt ooit mee gestart is, is opgelost					
		In hoeverre worden data gebruikt om te evalueren of het doel bereikt is?	niemand	individu	1 of 2 Sectie/ team	(bijna) hele school	
	Opschaling kwalitatief	Deelname aan de dtm heeft hier invloed op gehad	Helemaal oneens	oneens	eens	Helemaal eens	
		Wordt data stelselmatig ingezet om het onderwijs te verbeteren?	Beantwoorden door score hierboven gegeven				
	Ostensieve routine		Is de manier van werken opgenomen in de volgende beleidsdocumenten		ja	nee	weet niet
			Persoonlijk ontwikkelings plan				
			Vakplan en/of teamplan				
			Locatieplan				

Grade of sustainability, scores as follow:

Sustainability of the method			
Item		Points	Prospects
Continue		1 - 2	No= 1, Yes= 2
Scaling up		1 - 2 - 3 - 4	Original =1; spin-off =2; teams =3; location =4

Core components	eight steps	1 - 2 - 3 - 4	Never = 1; sometimes=2; regularly =3, always = 4
	manual use	1 - 2 - 3 - 4	
	meetings	1 - 2 - 3 - 4	Less than 4/year=1; 4/year =2; every 8 weeks=3, monthly=4
<b>Sustainability of the method</b>			
Core components	Setting goals	1 - 2 - 3 - 4	No one=1; individual -2; 1 or 2 teams =3; (almost) entire school =4
	Data collection	1 - 2 - 3 - 4	
	Analyze and interpretation	1 - 2 - 3 - 4	
	Take measures	1 - 2 - 3 - 4	
	Evaluate	1 - 2 - 3 - 4	
Ostensive	Job description employee	1- 2	No=1, yes=2
	Personal development plan	1- 2	
	Team/ subject plan	1- 2	
	School plan	1- 2	

10 - 46

## Data extraction form – Instruction

- Fill out the form in English.
- Answer every cell. When information is not available, not applicable or unclear, use the following codes:
  - NA – Not applicable in research
  - INA – Information not available in article
  - UC – Unclear
- Save the extraction form as *'data extraction form \_ [lastname authors] \_ [year]'* on P: *Datateam - project duurzaamheid - data extractie - eigen map*
- Try to remain the format
  - Page 1 : Response coder + general information
  - Page 2: Research set up
  - Page 3: Research population
  - Page 4: Results
  - Page 5: Quality



**Response coder**

<b>Name</b>		Anne
		Cindy
		Kim
		Rilana
<b>Date</b>	-	- 2017

**General information**

<b>Study title</b>		
<b>Authors</b>		
<b>Year of publication</b>		
<b>Country</b>		
<b>Context</b>		Primary education
		Secondary/high school
		Tertiary education (including teachers' professional education)
<b>Publication type</b>		Dissertation
		Journal article
<b>Journal type</b>		Professional
		Scientific
<b>Journal title</b>		

**Research design**

<b>Research question or research objectives</b>	
<b>Subject (i.e. data-based decision making, formative assessment)</b>	
<b>Description of study (max 3 sentences)</b>	
<b>Definition of sustainability</b>	
<b>Research design</b>	Qualitative
	Quantitative
	Mixed methods
<b>Type of study</b>	Intervention
	Narrative
	...
<b>Length of follow-up</b>	
<b>Research instruments</b>	
<b>Analysis method</b>	

<b>Research population</b>			
<b>Population schools (N) after possible attrition</b>			
<b>Sampling method</b>	<b>Random</b>		
	Simple		Stratified
	Cluster		Systematic
	Multi-stage		
	<b>Non-random</b>		
	Convenience or opportunistic		Critical case
	Typical case		Extreme case
	Other; ..		
<b>Population teachers (N) after possible attrition</b>			
<b>Sampling method</b>	<b>Random</b>		
	Simple		Stratified
	Cluster		Systematic
	Multi-stage		
	<b>Non-random</b>		
	Convenience or opportunistic		Critical case
	Typical case		Extreme case
	Other; ..		
<b>Population students (N) after possible attrition</b>			
<b>Sampling method</b>	<b>Random</b>		
	Simple		Stratified
	Cluster		Systematic
	Multi-stage		
	<b>Non-random</b>		
	Convenience or opportunistic		Critical case
	Typical case		Extreme case
	Other; ..		

## Results

<b>Answer to the research question or objectives</b>	
<b>Role of school leader (vision, norms, support, facilitation)</b>	
<b>Role of school board and/or team managers</b>	
<b>Other school organisational characteristics (i.e. facilitation, external support)</b>	
<b>User characteristics (ie motivation, attitude, ownership)</b>	
<b>Intervention characteristics (i.e. effectiveness, feasibility)</b>	
<b>Other influencing factors</b>	

### Quality

General	Score		
1. Is the research objective clear?			
2. Is the research in combination with the chosen method capable of finding a clear answer to the research question?			
3. Is the definition of sustainability concrete and measurable?			
<b>Selection sample</b>			
3. Does the study contain enough data to assure the validity of the conclusions?			
4. Is the context of the research clear (country, sample of the school/ teacher/student)?			
<b>Method</b>			
5. Do the researchers mention the research methods used?			
6. Do the authors give an argumentation for the methods chosen?			
7. Do the researchers take other variables that might be of influence into account?			
<b>Data analyses</b>			
8. Are the data analysed in an adequate and precise way?			
9. Are the results presented in a clear way?			
10. Do the researchers report on reliability and validity of the research? -			
<b>Conclusion</b>			
11. Is the research question answered using empirical evidence gained from the research?			
Quality score	0 1 2 3 4 5 6 7 8 9 10 11 12		
Other comments			
Usable for research?		Yes	
		Maybe	
		No	

**Appendix B: Table A-1 Results of comparing mean values for the influential factors between the three profiles.**

Characteristic	Dependent variable		Sum of Squares	df	Mean Square	f	Sig	
School organizational	Collaboration	Between-groups	.597	2	.299	.644	.526	
		Within-groups	75.549	163	.463			
		Total	76.146	165				
	Knowledge sharing	Between-groups	.077	2	.038	.117	.890	
		Within-groups	22.365	68	.329			
		Total	22.442	70				
	<b>Leadership</b>							
	<i>Vision, norms and goals</i>	Between-groups	.590	2	.295	.745	.476	
		Within-groups	76.800	194	.396			
		Total	77.390	196				
	<i>Providing individualized support</i>	Between-groups	2.630	2	1.315	5.853	.004	
		Within-groups	36.620	163	.225			
		Total	39.250	165				
	<i>Facilitation</i>	Between-groups	1.608	2	.804	2.368	.096	
		Within-groups	65.870	194	.340			
Total		67.478	196					
<i>Knowledgeable</i>	Between-groups	.293	2	.147	.553	.578		
	Within-groups	18.030	68	.265				
	Total	18.324	70					
Inter-vention	Effectiveness	Between-groups	.175	2	.087	.082	.922	
		Within-groups	174.040	163	1.068			
		Total	174.215	165				
Individual stakeholders	Attitude, buy-in and beliefs	Between-groups	.686	2	.343	2.159	.119	
		Within-groups	25.900	163	.159			
		Total	26.586	165				

## Appendix C: Table A-2 Results of the LSD post-hoc analysis

	Dependent variable	Sustainability	Sig vs. Not sustainable	Sig vs. Sustainable on the method	Sig vs. Sustainable on the goals
School organizational	Collaboration	Not sustainable		.403	.836
		Sustainable on the method	.403		.307
		Sustainable on the goal	.836	.307	
	Knowledge sharing	Not sustainable		.870	.632
		Sustainable on the method	.870		.829
		Sustainable on the goal	.632	.829	
	<b>Leadership</b>				
	<i>Vision, norms and goals</i>	Not sustainable		.230	.666
		Sustainable on the method	.230		.493
		Sustainable on the goal	.666	.493	
	<i>Providing individualized support</i>	Not sustainable		.644	.002*
		Sustainable on the method	.644		.003*
		Sustainable on the goal	.002*	.003*	
	<i>Facilitation</i>	Not sustainable		.544	.135
		Sustainable on the method	.544		.033*
		Sustainable on the goal	.135	.033*	
	<i>Knowledgeable</i>	Not sustainable		1.00	.345
		Sustainable on the method	1.00		.448
	Sustainable on the goal	.345	.448		
Intervention	Effectiveness	Not sustainable		.862	.688
		Sustainable on the method	.862		.786
		Sustainable on the goal	.688	.786	
Individual stakeholders	Attitude, buy-in and beliefs	Not sustainable		.517	.045*
		Sustainable on the method	.517		.115
		Sustainable on the goal	.045*	.115	

\*= statistical significant





# **PUBLICATIONS AND PRESENTATIONS**

## Scientific Publication

### Accepted manuscripts

Tappel, A.P.M., Poortman, C.L., Schildkamp, K., Visscher, A.J (2023), *Promoting sustainable educational innovation using the Sustainability Meter*, Journal of Professional Capital and Community, Vol.8. No.3, pp. 234-244 <https://doi.org/10.1108/JPCC-02-2023-0008>

Prenger R., Tappel A.P.M., Poortman C.L. and Schildkamp K. (2022) How can educational innovations become sustainable? A review of the empirical literature. *Frontiers in Education*. 7:970715. doi: 10.3389/educ.2022.970715<sup>6</sup>

Tappel, A.P.M., Poortman, C.L., Schildkamp, K., Visscher, A.J. (2022) Distinguishing aspects of sustainability, *Journal of Educational Change* <https://doi.org/10.1007/s10833-022-09465-3>

### Manuscripts submitted for publication

Tappel, A.P.M, Poortman, C.L., Schildkamp, K., Visscher, A.J., Luyten, J.W.(under review), *Factors influencing the sustainability of a data-use intervention*.

## Professional Publications

van den Boom-Muilenburg, E., Tappel, A., Poortman, C.L., & Schildkamp, K. (2020). Duurzame onderwijsontwikkeling door professionele leergemeenschappen: Leiderschap als smaakmaker, *Schoolmanagement Totaal*, 2, 32-35

Tappel, A., Hendrikse, P., Boezelman, D. & Oldenbeuving, P (2019), Samenwerken aan Sallands schoolsucces, *Veerkracht magazine voor pedagogische professionals kind en educatie*, 2, 23-46

## International Presentations

Tappel, A.P.M., Prenger, R., Poortman, C.L., & Schildkamp, K. (2022, April). *How can educational innovations become sustainable?* Paper presented at AERA Annual Meeting 2022, San Diego

Tappel, A.P.M., & Poortman, C.L.(November, 2021). *Leadership for sustainable educational innovation: research insights and practical tools*, Paper presented at EAPRIL Conference 2021, online

Tappel, A.P.M., Poortman, C.L., Schildkamp, K., & Visscher, A.J. (April 2021). *Factors influencing Sustainability of Educational Improvement: a data use example*, Poster presented at AERA Virtual Annual Meeting 2021, online

Tappel, A.P.M., Poortman, C.L., Schildkamp, K., & Visscher, A. J. (2021, March). *Development of a Sustainability Tool of Educational Interventions*, Paper presented at 34th International Congress for School Effectiveness and Improvement meeting, ICSEI 2021, online

Tappel, A.P.M., Poortman, C.L., Schildkamp, K., & Visscher, A.J. (2020, January), *Factors influencing Sustainability*, Paper presented at 33rd International Congress for School Effectiveness and Improvement, ICSEI 2020, Marrakech, Morocco

Tappel, A.P.M., Poortman, C.L., Schildkamp, K., & Visscher, A.J. (2019, January). *Sustainability of a data use intervention* Paper presented at 32<sup>nd</sup> International Congress for School Effectiveness and Improvement meeting, ICSEI 2019, Stavanger

Tappel, A.P.M., Prenger, R., Poortman, C.L., & Schildkamp, K. (2019, January). *How can educational innovations become sustainable?* Paper presented at 32<sup>nd</sup> International Congress for School Effectiveness and Improvement meeting, ICSEI 2019, Stavanger

## National Presentations

Tappel, A.P.M. Wolterinck, C.H.D. & Schikldkamp, K. (2024 april). *Via data-geïnformeerd werken naar betere basisvaardigheden*, Inspiratiesessie gegeven op de ResearchED- conferentie OCW dichtbij- masterplan basisvaardigheden, Amsterdam

Tappel, A.P.M. & Poortman, C.L. (2023, November). *Duurzaamheid van onderwijsontwikkelingen*, Workshop gepresenteerd bij leergang Teacher leaders, online

Tappel, A.P.M. & Poortman, C.L. (2023, May). *Professionele leergemeenschappen voor duurzame onderwijsontwikkeling*, Workshop gepresenteerd bij leergang Teacher leaders, Deventer

Tappel, A.P.M.(2022, October). *In zevenmijlslarzen onderwijs ontwikkelen?* Workshop gepresenteerd op medewerkersdag Twents Carmel College, Oldenzaal

Tappel, A.P.M. & Poortman, C.L. (2022, May). *Professionele leergemeenschappen voor duurzame onderwijsontwikkeling*, Workshop gepresenteerd bij leergang Teacher leaders, Deventer

Tappel, A.P.M. & Van den Boom-Muilenburg, S.N., (2021, November). *Masterclass leidinggeven aan duurzame onderwijsontwikkeling*, Masterclass gepresenteerd voor de VO academie van de VO-raad, online

Tappel, A.P.M., Van den Boom-Muilenburg, S.N., & Poortman, C.L., (2020, November). *Duurzame implementatie van formatief toetsen in de school*. Workshop online gepresenteerd tijdens Conferentie Formatief Toetsen/ Evalueren, Stichting LeerplanOntwikkeling (SLO)

Tappel, A.P.M., Van den Boom-Muilenburg, S.N., & Poortman, C.L., (2020, October). *Praktische handreikingen voor leidinggeven aan duurzame onderwijsontwikkeling*. Workshop online gepresenteerd op de Schoolleidingendag Stichting Carmel College

Tappel, A.P.M., Poortman, C.L., Schildkamp, K., & Visscher, A.J. (2019, November). *Met af en toe een scheutje Pokon*, workshop gepresenteerd tijdens Inspiratiemiddag Leiderschap aan Duurzame Onderwijsontwikkeling, Utrecht

Tappel, A.P.M., Prenger, R., Poortman, C.L & Schildkamp, K. (2019, March). *Sustainability of data use in schools*, Paper gepresenteerd op de ICO Spring school, Amsterdam

Tappel, A.P.M., Wolterinck, C.H.D. & Schildkamp, K. (2019, October). *Factoren van invloed op duurzaamheid*, Workshop gepresenteerd op de Schoolleidingendag Stichting Carmel College, Beekbergen

Tappel, A.P.M., Prenger, R. & Poortman, C.L. (2018, June). *Wat werkt in duurzame onderwijsinterventies? Definities, factoren en aanbevelingen*, Paper gepresenteerd op de Onderwijs Research Dagen (ORD), 2018, Nijmegen

Tappel, A.P.M. & Prenger, R. (2017, October). *Duurzaamheid van datagebruik met behulp van de datateam-methode*, presentatie op docentendag Stichting Carmel College, Ede

Tappel, A.P.M. & Prenger, R. (2017, April). *Duurzaamheid van datagebruik met behulp van de datateam-methode*, presentatie op Schoolleidingendag, Stichting Carmel College, Garderen





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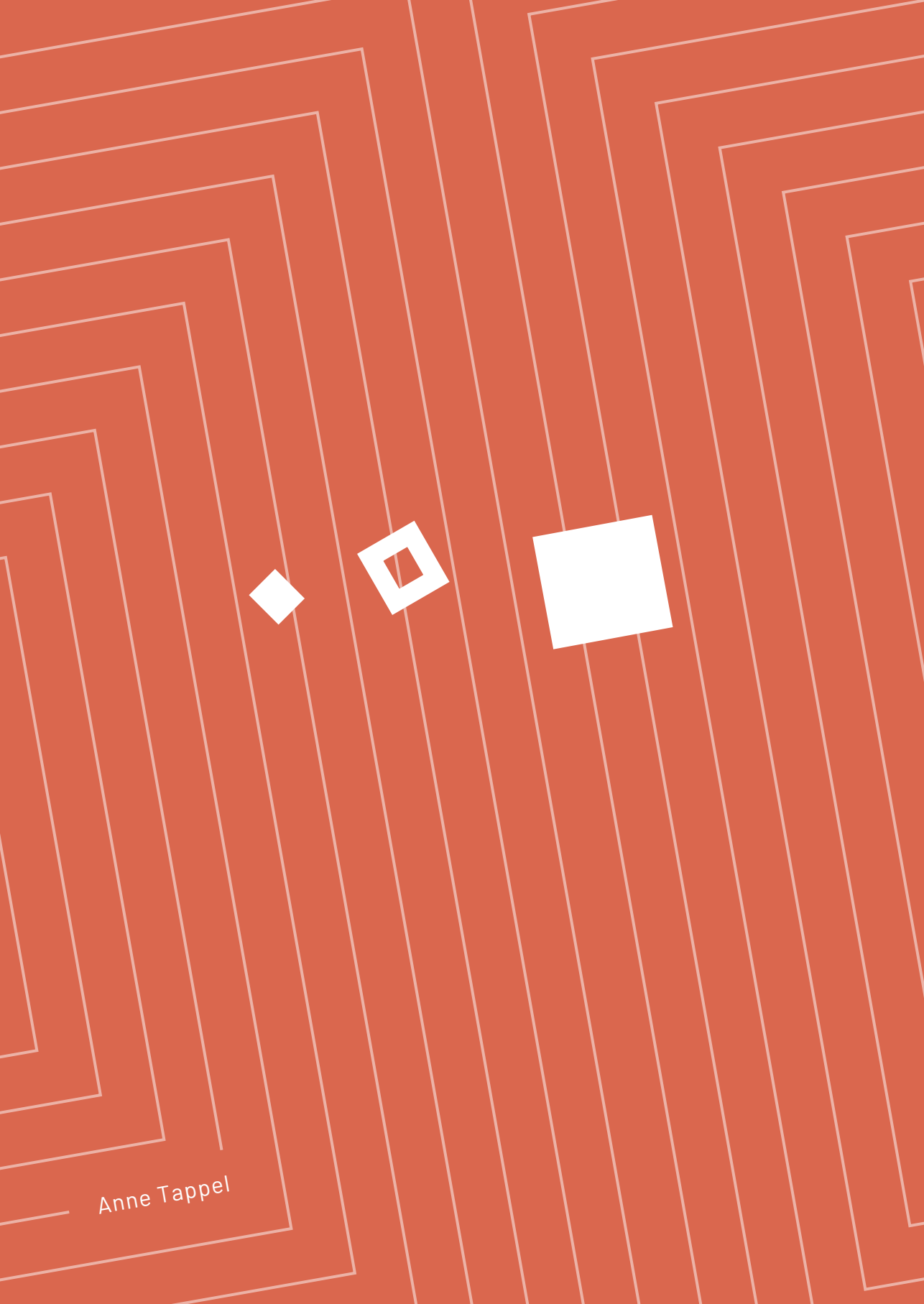
Buiten de Universiteit Twente was er nóg een werkzaam leven. Dank aan mijn collega's van het Netwerk Kwaliteit van de Stichting Carmel College en binnen de scholen waar ik werkte. Niet zelden zette ik jullie in als experts vanuit de praktijk om het onderzoek aan te scherpen en probeerde ik onderzoeksresultaten aan jullie te slijten. Op Sg. Marianum vond ik in Gitti Burema-Bekhuis een geweldige, visionaire rector die de wisselwerking tussen wetenschap en de onderwijspraktijk omarmt en op persoonlijk niveau vertrouwen geeft. Dank voor de flexibiliteit van haar en mijn collega's uit de schoolleiding, met name in de laatste fase van dit promotietraject.

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*The cover of this thesis is an artistic impression  
of The Sustainability Meter logo.*

*De kaft van dit proefschrift is een artistieke impressie  
van het logo van De Duurzaamheidsmeter.*



Anne Tappel