Sustainability of innovations in higher education: a literature exploration

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samen onderzoekend ontwikkelen van inspirerend onderwijs

Zuyd Onderzoek

Preface

Innovation is crucial for higher education to ensure high-quality curricula that address the changing needs of students, labor markets, and society as a whole. Substantial amounts of resources and enthusiasm are devoted to innovations, but often they do not yield the desired changes. This may be due to unworkable goals, too much complexity, and a lack of resources to institutionalize the innovation. In many cases, innovations end up being less sustainable than expected or hoped for. In the long term, the disappointing revenues of innovations hamper the ability of higher education to remain future proof.

Against the background of this need to increase the success of educational innovations, our colleague Klaartje van Genugten has explored the literature on innovations to reveal mechanisms that contribute to the sustainability of innovations. Her findings are synthesized in this report. They are particularly meaningful for directors of education programs, curriculum committees, educational consultants, and policy makers, who are generally in charge of defining the scope and set up of innovations. Her report offers a comprehensive view and provides food for thought on how we can strive for future-proof and sustainable innovations. I therefore recommend reading this report.

Dr. Marcel van der Klink

Inhoudsopgave

1. Introduction

Higher education is continuously changing and the need for innovation is widely recognized.

Innovation involves a wide range of areas such as the development of flexible learning paths, new didactics, and the use of technology. However, many educational innovations do not survive in the long run (Hargreaves, 2002; Hargreaves & Goodson, 2006). This may be due to plans being too ambitious or unforeseen changes entering the innovation process. Moreover, many educational innovations are initiated as projects, so for a limited time. Once the project ends, the money, energy, and attention dedicated to the innovation end as well. The innovation silently fades and in the long run nothing has changed.

Innovation usually follows several stages. The process starts with the generation of ideas based on an analysis of problems and/or ambitions. This is followed by an elaboration of ideas into practice, which may then be adjusted. In the final stage, the innovation is integrated into existing structures, procedures, or ways of working. But in many situations, the innovation is not, or is insufficiently, integrated, meaning the innovation ends up being unsustainable.

Since investments in innovation of educational practices usually require substantial amounts of time, energy, and financial resources, more sustainable outcomes are desirable for innovation activities.

This report addresses the sustainability of innovations in higher education by means of a literature exploration.

2. Research questions and method

2.1 Research questions

This literature exploration aims to generate an overview of what is known in the literature about sustainable innovation in higher education. Three questions are posed to achieve this aim:
What is understood by sustainable innovation in the context of higher education?
What does the literature say about the sustainability of innovations as a stage or phase in the innovation process?
What does the literature reveal about the characteristics or prerequisites of sustainable innovations in the innovation process as a whole?

2.2 Research method

The data collection and report writing took place from April to November 2021 and was performed by the author of this report. The search for relevant literature (articles and books) was carried out as follows: 1) a keyword search in electronic databases, 2) advice from experts in the field, and 3) snowballing.

Keyword search

Available databases from Zuyd University of Applied Sciences were used: DiZ (Discovery Service for Zuyd Hogeschool), ERIC (Education Resources Information Center) and Google Scholar. Initially, the search was conducted with the following keywords: educational innovation, sustainable innovation, sustainable educational innovation, innovation adoption, sustainable program implementation, and sustainable implementation, in combination with the term higher education. In literature the concept of sustainability in educational innovation, change, development, and reform are used interchangeably to describe the same phenomenon: a process of improving an existing situation. Therefore another search was carried out for additional keywords: sustainable educational change and sustainable school reforms (both in the context of higher education). All searches were carried out in both Dutch and English. As the search for these keywords in combination with higher education led to a limited number of literature sources, the search was broadened to education in general. So, articles about sustainable innovation, change and reform in schools (primary/secondary education) and vocational education were also included.

Selection criteria

Only articles and books from 2002 and after were inspected; articles and books were selected based on the title and abstract and number of citations. Only articles and books with more than 10 citations were included. An exception was made for articles and books from 2018 or later, which may have fewer citations.

The above search yielded 132 articles and books. After a closer inspection of these articles and books, 37 were considered relevant to answer at least one of the research questions. Twenty-six of these articles and books describe results of empirical research, of which five can be classified as quantitative research, three a mix of quantitative and qualitative research, and 18 as qualitative (see Table 3 for an overview). The remaining 11 articles are position papers, inaugural lectures, literature reviews etc. An overview of all references can be found in the annex.

3. Results of the exploration

This section describes the results of the exploration. Section 3.1 answers the first two research questions: what does sustainable innovation mean and what do we know about sustainability as a stage in the innovation process. For the purpose of clarity, this section begins by explaining the concept of educational innovation, as different concepts are used interchangeably in literature on sustainable educational innovation. For this section, five articles and books were used. Section 3.2 explains sustainability. Several definitions are presented, as well as related concepts. The section ends with a summary of the main factors related to sustainability in literature. Nineteen articles and books were studied for this section. Section 3.3 explores sustainability as a stage in the innovation process. As we will see here, sustainability can be considered both a stage in the innovation process, as well as a result of that same process. For this section, five articles and books were studied.
Section 3.4 answers the third question concerning the prerequisites for sustainable educational innovation throughout the innovation process. Striving for sustainability does not start at the completion of the innovation process, but needs to be an aim from the very start. This chapter includes empirical evidence from qualitative and quantitative research (26 articles in total) on what works when aiming for sustainable innovation in education.

3.1 Some clarity on the meaning of educational innovation

Introduction

When examining literature on sustainable educational innovation, we find that the concept of 'innovation' is often interchangeably used with the word 'change', 'improvement', 'development', or 'reform'. Whatever concept we choose, as we will see in this section, they all point in the same direction: educational innovation, change, improvement reform, and development are about change in teacher behavior in order to create a new situation.

Creating a new situation

Strictly speaking innovation, development, change, improvement and reform are general terms. Not every change, development or innovation is automatically an improvement. They may even imply a return to the old situation (Verbiest, 2017). But assumedly the old situation was no good enough; otherwise the innovation would not be needed. So, returning to the old situation is not an innovation. A new situation has to be created in order to call something an innovation. Waslander (2007) states that *behavior* is what needs to change for something to be considered an innovation, be it individual or group behavior. Innovation is about activities comprising a concept or idea, the translation of those concepts into practice, and the implementation in practice. Innovation is not a goal in itself, but the act of it suggests both a problem and solution. Thus, something is an innovation when it adds value. Moreover Waslander points out that innovation means that something is new (or a new combination of something already existing) and can only occur when embedded in new behavior of people in daily routines. According to Waslander, sustainable innovation is even considered a pleonasm. When behavior has changed, the innovation as well as its sustainability is a fact.

Ownership of the new situation

Van Staveren (2017), just like Verbiest, notes that a range of concepts is interchangeably used in the context of sustainable educational innovation, such as renewal, innovation, and change. According to Van Staveren, *innovation* is more a technological phenomenon, which implies a planned process: product development, implementation, and embedding. *Renewal* is linked to development. A development process starts with making sense of a new concept. *Change* is the interaction between

renewal and the existing reality. When this is done collectively and continuously, people become owners of the changed reality. This ownership is needed for a sustainable change to occur.

Multilevel or organizational change

Michael Fullan (2007) uses both change and innovation to describe the same multidimensional phenomenon. Change or innovation requires an approach on three levels: in materials, teaching approaches, and beliefs – in what people do and think, thus a change in people's behavior in daily routines. Innovations that do not include changes on these dimensions are probably not significant or sustainable changes. Fullan adds that for changes to occur at the individual level, organizational changes are often needed to provide supportive or stimulating conditions that foster change in practice.

This is in line with Hubers' (2020) definition of second-order educational change, which is considered behavioral change as it requires new knowledge and skills as well as adaptations in the prevailing values and norms. This type of change is transformational by nature, can be classified as 'substantial', and affects the core of educators' everyday practice. Teachers involved in educational change learn and change their way of doing things. And, as organizations are multilevel systems, not only the individual teacher needs to change, but the entire organizational system needs to change for the change to be genuine.

Summary

Many concepts are used in the literature on educational innovation to describe the same phenomenon. Whether it be an innovation, change, reform, renewal, or improvement, most authors seem to agree that it is about a change in the behavior of teachers. Not only at the individual level, but also at the organizational level. This is also referred to as multilevel change.

3.2 Sustainability

Introduction

When discussing the sustainability of an innovation, it is interesting to know whether an innovation lasts over time and becomes institutionalized or sustained (Datnow, 2005). Although institutionalization and sustainability are often used interchangeably in the literature (Baglibel, Samancioglu & Crow, 2018), a distinction can be made. Institutionalization in the literature typically refers to the last stage in an innovation process, the stage in which the implementation is institutionalized, meaning it will be sustained over time. Sustainability can be described as the result of a successful innovation process that lasts over time.

This section explores the concept of sustainability. First, it presents some definitions of sustainability. Although the literature reveals a wide range of definitions, they all contain common elements. In addition to these definitions, this section also presents other concepts related to sustainability. The section ends with a summary. After that, section 4.1.3 explores how sustainability is linked to the innovation process.

Defining sustainability

Various definitions of sustainability exist in the literature on sustainability. Table 1 provides an overview. Several definitions address a change in the daily behavior of teachers; other definitions include a system perspective. Some definitions refer to maintaining the change, without further

explanation of what needs to change. This variety in definitions indicates that conceptual clarity does not yet exist.

Table 1. Definitions of sustainability

Authors	Definition
Gallagher, Malloy & Ryerson (2016, p. 495)	"… the degree to which activities and programs become ongoing habits of teacher and school practices…."
Askell-Williams & Koh (2020, p. 662)	"the implementation of an effective initiative over a context-dependent timeframe leading to irreversible desirable system change".
Hargreaves (2002, p. 193)	"Sustainability in educational change comprises five key and interrelated characteristics. These are 1) improvement that sustains learning; not merely change that alters schooling, 2) improvement that endures over time, 3) improvements that can be supported by available or achievable resources, 4) improvements that do not impact negatively on the surrounding environment of other schools and systems 5) improvement that promotes ecological diversity and capacity throughout the educational and community environment".
Hargreaves & Fink (2006, p. 30)	"Sustainability does not simply mean whether something will last. It addresses how particular initiatives can be developed without compromising the development of others in the surrounding environment, now and in the future".
Fullan (2005, p. ix)	"the capacity of a system to engage in the complexities of continuous improvement consistent with deep values of human purpose."
Datnow (2005, p. 123)	"Although in dictionary terms *sustainability* refers to longevity and *institutionalization* refers to something becoming an established practice, their definitions in the research literature are inextricably connected. For a reform to be sustained, it must become institutionalized. So too, when a reform is institutionalized, it has been sustained over time".
Wierda- Boer, de Lange & de Vijlder (2020, p. 12)	"Routines have changed permanently compared to the starting situation, the innovation is consolidated and serves as a basis for further development (both enriching and deepening) and the capability to develop oneself (2nd order learning)".
Bakah, Nihaku & Anto (2019, p. 332)	"The term sustainability implies the continuation of a programme in some way".
Fix et al. (2021, p. 132)	"Sustainability can be seen as a process of institutionalization in which the educational innovation must be spread over the organization".
Geijsel & Van Eck (2011, p. 70)	"Sustainability is the process of change, the way in which the school works on innovations and whether this way of working becomes part of the daily routines of teachers".
Hubers (2020, p. 7)	"Taken together, sustainable second-order educational change within a school refers to (….): 1. substantial changes that are made by the schools' educators. These changes affect the core of their everyday practice. 2. a longitudinal process that starts as early as when the schools' educators contemplate whether or not changes need to be made. It ends when satisfactory achievement on the other three characteristics is reached and overt learning efforts are stopped. 3. a process of individual learning (professional development) and organizational learning as well as of changing behaviors at both the individual and organizational levels. 4. a change process that results in improved student outcomes".

Rikkerink et al. (2016, p. 240)	"Sustainable development, that is, institutionalization, originates when these processes are being systematically supported, stimulated and warranted in the organization".
Rikkerink (p. 61, p. 171)	"Institutionalization comes down to the establishment, the standardization and making routine of the new practice". Sustainability is operationalized as "institutionalization of the use of digitalized learning materials".
Coburn et al. (2012, p. 140)	"…. Sustainability, defined here as the degree to which teachers use reform-related practices in high-quality ways after support for these practices has dissipated".
Loh, Friedman & Burdick (2013, p. 32)	"the ability of a project to maintain its operations, services and benefits during its projected lifetime".

Other concepts related to sustainability

In addition to the definitions listed above, other concepts exist that are related to sustainability. These are dissemination, diffusion, and scale. See Table 2 for a description of these concepts. Again, this shows that no one clear definition exists yet and that there are a range of concepts related to sustainability.

Table 2. Concepts related to sustainability

Author	Concept	Definition
Gannaway et al. (2011, p. 53 in Gannaway et al, 2013)	Dissemination	"the planned process of understanding potential adopters and engaging them throughout the life of the project, to facilitate commitment to sustained change".
Rogers (2003, p. 5; p. 6)	Diffusion	"the process in which an innovation is communicated through certain channels over time among the members of a social system." "Diffusion is a kind of *social change,* defined as the process by which alteration occurs in the structure and function of a social system".
Coburn (2003)	Scale	"Scale is about four interrelated dimensions: depth, sustainability, spread and shift in reform ownership. Depth refers to deep change that goes beyond structures and procedures and alters teachers' beliefs, norms of social interaction and pedagogical principles. Sustainability means that changes persist over time. Spread is about spreading the norms and beliefs that come along with the innovation not only within multiple classrooms, but also in school policies and priorities. Shift in reform of ownership means that the change is internalized by teachers and schools who have the capacity to sustain, spread and deepen the reform principles themselves."

Summary

Given this variety of definitions and concepts (not an exhaustive list), it is clear that no agreement exists on a single definition of sustainability. Despite the heterogeneity, the literature reveals some common elements for defining sustainability. In summarizing all of the above, sustainability refers to:

- a change in behavior of teachers

- a change that can be classified as second-order learning
- a change that spreads over a social system and leads to a system change
- a change that does not harm its environment
- a change process that results in improved learning outcomes for students
- a process of institutionalization (something becoming an established practice)
- a change that persists over time

3.3 Sustainability in the innovation process

Stages in the innovation process

An innovation process is typically divided into three stages: initiation, implementation, and institutionalization (Fullan, 2007). The first phase is the process that leads up to and includes a decision to adopt or proceed with the change. The process then moves to the implementation phase, where ideas are put into practice. Finally, when the change is implemented and adopted by most of the teachers, it becomes institutionalized. An example of this is when a new program is sustained beyond the first year or two (or whatever timeframe is chosen) (Fullan, 2007). Recent research on educational innovations points to Innovative Work Behavior (IWB) of teachers as an emerging concept. In IWB, innovation is seen as a multi-stage, iterative process, consisting of five phases: opportunity exploration, idea generation, idea promotion, idea realization, and idea sustainability (Lambriex-Schmitz et. al, 2020). The idea realization phase corresponds to Fullan's implementation phase (including a communication dimension). The idea sustainability phase of IWB (here operationalized as external dissemination and internal embedding) corresponds to Fullan's institutionalization phase: the innovation is embedded and anchored in the organizational system.

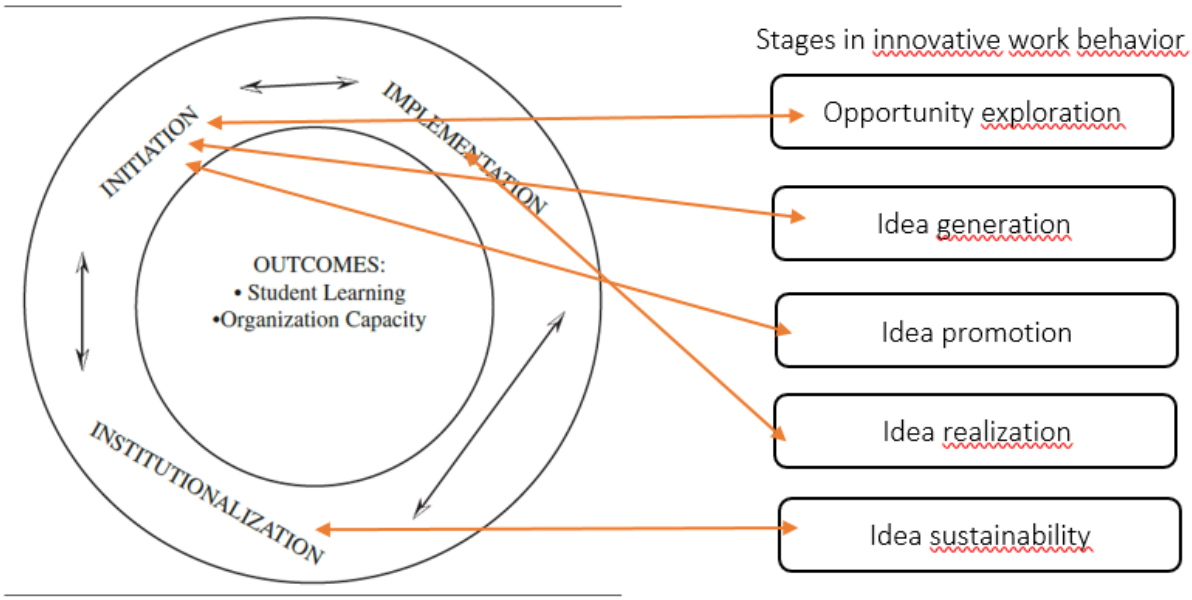

Figure 1. The relation between the stages of the change process according to Fullan (2007) and the stages in innovative work behavior identified by Lambriex-Schmitz et al. (2020).

Sustainability and the non-linear order of the innovation process

Both Fullan (2007) and Lambriex-Schmitz et al. (2020) define educational innovation as a multi-stage process in which the phases partly overlap. However, they also recognize that the phases do not necessarily follow a fixed linear order. All phases must be considered from the beginning and continually thereafter, resulting in a complex, non-linear process of innovation. Sustainability or

institutionalization is therefore not something that comes at the end of the innovation process. It must be thought through from the beginning. Hubers (2020) also reaches this conclusion: sustainability is not to be considered an after-thought after changes have already occurred; rather it is the build-up and continuation of the change process. Or, in other words: sustainability is something that starts as soon as teachers are considering a change and ends when the change process has been successfully completed.

Institutionalization or sustainability, or both?

As becomes clear from the above, and as mentioned earlier by several authors, institutionalization and sustainability are often used interchangeably in the literature, or at least inextricably connected (Datnow, 2005; Baglibel, Samancioglu & Crow, 2018). Whereas Fullan (2007) refers to the institutionalization stage, it is referred to as the sustainability stage in the concept of IWB (Lambriex-Schmitz et al., 2020). Datnow (2005) suggests that for a reform to be sustained, it must become institutionalized. So too, when a reform is institutionalized, it has been sustained over time. As a final point, it can thus be suggested that sustainability refers to both a stage in the innovation process as well as to the successful result of that same process.

Summary

An innovation process is typically divided into three stages: initiation, implementation, and institutionalization (sometimes called the sustainability stage). Although these stages are partly dependent, they do not follow a fixed linear order. Innovation is a complex, non-linear process in which all the stages must be thought through from the beginning. Thus, planning for institutionalization or sustainability starts at the beginning of the innovation process. Once the process including the institutionalization stage has been successfully completed, this means the innovation is sustainable. Sustainability therefore refers to both a stage in the process, as well as to the successful result of that same process.

3.4 Mechanisms promoting sustainability of educational innovations

Introduction

Empirical research on the sustainability of innovation or change in higher education institutions is scarce. For that reason this section also gives an overview of relevant empirical research on the sustainability of educational innovations in other school systems. Although these systems differ, the literature reveals similarities in the mechanisms that promote sustainability. In total, 26 articles were examined. Table 3 shows the number of articles per component of the school system (higher education, vocational education, primary and/or secondary education) and whether these studies were of a quantitative nature, a qualitative nature, or both.

Table 3. Number of empirical studies per school system and their qualitative or quantitative nature.

School system / Research method	Higher education	Vocational education	Higher and vocational education	Secondary and vocational education	Primary and/or secondary education	Totals
Quantitative		1	1		3	5
Qualitative	6	2		1	9	18
Quantitative/qualitative					3	3
Totals	6	3	1	1	15	**26**

Comparability of articles

The research studies included in this part of the exploration have in common that they all present empirical evidence (qualitative and/or quantitative) regarding the concept of sustainability, but it is important to note that the articles all cover different types of innovations, different timespans, different school systems, and different countries. Utmost caution is necessary when comparing the studies. As a consequence, it is difficult to draw any firm conclusions on what exactly works under which circumstances. This would require a more detailed study and comparison of the projects presented. However, it does not mean it is impossible to draw any conclusions: the 26 articles together present 20 prerequisites that appear to have a positive impact on the sustainability of innovations.

Presentation order

Only factors mentioned in five or more articles are described from here on. This results in a set of 8 factors presented in Table 4. The table below shows how many articles mention each factor.

Table 4: Factors promoting sustainability and presentation order

1.Leadership	22	5. Focus	10
2.Teacher learning and development	13	6. Commitment	9
3.Communities	13	7. Continuity of resources	8
4.Evaluation	10	8. Communication	6

The factor that is mentioned most to have an impact on sustainable innovation is described first, followed by the factors that are mentioned less often. Although this order may indicate an order of importance (i.e., leadership as the factor most influential on sustainability), this conclusion cannot be drawn from this exploration. Further research would be needed here.

3.4.1 Leadership

Leadership is mentioned by 22 of the 26 articles examined. As outlined below, the concept of leadership in relation to sustainability does not refer to the personal characteristics of a leader, but rather to the style of leadership and the conditions in which the leader works. Leadership also refers to the extent to which a leader is able to manage the context of the school for the benefit of the innovation (known as context-conscious leadership).

Autonomy

Leadership plays a crucial role in helping to choose the right design of the reform or innovation, allocating resources and scheduling, supporting teachers through professional development, and serving as an intermediary between school and policy makers. For leaders to be able to do this, they need a certain amount of autonomy that gives them authority over curriculum and instruction, budgeting, staff, and the school mission (Desimone, 2002).

Leadership support

A supportive manager is a manager who is positive about the innovation, sees its long-term benefit, creates time and space for teachers to work on it, and empowers teachers (Sierpina et al., 2007; Loh, Friedman & Burdick, 2013; Kunnari & Ilomäki, 2016; Bakah, Nihuka & Anto, 2019; Wierda- Boer, de lange & de Vijlder, 2020; Lambriex-Schmitz et al., 2020; Lambriex-Schmitz et al., 2020).

Distributed or shared leadership

Having a strong or supportive leader does not mean the leader has to exert authority or impose expertise over the practice of others. *Distributed or shared leadership* is the type of leadership that leads to sustainable innovations (López Yáñez & Sánchez Moreno, 2013; Gallagher et al., 2016; Rikkerink et al., 2016; Toh, 2016; Koeslag-Kreunen et al., 2018; März et al., 2018; Fix et al., 2021). Distributed leadership means that leadership behavior is not only something observed in people with formal management positions but also in other people in the organization. In other words, many aspects of leadership are also exerted by teachers (Rikkerink et al., 2016). Collaboration and open communication are aspects of distributive leadership in practice that might influence teachers' organizational commitment (Rikkerink et al., 2016). In the schools observed by López Yáñez & Sánchez Moreno (2013), distributed leadership was seen in the behavior of teachers who were in charge of the projects in which the school was participating. Strong collaboration, mutual confidence, and flexible and complementary distribution of roles and responsibilities was found among teachers and leaders.

Distributed or shared leadership is also connected to teacher team learning (Koeslag-Kreunen, 2018; März et al., 2018; Fix et al., 2021). This type of leadership is about collaborative problem solving and about inquiry and collaboration that fosters risk-taking and learning from mistakes (see also Grymonpre et al., 2016), so learning as a team. As leadership (formal and informal) is executed by more than one person in a school, it is important for the formal leaders to invest in collective capacity building and in organization modes that combine learning, organization, and social capital for teachers (März et al., 2018). Investment also means leaders play an important role in ensuring that collaborative professional learning remains a priority with substantial time spent on it. As schools often prioritize student learning over teacher learning, this can be a challenge (Gallagher et al., 2016). Collective learning processes not only apply to teachers: in innovations that turned out to be sustainable, leaders were also part of the collective professional learning process (Rikkerink, 2011). In addition, it is important that leaders invest in their own professional learning networks through leadership networks (März et al.,2018).

Context-conscious leadership

A leader who is able to manage the context influences sustainability in a positive way. Context refers to the environment of a school. Although it is recognized that the context is hard to change (or manage), when managers both undergo the external changes and integrate external changes for the benefit of their own school, this has a positive effect on sustainability (Desimone, 2002; Waslander, 2011; Rikkerink, 2011; Rikkerink et al., 2016). Rikkerink et al. (2016) refer more specifically to this type

of leadership as context-conscious leadership: leadership that manages both developments within the school as well as outside of the school and succeeds at aligning the two.

Context-conscious leadership requires a leader to stay on track and to keep control over the school goals, while at the same time engaging others in plans and aligning plans with the environment (Waslander, 2011). Leaders who share evaluation results and achievements with stakeholders outside the organization may influence stakeholder's opinion about the innovation in a positive way (Geijsel & Van Eck, 2011). This prevents the school from being distracted by for example excessive bureaucratic demands from governments (Gallagher, Malloy & Ryerson, 2016), and so maintain both the pace of the change and the internal commitment of staff (López Yáñez & Sánchez Moreno 2013).

Leadership succession

Another aspect of leadership that shows to have an impact, or rather, that shows how the organization deals with leadership, is leadership succession. Leadership succession (or the lack of careful planning for it) has a major effect on sustainability (Hargreaves & Goodson, 2016). In a study on educational change over time that spanned 30 years of school change, they found that change of leadership is one of the most significant events in the life of a school. There seem to be very few examples of leadership succession whereby the new leader would build on past achievements to move the school forward. Successions are often poorly planned. They are more a reaction to events than a thoughtful attempt at creating sustainable improvements that go beyond individual leaders. When a school has developed distributed leadership, however, it is the staff as a team, not just one (new) leader, who may be able to move the school into the next phase of its development.

Physical location

The physical location of the leader also has an effect on sustainability. A central place for the leader's office in the school building leads to more interaction with school staff. However, a negative side-effect of a central location could be that the leader misses out on a lot of informal communication that takes place among staff on the outskirts of the building (Shirell & Spillane, 2020).

Summary

Summarizing the above, the literature shows that the concept of leadership in relation to sustainability not only refers to the personal characteristics of a leader, but also to the style of leadership and the conditions in which the leader works. Strong leadership can occur when the leader has a certain amount of autonomy, which gives the leader the opportunity to invest resources in the innovation and take other necessary actions. A leader must also be able to manage the context (also known as context-conscious leadership), which means the school should not only undergo external changes but also integrate them for its own good. It is equally important that teachers feel supported by their leader and that leadership is shared among the formal leaders and the teachers. The physical location of the leader matters: a location that leads to more interaction with teachers (both formal and informal) has a positive impact. Leadership succession may however have a negative effect on sustainability and is something that should be carefully planned.

3.4.2 Teacher learning and development

Teacher learning and development is mentioned to varying degrees by 13 of the 26 articles studied. It is revealed that teacher learning is more than individual learning. It is when individual learning turns

into collective learning that teacher learning has a positive effect on the sustainability of an innovation.

Learning to understand the reform

Teacher learning and development refers to consistent capacity building, focused on understanding and implementation of the reform (Desimone, 2002; Toh, 2006). When teachers have gained a deep understanding of the innovation, they are able to sustain the innovation even when conditions change (Coburn et al., 2012).

Exposure to other innovations

Exposing teachers to other innovations also helps them to develop their innovative behavior, which has a positive effect on sustainability (Lambriex-Schmitz et al., 2020). Often however, time constraints may prevent teachers from being exposed to innovations, which hinders them from gaining a clear picture of what innovations imply and in what way they could change their own way of working. This has an effect on the motivation of teachers to adopt and sustain innovations (März et al., 2018; Kunnari & Ilomäki, 2016). It is therefore important to give teachers the opportunity (in terms of time) to be exposed to other innovations.

Professional learning and teacher autonomy

Professional development with the purpose of filling gaps in teacher knowledge does not encourage teacher learning (Gallagher et al., 2016). Professional learning is about giving teachers the opportunity to make sense of the innovation and adapt their behavior in a way that the innovations can have the intended effect in practice (März et al., 2018). Effectiveness in professional learning is defined in terms of its impact on classroom practice and student learning. Enabling teachers to connect their own learning to student learning has a positive effect on sustainability (Gallagher et al., 2016).

Professional learning is essentially different from the traditional view on learning in the (autonomous) teacher profession. In the traditional view, the teacher has a great deal of autonomy and teaching and learning is regarded as consisting of individual work and planning by each teacher. Learning takes place (more or less) in isolation. This may lead to person-dependent ways of working in which only few students benefit from the new integrative ways of learning (Kunnari & Ilomäki, 2016). Although professional autonomy is seen as having a positive effect on teacher learning, too much individual autonomy damages the sustainability of the innovation (Fix et al., 2021). In terms of sustainability, the innovation not only requires individual but also collective sense-making. Learning and collective sense-making is a collaborative act (Rikkerink, 2011; Coburn et al., 2012, Gallagher et al., 2016, Rikkerink et al., 2016, Kunnari & Ilomäki, 2016; Bakah, Nihaku & Anto, 2019; Wierda- Boer, de Lange & de Vijlder, 2020; Fix et al., 2021). When teachers jointly recognize the need for collaboration in order to facilitate the learning process of students, an exchange occurs of evidence-based experiences and personal views. This develops into a cyclical process of systematic joint reflection on experiences with new ways of working and collective agreement on what improves student learning. Eventually this leads to a team culture of learning and innovation (Rikkerink, 2011).

Summary

In summary, the literature shows that teacher learning and development is important for sustainability, but not when the learning and development is an individual act. Innovations become much more sustainable when individual learning leads to collective learning. This requires a shift from the more traditional view on teacher learning, where the teacher is autonomous and where teaching

and learning take place at the individual level, to a view on teacher learning where learning takes place in a collaborative and networking environment. This latter view is further elaborated in the next section.

3.4.3 Communities

The importance of communities is mentioned in 13 articles. Communities are a vital part of a strong school culture, which is linked to sustainable performance (Lee & Louis, 2019). Effective teacher learning takes place in communities: the social interaction and networking create a feeling of relatedness among teachers. Empirical research shows that innovations that are sustainable occur in schools that operate as a community (Desimone, 2002; Gallagher et al., 2016; Sierpina, 2007; Rikkerink, 2011; Waslander, 2011; Coburn et al., 2012; Loh, Friedman & Burdick, 2013; López Yáñez & Sánchez Moreno, 2013; Kunnari & Ilomäki, 2016; März et al., 2018; Bakah, Nihuka & Anto, 2019; Wierda-Boer & de Vijlder, 2020). It is also important to note that a professional community not only consists of teachers but also includes leaders and every other member of the system involved in the change (e.g., administrators, professionals working in the local community) (Loh, Friedman & Burdick, 2013).

Communities allow open dialog and reflection to make progress as a collective. Working in a community is essential for the innovation to become embedded in the day to day operation of teachers (Waslander, 2011). It is indispensable for integration, diffusion, and communication (Kunnari & Ilomäki, 2016). Communities compensate for shortcomings at the individual level and allow for teacher interaction that leads to a shared understanding of the innovation. This appears to be crucial for sustainability (März et al., 2018). Communities give teachers the opportunities to interact and communicate about the innovation, which helps to make it part of teachers' daily discourse. It is the place where the innovation is adopted and gains authority and where normative changes take place (Desimone, 2002; Bakah, Nihuka & Anto, 2019). Social relations among colleagues are an important vehicle for an innovation to become adopted and sustained, or in other words: using social relations is much more effective than exerting power if an innovation needs to become daily routine of a teacher's work (Toh, 2016). Coburn et al. (2012) have analyzed three dimensions of social networks and their relation to sustainability. These dimensions are *tie strength* (high frequency, social closeness or a combination of the two), *level of expertise* (competences and resources available) and *depth of interaction*s (the content of interaction). The research of Coburn et al. shows that all three dimensions in their interaction are equally important for sustainability. In other words, it is not the network or community as such that promotes sustainability, but first and foremost the quality of the interaction within the community.

Working on the innovation together

Communities may also help in the socialization of new teachers, providing them with information, support, and even responsibilities (López Yáñez & Sánchez Moreno, 2013). Not only can teachers develop a shared vision, but *working on the innovation together* is a powerful way to learn together, in a formal and informal way. The community is a safe space for making mistakes, for developing and learning, and for celebrating successes. This leads to more ownership, commitment, satisfaction, and willingness to go the extra mile (Wierda-Boer, de Lange & de Vijlder, 2020).

When communities are too close

Strong networks or communities may, however, also have a downside. When the relationships are too close, and the school climate is too positive, this may hinder open communication (Waslander 2011; López Yáñez & Sánchez Moreno, 2013).

Summary

Empirical research shows that innovations that are sustainable take place in schools that operate as a professional community. A professional community consists of teachers, leaders, and everyone else involved in the change. The community is the place where teachers can interact and communicate about the reform, which helps make the innovation part of the daily discourse. Communities are not only about sharing ideas: when teachers work on the innovation together, they can learn together, as the community is a safe space to learn and make mistakes. The quality of the community depends on dimensions such as tie strength, level of expertise, and depth of interactions, and on how these dimensions interact. A combination of strong ties, high levels of expertise, and a certain depth of the interaction have a positive effect on sustainability. Ties that are too strong however weaken the community. They can prevent open communication in schools.

3.4.4 Research

Several articles (10 out of 26) show that consistent research of the process of innovation has a positive effect on sustainability (Desimone, 2002; Datnow, 2005; Sierpina, 2007; Geijsel & Van Eck, 2011; Loh, Friedman & Burdick, 2013; Gallagher et al., 2016; Grymonpre, 2016; März et al.,2018; Toh, 2016;; Bakah, Nihuka & Anto, 2019).

An empirical study on five years of innovations in secondary schools in the Netherlands shows that the effect of research impacts sustainability in three ways. First it helps clarify what the innovation means in practice and how it affects other parts of the organization, for example quality assurance and HR policies. This is because in order for the innovation to become embedded and sustained, it must become part of the daily routines of the organization. Therefore alignment needs to take place with other parts of the organization. Second, research findings may also help create a need for the innovation within and outside the organization. Showing teachers positive interim results of the change process may convince them to become part of the change. Students who can share their experiences are more involved. And sharing research findings with the outside world may have a positive effect on the school's reputation. Third, the use of research results also impacts the learning process of teachers. By periodically sharing and reflecting on research findings with teachers, the innovation process can be adapted during the innovation process or even stopped if needed (Geijsel & Van Eck, 2011). In addition, sharing the results of the innovation with other teachers helps spread the innovation (März et al., 2018). It can also help schools stay focused on what needs to be implemented (Desimone, 2002). Schools that invest in instructional capacity based on data that informed learning, in order to make data-driven decisions, are able to make sustainable improvements. Building a culture of evidence that connects practice and research works (Gallagher et al., 2016). Evidence-based data can motivate teachers to come on board voluntarily and gives leaders a basis for judgment to decide whether to incorporate the innovation into the department's work scheme (Toh, 2016).

Measuring performance

When evaluating the results of an innovation, it is important to note that focusing too much on traditional performance indicators (e.g., finance, certain measures of quality, or student performance) may run counter to sustainable school reform efforts. Measures of success might instead (also)

address long-term school improvement, teacher development, and the creation of a school culture that is ripe for change or whether the school culture works against (Datnow, 2005). This means being responsive to the diverse contexts of schools when designing performance indicators, without losing track of the effectiveness of the innovation (Gallagher et al., 2016).

Summary

Monitoring the effects of the innovation and sharing the results with everyone involved benefits sustainability. It helps clarify what the innovation entails and how it affects other parts of the organization. Positive changes made visible may convince teachers to participate in the innovation, to discuss advancements, and to make decisions. Monitoring and sharing monitoring results also helps build a reputation in the outside world. When measuring performance in the innovation processes, other measures than traditional performance indicators may be more adequate, for example long-term school improvement in teacher development.

3.4.5 Focus

Focus refers to concentration on activities linked to teaching and learning, but also to coherence: linking innovative activities to the school's goals. Focus is about aligning innovative activities with the school's institutional strategy, but also about aligning the innovation with local norms, culture, needs, and the daily practice of teachers (which is the school's core practice). Focus appears in 10 articles.

It may sound obvious, but innovations that are directly linked to teaching and learning have a greater chance of being sustained than innovations that are not (Waslander, 2011; März et al., 2018). Examples of innovations that are not directly linked to teaching and learning are innovations that focus on student wellbeing, collaborative projects with other professionals (in literature referred to as didactic-pedagogical innovations), and process innovations (organization, ICT, infrastructure). A Dutch study in secondary education (in: Waslander, 2011) shows that innovations that are most connected to teaching and learning (such as curriculum design) turn out to have a positive effect on the productivity of a school. Productive schools, in turn, are better at sustainable innovation. In other words: focusing the innovative activities on teaching and learning works for sustainability. Moreover, the innovations in the aforementioned research project were more effective when they were connected to the school's quality system and when teachers had a very clear picture of the consequences of the innovation for their daily practice. Making innovations specific, thus focusing on teaching and learning and aligning them to other domains in the school is important (Waslander, 2011).

Teachers, leaders, and researchers are more satisfied with the results of innovative projects when schools innovate in a coherent way. That means with a clear vision, approval of teachers, and coherence between activities and allocated time. It is considered a sign of focus when the vision is connected to (activities in) other domains in the school, for example HR or quality assurance (Waslander, 2011).

This internal alignment is mentioned by several authors (Datnow 2005; Waslander, 2011; Loh, Friedman & Burdick, 2013; Gallagher, Malloy & Ryerson, 2016; Toh, 2016; Bakah, Nihaku & Anto, 2019). Integrating the innovation in the school's strategy or designing the innovation in such a way that it is coherent with existing policies supports sustainability. This is also the case when school leaders actively use the results of an innovation (Loh, Friedman & Burdick, 2013; Bakah, Nihaku & Anto, 2019). It is therefore important to be vigilant about distractors such as excessive bureaucracy

and ad hoc activities, to focus on core priorities, and to have a limited number of goals (Gallagher, Malloy & Ryerson, 2016; Waslander, 2011).

Adapting to local needs and local accountability measures

Focus refers to having a manageablenumber of ambitions as a school (as well as not having too many distractions), but also to aligning the innovation with local norms, culture, and needs, and again, the daily practice of teachers. Innovations that can adapt to local (organizational) culture have more chances of survival. The same goes for innovations that connect with the interests of all stakeholders involved (Datnow, 2005; Baglibel, Samancioglu & Crow, 2013; Gallagher, Malloy & Ryerson, 2016; Wierda-Boer, de Lange & de Vijlder, 2020).

In addition, it is important to create coherence between the innovation and government accountability measures (local, regional, national), as these accountability measures can conflict with the process of innovation, which in turn is a threat to sustainability. It clearly helps when these accountability measures are in line with internal school policies, or when a school is given the freedom to adapt the accountability measures to their own situation or their own definition of success (Datnow, 2005).

Feedback mechanisms

Focus can be generated among everyone involved by ensuring healthy feedback mechanisms at multiple levels in the organization (Toh, 2016).

Summary

Focusing the innovation specifically on teaching and learning and aligning it with other activities, policies, and domains such as HR or quality assurance helps ensure sustainability. When schools focus their innovations on teaching and learning, they become more productive. Productive schools in turn are better at innovation. It is important to integrate the innovation in the school's strategy, adjust existing performance measures for the purpose of good measurement of the innovation, and align everyone involved by ensuring healthy feedback mechanisms.

3.4.6 Commitment

Commitment refers to ownership of everyone involved in the change process and appears in 9 articles. It concerns not only teachers and leaders but also other stakeholders, such as school or university boards and governments (Sierpina, 2007; Waslander, 2011; Grymonpre, 2016; Wierda-Boer et al., 2020). It also includes commitment from administrators for technical support (Bakah, Nihaku & Anto, 2019).

Creating commitment

Commitment also refers to the time dimension of sustainability (Datnow, 2005). Educational innovation requires a long-term effort and is hard work. This is true not only on a strategic, conceptual, and practical level, but also on an emotional level. Teachers are confronted with their own beliefs. It is up to leaders to allow space for everyone's opinions and for teachers to become owners of the innovation. It turns out that the closer the innovation is to the daily practice of the teacher, the greater the chance of ownership (Waslander, 2011). This is also the case when using evaluation findings to promote sustainability: it has a positive effect on the commitment of teachers. The more the research findings of the innovation process are relevant for their daily work, the more teachers are willing to use them (Geijsel & Van Eck, 2011). This not only applies to the teachers directly involved in

the innovation, but also to the teachers surrounding them. The deeper the understanding teachers have of the change, the more they become owners (März et al., 2018).

Summary

Commitment refers to the ownership of everyone involved in the change process. The closer the innovation is to the daily practice of teachers, the bigger the chance of ownership (and thus commitment). Commitment also refers to the time-dimension of sustainability, as innovation requires a long-term effort of everyone involved.

3.4.7 Continuity of resources

Securing a stable resource base is vital for sustainability (Datnow, 2005; Loh, Friedman & Burdick, 2013; Gallagher, Malloy & Ryerson, 2016; Kunnari & Ilomäki, 2016; März et al., 2018). This factor appears in 8 articles. Resources not only refer to money, but also to time and energy available for the innovation, or support from experts (Kunnari & Ilomäki, 2016; März et al., 2018). Resources have to last through leadership and political changes (Datnow, 2005). The more the organization is capable of securing adequate resources, the more sustainable the innovation will be (Loh, Friedman & Burdick, 2013). And when resources \come from outside the organization, it is important for schools to prepare at an early stage for a transfer from external resourcing and responsibility to internal support in order to continue the innovation (März et al. 2018).

Time

It takes time for changes to become sustainable (Desimone, 2002; Datnow, 2005; Waslander, 2011; Gallagher, Malloy & Ryerson, 2016; Wierda-Boer, de Lange & de Vijlder, 2020). The process of embedding an innovation may take years. Innovation is therefore not only exciting and challenging, but also a matter of perservring simply 'holding on'. That means persevering holding on even when one is being confronted with obstacles, when there is a need to do things differently, when colleagues are unwilling, or when there is a lot of resistance to the innovation. It means resisting the temptation to expect results too quickly and allowing time for the innovation to develop.

Staff

Apart from upholding the change for a long period of time to give it the opportunity to grow and become part of the organization, it is also important that there is continuity in teachers, administrators, and leaders. Staff turnover has a negative effect on sustainability (see also Leadership) (Desimone, 2002).

Support for innovative activities

When innovation becomes the way of doing things (i.e., improvement works through professional learning), it may become hard to distinguish between an innovative practice and everyday practice. The challenge for sustainability is to maintain this distinction so you can continue to differentiate between different types of support for innovation initiatives (Gallagher, Malloy & Ryerson, 2016).

Summary

Resources refer not only to money, but also to time and energy available. Embedding changes may take years. Some stability in resource base is required: time, money as well as staff (staff turnover has a negative effect). When resources come from outside the organization, it is important to prepare in an early stage for a transfer from external resourcing to internal support.

3.4.8 Communication

Communication (referred to in 6 articles) impacts sustainability (Sierpina et al., 2007; Geijsel & Van Eck, 2011; Grymonpre, 2016; Toh, 2016; Fix et al., 2021; Wierda-Boer, de Lange & de Vijlder, 2020). Creating a common language within the organization, but also with stakeholders from outside the organization adds to trust and respect. It creates a common ground for collaboration.

3.4.9 Some remarks on how to consider the above factors

It is important to realize that the factors influencing sustainability should not be studied in isolation. It is a combination or configuration of the factors listed above that make educational innovation and change sustainable. The more factors there are supporting implementation, the more that change in practice will be accomplished; they form a system of variables that interact to determine success or failure (Desimone, 2002; Fullan, 2007; Rikkerink, 2011; López Yáñez & Sánchez Moreno, 2013; Rikkerink et al., 2016; Grymonpre et al., 2016; März et al., 2018; Askell-Williams & Koh, 2020; Wierda-Boer, de Lange & de Vijlder, 2020).

Hargreaves and Fink (2006) say lists of this kind are a meal, not a menu. What they mean is that one has to experience and engage in the change process to really understand how these factors interrelate. Or in other words: the proof of the pudding is in the eating of it. And, as Fullan adds (2007): you need all ingredients, not any six or seven, to make a well-balanced meal. So, the more factors that are in place in the process of innovation, the more sustainable the change will be.

3.4.10 Summary: mechanisms promoting sustainability

The literature reveals similarities in the mechanisms that promote sustainability. This literature exploration has identified and described 8 factors. Factors promoting sustainability are leadership, teacher learning and development, communities, research, focus, commitment, continuity of resources, and communication. It is important to note that these factors should not be studied in isolation. It is the combination of factors that leads to a sustainable innovation. And the more factors that are in place in the process of innovation, the more sustainable the change will be.

4. Conclusion

This literature exploration aimed to generate an overview of what is known in literature about sustainable innovation in higher education. To achieve this aim, three questions were posed:

1. What is understood by sustainable innovation in the context of higher education?
2. What does the literature say about can be found about the sustainability of innovations as a stage or phase in the innovation process?
3. What does the literature reveal about the characteristics or prerequisites of sustainable innovations in the innovation process as a whole?

To answer these questions, 37 articles and books were considered relevant to answer at least one of the three research questions. This chapter summarizes the results.

4.1 Some clarity on educational innovation

Before explaining sustainable innovation, we provided some clarity on educational innovation. Many concepts are used in the literature on educational innovation to describe the same phenomenon. Whether it be an innovation, change, reform, renewal, or improvement, most authors seem to agree that it is about a change in the behavior of teachers. Not only at the individual level, but also at the organizational level (called multilevel change).

4.2 What is understood by sustainable innovation in the context of higher education?

Given the variety of definitions and concepts in literature, no agreements exist on a single definition of sustainability. Despite the heterogeneity, the literature reveals some common elements for defining sustainability. These elements are: a change in the behavior of teachers; a change that can be classified as second-order learning; a change that spreads over a social system and leads to a system change; a change that does not harm its environment; a change process that results in improved learning outcomes for students; a process of institutionalization (something becoming an established practice); a change that persists over time.

4.3 What does the literature say about the sustainability of innovations as a stage or phase in the innovation process?

An innovation process is typically divided into three stages: initiation, implementation, and institutionalization (sometimes called the sustainability stage). Although these stages partly overlap, they do not follow a fixed linear order. Innovation is a complex, non-linear process in which all the stages must be thought through from the beginning. So planning for institutionalization or sustainability should already start at the beginning of the innovation process. Once the process including the institutionalization stage has been successfully completed, this means the innovation is sustainable Sustainability therefore refers to both a stage in the process, as well as to the successful result of that same process.

4.4 What does the literature reveal about the characteristics or prerequisites of sustainable innovations in the innovation process as a whole

The literature reveals similarities in the mechanisms that promote sustainability. In this exploration, 8 factors have been identified and described. Factors promoting sustainability are leadership, teacher learning and development, communities, research, focus, commitment, continuity of resources, and communication. It is important to note that these factors should not be studied in isolation. It is the combination of factors that leads to a sustainable innovation. And the more factors that are in place in the process of innovation, the more sustainable the change will be.

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