The effectiveness of educational innovations

An explorative study into innovation effectiveness, types of innovation and the role of institutional governance

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Abstract

The Dutch government uses public funds to create education innovation programmes in which teacher initiatives to innovate within their own educational institutes are supported. However, there is a lack of evidence that the developed innovations are effective and improve education. This study was done to explore the effectiveness of such innovations, studying which types of innovation were effective, and what role the governance of the educational institutes played in this. The research question of this study was: "What is the effect of institutional governance features and types of innovation on the effectiveness of innovations in Dutch secondary and higher education?"

This question was answered through qualitative research, consisting of eighteen interviews and content analysis of 78 documents. The results indicated that educational content innovation was effective in terms of teacher and student attitude improvement, student skill and knowledge development, and goal achievement. Didactical method, educational tool, and organisational innovations were less effective for these dimensions. The complexity of the innovation, professionalisation, and embedding of an innovation in its school organisation were found to be determinants for innovation effectiveness. Of the four studied institutional governance features, only the hierarchical structure had an effect on the effectiveness of the educational innovations. Organisational size, organisational culture, and leadership did not influence the effectiveness of an innovation.

An implication of these results was that the studied innovation programmes successfully stimulated the development of diverse innovations and allowed teachers to further develop their education and themselves. Moreover, it was found that innovations with a low complexity and small scope tended to be more effective within these programmes. Therefore, the innovation programmes could consider focussing their efforts on these innovations. One of the scientific implications of this study is that the findings help better understand the relationship between types of innovations and their effectiveness. The mechanism between institutional governance and innovation effectiveness remains relatively unclear and more research on this is needed.

Keywords: *Educational innovation; Secondary Education; Higher Education; Governance; Types of innovation; Innovation effectiveness.*

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Reading guide

This document is a combined thesis for both my Educational Science & Technology master's degree and my Public Administration master's degree. While the combined work gives the full picture, some sections are written towards one or the other part of the thesis. Therefore, an overview is provided below with an indication of the sections that belong to the public administration or educational science & technology aspect of the research.

	EST	**PA**	**Both**
Theoretical framework	2.1	2.3	2.2, 2.4
Methodology	3.2.1, 3.2.3, 3.2.4	3.2.5	3.1, 3.2.2, 3.3, 3.4, 3.5, 3.6
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1. Introduction

Education is an essential part of the public sector and creates the basis of the future of our society (Apple, 2014). Moreover, education is a key influence on the economy and culture (Apple, 2014). Because of its function in society, it is important that education is both effective and efficient in achieving its goals. While the majority of education is funded by public money, the Dutch education system is known for its high levels of autonomy for schools themselves. Up to 85% of decisions in the educational system are made by school boards and only 15% by the government (OECD, 2016). Instead of decision-making, the Dutch government attempts to steer the educational system through policy regulations and financial incentives (Waslander et al., 2016). These regulations and incentives are aimed at increasing the quality of education, for example by steering schools towards innovating (Hofman et al., 2013).

Regulations and financial incentives are one of the most common ways to steer innovative behaviour in the educational system (Tracey et al., 2016). Moreover, innovation is deemed necessary for educational institutes to stay relevant and meet societal developments and needs (Thurlings et al., 2015). However, there is a lack of evidence that the public funds spent on promoting innovation and change in education pays off in terms of student outcomes, i.e. reduced drop-out or increased average grades, and quality of education (Hanushek, 2005). It has already been found that putting more funds towards education does not necessarily lead to more effective education (Waslander, 2007). A study into innovation in secondary schools has shown that highly innovative schools have lower quality of teaching and learning processes than less innovative schools (Hofman et al., 2013). Moreover, secondary and higher education have traditionally been conservative and are known for their slow adoption of innovation (Serdyukov, 2017). Therefore, there could be a mismatch between the way policies aim to steer education towards innovation and how these policies work in practice (Waslander, 2007), with them not leading to more effective education.

Due to the large amount of autonomy educational institutes have in the Netherlands, the institutional governance can be of influence in this effectiveness. The execution of policies and incentives for innovations are shaped by the educational institutes and their boards. Moreover, educational institutes' governance could influence not just the effectiveness of innovations, but also the types of innovations that are developed and implemented within that institute (Haelermans & Witte, 2012).

It was previously found that different types of innovations spread beyond their initial place of implementation at differing rates over time. Moreover, different types of innovations could impact the quality of education in various ways (Haelermans, 2010). However, much is still unknown about the how and why of this impact and of the effectiveness of the different types of innovations. Previous research indicated the existence of some relationships, e.g. that innovation in teaching methods could have a positive results on students (Thurlings et al., 2015). More research needs to be done to understand what factors influence the effectiveness of innovation (Thurlings et al., 2015). Research into various types of innovations and their effectiveness could therefore fill the research gap about the role of these types of innovations on the quality of education. Moreover, studying the governance of the educational institute in relation to the effectiveness of innovations could provide more insights into the governance factors influence innovations' effectiveness.

A new connection is made by studying types of innovation and their effectiveness. Gaining insight into this relationship can help guide innovation development in educational institutes to be as effective as possible for the different forms of innovations. This is of societal relevance as the outcomes of this research could help streamline financial incentives for innovations and their processes, which benefits the public as less resources are spent on futile innovations. In addition, this study could result in a better understanding of the influence of institutional governance on the innovation process. That could give indicators for improving the environment in which innovations are developed and implemented, and how this could potentially increase their effectiveness.

Two financial incentive programmes will be used as a context for this study, which are LOF and the Comenius programme. Even though secondary and higher education differ from one another in terms of student population, teacher backgrounds and learning content, the two innovation programmes will provide common ground between the two. For secondary education, LOF (LerarenOntwikkelFonds)[1] will be studied. The goals of the LOF programme were to further professionalise teachers and aid in their development, as well as support innovative ideas that can further develop education (van den Berg & Bisschop, 2019). For higher education, cases will be selected based on the Comenius programme. Within Comenius, the teaching fellow programme provides opportunities for relatively less experienced teachers to develop themselves and their education within their teaching courses (Kottman et al., 2021).

[1] The financial incentive 'LerarenOntwikkelFonds' was discontinued in December 2021.

The Comenius teaching fellow programme and LOF have a similar goals and budgets. Both provide guidance during the innovation process and allow teachers to develop and implement their own innovation in their educational institute (van Lin, 2020).

1.1 Research questions

To explore the identified gaps in the literature, several research questions are formulated. Multiple sub-questions will be employed to answer the research questions, as stated below. Before the effectiveness of different types of innovations can be studied, these types themselves need to be studied, which leads to the first sub-question. (1) *What types of innovations are prevalent in Dutch secondary and higher education?* Then, the effectiveness of these types of innovations will be researched, with sub-question two. (2) *What is the effectiveness of different types of educational innovations in Dutch secondary and higher education?* To contextualise the answers to sub-questions one and two and further understand the factors that influence the effectiveness of innovations, a third sub-question is employed. (3) *Which process and innovation features influence the effectiveness of educational innovations?* Together, these three sub-questions build up to an answer of the main research question for the Educational Science & Technology side of this research. This question is: "**What is the difference in effectiveness of different types of educational innovations in Dutch secondary and higher education?"**

A fourth sub-question is posed to study the institutional governance aspects that were previously mentioned. First, more insight into the governance features themselves is needed, which sub-question four aims at. (4) *What institutional governance features play a role in educational innovation processes in Dutch secondary and higher education?* This sub-question helps answer the main research question for the Public Administration side of this research, which is: "**What is the effect of institutional governance features institutes on educational innovations' effectiveness in Dutch secondary and higher education?"**

Together, the two main research questions aim towards providing insight into the effectiveness of different types of innovation, which is the educational science perspective, and the role of institutional governance in this, which is the public administration perspective. Combining these two perspectives can lead into additional insights, which is studied using an overarching research question. To get all insights in the relationships between the main variables, a fifth sub-question was composed, which was the following. (5) *What is the*

relationship between the institutional governance features and types of innovation in Dutch secondary and higher education?

The answer to this research question, in combination with the main question will lead up to the overarching research question that combines the different perspective. This question is the following: **"What is the effect of institutional governance features and different types of innovation on the effectiveness of innovations in Dutch secondary and higher education?"**

2. Theoretical framework

In this section, a framework is presented in which the types of innovation and the governance of educational institutes are elaborated on and linked to innovation effectiveness. Moreover, factors of influence in this are presented. First, definitions of innovations as well as various categorisations of innovation types are discussed. Second, different interpretations of effectiveness of innovations are presented. Then, institutional governance and its role in educational innovation is discussed. Within each of these sections, the related factors that could be of influence before, during, and after the innovation process are discussed as well.

2.1 Innovation in education

This section will first define innovation and discuss the differences between innovation in secondary and higher education. Then, the different types of innovation and the conditions that stimulate and support innovation are listed and elaborated on. Finally, a comprehensive overview of the different types of educational innovation and the factors of influence are presented.

There are various ways of defining educational innovation, of which four are discussed here. Firstly, innovation in education can be seen as the introduction of a new or changed method or means for learning and teaching (Hannan et al., 1999). Secondly, the OECD (2005) has defined innovation as implementing a new or improved product, process, method or organisational method. A third way of understanding innovation is "A new or significantly improved product, process, organisational method or an organisation itself, developed by or having a significant impact on the activities of a higher education institution and/or other higher education stakeholders." (Brennan et al., 2014 p.35). A fourth perspective on innovation is that it can be understood as a process of three phases of change, which are initiation, implementation and institutionalization (Alexander & McKenzie, 1998). More specifically, this includes initial planning and evaluation of the current circumstances, followed by the development, execution, and evaluation of the innovation project, and lastly taking steps to maintain and sustain the innovation in the institute (Kirschner et al., 2004).

These four definitions highlight different aspects of innovation. The first two definitions lack something that the third definition does have. Namely, the definition of Brennan et al. (2014) has a broader scope that includes the process, and the different forms of impact innovation can have, which the other two definitions do not entail. The fourth definition of

Alexander and McKenzie (1998) describes innovation as a large process with different phases, which includes implementation, which is in contrast with the second definition, as the OECD (2005) limits itself to the implementation only.

With these four definitions, it becomes clear that innovation can be understood in multiple ways. The innovation process and variety of ways innovations can have an impact on education seem to encompass the context of the innovation as well. This understanding of innovation will be used throughout this study. With this in mind, one can look at how innovations exist in practice within educational institutes.

According to Brennan et al. (2014), innovation in higher education can be viewed from a system perspective, which includes components, relationships and functions. The components refer to the actors. The relationship part of the system looks at the collaboration of those actors. These collaborations are in turn geared towards one of the functions in the higher education system, which are education, research and societal engagement (Brennan et al., 2014). Looking at higher education institutions and their innovation from this system perspective aids in understanding the innovation process, because each element that influences innovation can be pinpointed and dissected.

On the content of the innovations, innovation in secondary education can take many shapes and forms, with the majority of interventions focusing on innovating within the classroom (Hofman et al., 2008). Most of the innovations focus on modes of instructions that could apply throughout educational institutes, instead of having a focus on a specific course or topic. In these innovations, teachers play an essential role in the execution and often need to be trained to do so, especially since curriculum-wide innovations in pedagogical or didactical approaches largely depend on the teacher (Hofman et al., 2008). Many of the innovations implemented in secondary education concern the general student body and are implemented school wide, where about a third of the innovations target a specific group of the student body. An example of this is student who have learning problems or students that have a lower socio-economic status (Hofman et al., 2008). Compared to secondary education, higher education tends to implement a wide variety of innovations. However, the majority of these innovations concern the methods of learning or the content (OECD, 2014).

2.1.1 Innovation types in education

Various studies have made distinctions between types of educational innovation, of which five will be discussed in this section. Some of these categorizations were created based

the research sample at hand (Haelermans, 2010; Kolster, 2021), while others were based on the existing categorizations (Hofman et al., 2013) or general innovation theory (Crossan & Apaydin, 2010). The different origins of these typologies of innovation lead to different ways of creating typologies as well. Crossan and Apaydin (2010) found that innovation can usually be divided over two categories: a focus on social structure of an organisation, or a focus on technology. Following Crossan and Apaydin's research (2010), innovation in secondary and higher education tends to focus on the social structure.

More categories can be identified in educational innovation. For example, the OECD (2014) separated innovations in three categories. Innovations in (1) products and services, (2) technology, tools and instruments and (3) knowledge and practices.

A more thorough categorisation of innovations was created by Haelermans (2010), who identified five types of educational innovation in secondary education. These were the following: (1) New courses and school profiling; (2) Pedagogical or didactical innovation; (3) Process innovation; (4) Teacher professionalisation; (5) Educational chain. Process innovation referred to ICT and organisational innovation and educational chain included the inter-educational level contact of secondary schools, including both primary and tertiary education (Haelermans, 2010).

Another way of distinguishing innovations is by the spaces that it applies to, where classroom innovations can be separated from school changes (OECD, 2014). Classroom innovations have to do with teaching and learning, including teaching practices and educational resources (OECD, 2014). School innovations are of an organisational nature and are more likely to be directly influenced by educational policy. Such innovations include the provision of special education programmes, new management practices and the relationship with parents (OECD, 2014).

Lastly, Kolster (2021) found five types of innovation in Dutch higher education, specifically in excellence programmes. These were the following: (1) Educational concepts and didactical methods; (2) Forms of assessment; (3) Educational content; (4) Educational tools; (5) Organisation (Kolster, 2021). The first type of innovations refers to different ways of teaching and learning, such as flipped classroom, and student-driven learning (Kolster, 2021). The educational content innovation includes covering topics in courses that were traditionally not offered, such as societal relevant themes.

Combining the various typologies several points of overlap can be identified. Based on Haelermans (2010), Kolster (2021) and the OECD (2014) typology, including the specifications they made for each level of education, the following types of innovations can be expected to be present and relevant in both secondary and higher education in the Netherlands.

(1) Educational content, such as courses;

(2) Didactical methods;

(3) Educational tools and technology;

(4) Organisation.

Other types of innovations were either not relevant for both secondary and higher education or, upon a review by the researcher of the innovation were only minimally present in Dutch innovation programmes. Innovations in assessment, teacher professionalisation, special needs programmes, and inter-school communications were therefore not included in this study. Below, the four selected types of innovations will be elaborated upon.

Educational content

Innovations in the educational content entail the development of new courses, improving current courses with a different structure or focus, as well as extra-curricular programmes (Haelermans, 2010). More specifically, these are innovations that are focused on providing new content regarding student knowledge and/or skills – and not just a new way of teaching pre-existing content – and can therefore be classified as educational content innovations.

Hofman et al. (2007) found that only 10% of the innovations in Dutch secondary education concerns the educational content. This is especially unfortunate as it was also found that educational content innovation can have a positive effect on the academic performance and behaviour of students (Hofman et al., 2007). Next to that, these types of innovations are in particular well-suited to match the needs of both teachers and students, which is the case when the designing of the programme is done in a bottom-up fashion in which staff can fulfil their and their students' needs and wishes (Bohle Carbonell et al., 2013).

Didactical methods

This type of innovation entails innovations in teaching and learning, such as project or team-based learning. Haelermans (2010) included services like specialists for certain students,

a focus on peer learning, and different teaching methods in this category. Innovation in didactics can generally be seen as stimulating new ways of interaction between students and teachers (Mynbayeva et al., 2018). Several factors can be found in most innovations in pedagogy, which include a personal-oriented approach and the stimulation of nonlinear thinking (Mynbayeva et al., 2018; Derijan & Valchev, 2012). Innovations of this type tend to be curriculum-wide and not focused on specific courses**.** Another innovation in didactics could be to change the amount of front-of-class teaching. It was found that an increase in this type of teaching could lead to more lecturing about fundamentals of courses, while a decrease in such teaching could promote individual work and greater autonomy of students (OECD, 2014).

Moreover, innovations in instruction by teachers include ways for students to apply knowledge and skills in practice, which can be done to increase motivation or creative skills (OECD, 2014). Next to this, skill development was found to be causing more change when imbedded in regular education, instead of teaching it in separate courses (Teurlings, van Wolput & Vermeulen, 2006). It would therefore be most suited if developed as a didactical method instead of a form of educational content. Additionally, innovative didactical methods and their success are affected by the teacher in multiple ways, for example through their attitude, methodological competence and pedagogical skills (Mynbayeva et al., 2018).

Interestingly, it was found that most innovations that fit in this type of innovation have some form of student-centred vision (Brannan et al., 2014). When looking at innovations in secondary and higher education separately, however, it can be seen that there is increased interest in pedagogic innovation in secondary education due to the belief that teaching is the most impactful factor on the learning of students (OECD, 2014). This is different from higher education, where didactical innovations mainly concerned student-led learning (Dumont et al., 2010).

Potential downsides of introducing didactical innovations can be mitigated by educational institutes by actively engaging both students and teachers in the innovation process to allow them to see the full potential of the innovation and increase enthusiasm (Brennan et al., 2014).

Educational tools & technology

Educational tools, especially digital tools, are most often developed in innovation projects (Kirschner et al., 2004). Innovation in educational tools can include both physical and digital tools for learning and teaching. This includes innovations in IT, such as digital portfolios,

video lecturing, the use of web applications, but also physical resources for students and teachers (Haelermans, 2010).

There are concerns that innovation in educational tools, and in particular in technology, can make students more passive, as such technologies can make studying too convenient and not require active resourcefulness (Brennan et al., 2014). However, through ensuring that the learning needs of the students are met and that the technologies benefit them and their learning, institutions can prevent such passiveness (Brennan et al., 2014).

Innovation in educational technology seems to be different from other types of innovation in its developmental process, as it was found to not be dependent on policy or governmental regulations, but instead more heavily relates to the support of the educational institution given to innovators in their organisation. This is the case as top-down support in funding aids the innovation development of educational technology in particular and helps it being diffused throughout the institute (Brennan et al., 2014).

Organisational innovation

Innovations in the organisation of an educational institute can include infrastructural changes, for example on the building or classroom, as well as renewed ways of working for school management or teacher collaboration. Although these innovations often do not influence the students directly, such organisational changes do tend to change the environment for both students and teachers in a way that helps improve their learning (OECD, 2014). Therefore, innovation in the organisation can be helpful for staff, students and management in direct and indirect ways.

2.1.2 Takeaways

Innovation in education can be seen as a process in which there is an initiation, implementation and institutionalization phase, and that could influence the learning and teaching within an educational institute. Within both secondary and higher education, four types of innovation can be distinguished, which are innovations with respect to: (1) Educational content, (2) Didactical methods, (3) Educational tools and technology and (4) The organisation. Educational content innovation focuses on teaching students new skills and knowledge, and might work best if created bottom-up, to fit with both student and teacher needs. Didactical method innovation is typically implemented throughout the entire curriculum and can help in student and teacher skill development. This innovation is influenced by the attitude of teachers

and students towards it, as it can be challenging for them. It is therefore necessary to include them in the innovation process to ensure continuation after the initial implementation. Educational tool innovation is seen as the most common type of innovation and tends to rely more heavily on support from the educational institute for continuation and potential diffusion. Lastly, organisational innovation tends to only impact students indirectly, but it can shape a better learning environment through better collaboration between teachers or an improved quality assurance system.

2.2 Effectiveness of innovation in education

Effectiveness of innovations in education has been understood in terms of increased student performance, student satisfaction, student functioning, academic achievements, and prevention of dropout (Hofman et al., 2013; Hattie, 2003; Timperley et al., 2007). Effectiveness can be measured by looking at "student satisfaction, motivation and interest, enrolment levels, attrition rates, grades, achievement levels and learning outcomes" (Vidicki et al., 2011 p.444). On top of this, one could look at improved quality of teaching and learning for effectiveness. In secondary education, effectiveness of innovations focusses on student learning outcomes, where innovations are effective when their outcomes benefit students' learning more than before the innovation.

As this indicates, there are various ways of understanding and measuring effectiveness of innovations in education. Here, different definitions of effectiveness, such as effectiveness in terms of study success, efficiency, personal development, and diffusion are used, after which various factors that could influence these understandings of effectiveness are discussed.

2.2.1 Study success

Study success is the term that is used in policy as well as in practice in the Netherlands as a measure of effectiveness of education. It entails many different aspects but is often undefined when used. Existing definitions revolve around financial considerations, such as costs per student and efficiency of students in higher education, as well as drop-out rates, and average grades (Glastra & van Middelkoop, 2018). The efficiency perspective of study success concerns the time a student takes between enrolling in higher education and graduating, with often the aim of doing so within a set period of time.

A similar understanding of effectiveness of innovations exists in secondary education. There, study success was seen as student performance and efficiency, where the effectiveness of innovations was determined by looking at the percentage of students that finish their secondary education without having to repeat a school year.

Efficiency can also be measured by comparing students' starting and finishing level of secondary education (Hofman et al., 2008). Some interventions are deemed effective when there is a higher number of students (compared to the control group) graduating within a set period of time, therefore seeing effective innovations if they increase study efficiency.

It was also found that some innovation studies interpret effectiveness as increased cognitive development of the students, where the students perform better in terms of grades (Hofman et al., 2008). However, the same study found that such effectiveness of an innovation was rarely achieved. Study success as effectiveness has previously been measured as the change in terms of average grades in the final central exams of the school or for a specific course (Hofman et al, 2008)

Stemming from this efficiency and performance perspective, one could argue that an innovation is effective if it reduces the time students take to graduate and/or increases their performance in terms of grades. However, criticism is voiced on this view of effectiveness. The main counter argument is that this view of effectiveness dismisses the other goals of education, such as its function to society to raise good citizens and to stimulate (personal) development (Glastra & van Middelkoop, 2018). This view is can, therefore, be seen as too narrow.

Biesta (2007) notes that although research might have shown evidence that a certain innovation has increased students grades or efficiency, such an intervention and its actual effectiveness depends heavily on the circumstances in which it is used. These circumstances include the class environment as well as the teaching and learning experience that students and teachers had with it. It is argued that although knowing what has worked in the past is useful, the effectiveness of an intervention changes depending on the situation (Biesta, 2007). This critique is supported by Hofman et al. (2008), who found that although some innovations have positive effects on the student performance and could be deemed effective, this effectiveness of the innovation depends on organisational factors, such as culture and school size. Therefore, innovations that were effective, in terms of increased performance and efficiency, in education in the past, might not be as effective elsewhere. This depends on many factors, including the

goals a teacher has for introducing it, the way it is taken up by students and how it fits and interacts with the educational environment.

2.2.2 Teaching and learning attitudes

Another understanding of the effectiveness of innovation in higher education could perhaps be better suited to different contexts than effectiveness in terms of study success. One of these interpretations encompasses the personal or social effects innovations can have, for example in teaching or learning attitudes, or in personal development (Hofman et al., 2008). Attitudes are a learned negative or positive disposition an object, situation or concept, such as teaching or learning (Sarmah & Puri, 2014). Positive attitudes towards learning and teaching can improve the learning of students and teaching of teachers (Mazana et al., 2019). Attitudes are often discarded in research due to difficulties in measurement but can be seen as equally important for students and teachers themselves. This is especially the case since better experiences in education can aid knowledge and skill development as well, and improved attitudes could therefore have a more indirect effect.

2.2.3 Knowledge and skill development of students

Other interpretations of effective innovation in higher education state that an innovation is effective if it aids the development of students towards one of the goals of education, such as aiding the development of well-rounded critical citizens (Glastra & van Middelkoop, 2018). This perspective ties in with another definition of effective innovation in higher education, namely that the effectiveness can be determined by the extent to which it contributes to the goals of the education (van Berkel, 2006). Similarly, some innovations were deemed effective if the innovation affected students' social-emotional skills positively, by increasing their view of their own emotional competences or improved their social interaction skills (Hofman et al., 2008). This perspective on effectiveness is different than study success, because study success concerns grades, performance and efficiency. Knowledge and skill development can aid the development of a student without this showing up in their grades, result in faster graduation or lead to less drop-out.

2.2.4 Goal attainment

The effectiveness of innovations also depends on the aim of the innovation, as innovations that aimed at increasing student performance should not be judged on the basis of class behaviour improvement and vice versa. The effectiveness of an innovation therefore depends

on the goals those working on the innovation set out for it. To judge whether an innovation was effective, a comparison can therefore be made between the goal that was set at the start and the goal attainment after the innovation process (Alexander and McKenzie, 1998). The effectiveness can then be measured based on the type of goals set out and to what extend these were met. Little research has been done that looks at the level of goal attainment of the innovations and whether the achieved results line up with the goals that were set out, or whether the innovation was initiated for different goals (Glastra & van Middelkoop, 2018). As the innovation goals can concern one of the other effectiveness criteria, goal attainment as an effectiveness dimension can overlap with the previously described criteria.

2.2.5 Factors that influence the effectiveness of innovations

There are various characteristics of innovations that could influence their effectiveness. These innovation features, which are the complexity and the compatibility of the innovation, will be discussed below.

Complexity

The effectiveness of a single innovation depends on the complexity of the innovation, meaning the amount of change and difficulty for the people involved in implementing and sustaining it (Fullan, 2007). Some innovations require more activities, structures, strategies and understanding than others, and therefore, depending on the starting point of the educational institute, can be complicated (Fullan, 2007). Complex innovation processes can, however, also lead to more change. Even if the pre-set goals are not all achieved, complex and ambitious innovation projects still stimulate more change in the institution than small and simple innovations (Berman & McLaughlin, 1977). Therefore, the effectiveness of an innovation also depends on its scale and complexity. Simple innovations may be easily implemented, but do not cause much change and could have a smaller effectiveness than complex innovations, although the risk and effort is much higher with the latter than the former (Fullan, 2007).

It was found that the scope of the innovation also affects the influence that national governmental and institutional policy regulations have on it. A larger scope innovation leads to a higher influence of national factors, where a smaller innovation scope might only be affected by institutional factors (Brennan et al., 2014).

Along these lines, it has been found that innovations in the factors that are close to the students' learning, such as in the school or classroom environment, or in their direct study

materials, had the most impact (Luyten et al., 2005). Therefore, these innovations could be the most effective in attaining its goals. In general, innovations that stimulate an active attitude of students were found to be effective in terms of increasing student performance (Teurlings, van Wolput and Vermeulen, 2006). However, the potential differences in cognitive development and prior knowledge of students can change the effectiveness of such measures.

Compatibility

Whether an innovation moves through the innovation process as described by Alexander and McKenzie (1998) depends on the compatibility of the innovation with the educational institute. Compatibility refers to the fit of an innovation with the values, morals, and aims of the organisation in which it is adopted and implemented (Levine, 1980). This fit is important as the boundaries of the norms and values of an educational institute maintain the organisational culture and should not be crossed, as this can cause dissatisfaction with the innovation (Levine, 1980). The compatibility can therefore influence the process of an innovation within an organisation and prevent successful adoption, implementation and institutionalization.

2.2.6 Effectiveness & the innovation process

During the innovation process, during which the innovation is thought out, developed and executed, effectiveness of an innovation can develops. Various factors within this process influence the effectiveness of an innovation. These will be discussed below.

1. *Innovation initiation*

During the first stage of the innovation process, the innovation ideally is planned and formulated to fit to the needs of the educational institute (Levine, 1980). External drivers for innovation during this phase of the innovation process have been found to be knowledge-based economies, the increase of accessibility of education, increased financial pressures as described before, the pressure to perform the third function of education – societal engagement, and disruptive innovation (e.g. the rise of internet in the late 1990s) (Florea & Hoareau McGrath, 2014).

One of these external drivers are national governments, who can steer and promote innovation through policies. For example, educational institutes are stimulated to innovate through subsidies, but this is often not enough for actual change to take place within the institutes as there is a large amount of different educational policies and guidelines that they still have to abide to, which prevents truly innovative initiatives (Waslander, 2007). However,

it has been found that financial incentives do tend to play a facilitating role for educational staff to innovative, meaning that these incentives do not motivate to innovate, but instead aid the execution of already existing ideas or plans, allowing solutions to be executed (Hannan et al., 1999).

During this stage, goal setting is important, as the problem or need in the organisation needs to be precisely targeted by the solution and having clear goals for the innovation planning and implementation is a large aid in this (Stetler & Magnusson, 2015).

2. *Innovation implementation*

The second stage of the innovation process entails the implementation of the innovation (Alexander & McKenzie, 1998). It was found that feedback and reflection on the process and keeping stakeholders in the loop were important for the innovation implementation in education (Hofman et al., 2008). The role of students during this phase is mainly through their (un)responsiveness to the innovation, as their support or rejection of the innovation shapes the effectiveness of the innovation (Brannan et al., 2014).

Moreover, teachers play a large part in the innovation process and their attitude, skills and knowledge can influence the effectiveness of an innovation. The professionalisation of teachers is therefore another factor that influences the innovation process. Professionalisation refers to learning activities that explicitly aim to increase or strengthen knowledge, skills or attitudes of teachers with the aim of improving students' learning (Van Veen et al., 2010). Professionalisation entails a large variety of activities, varying in focus, duration and formality. Activities can focus on teacher knowledge, skill and/or attitude development. Desimone (2009) created a theory of action in which the process of professional development of teachers is described, and how teacher professionalisation could lead to improved student learning (figure 1). Here, a connection is made between the professionalisation activities, how this impacts the teacher, leads to a change in instruction, and eventually improves student learning.

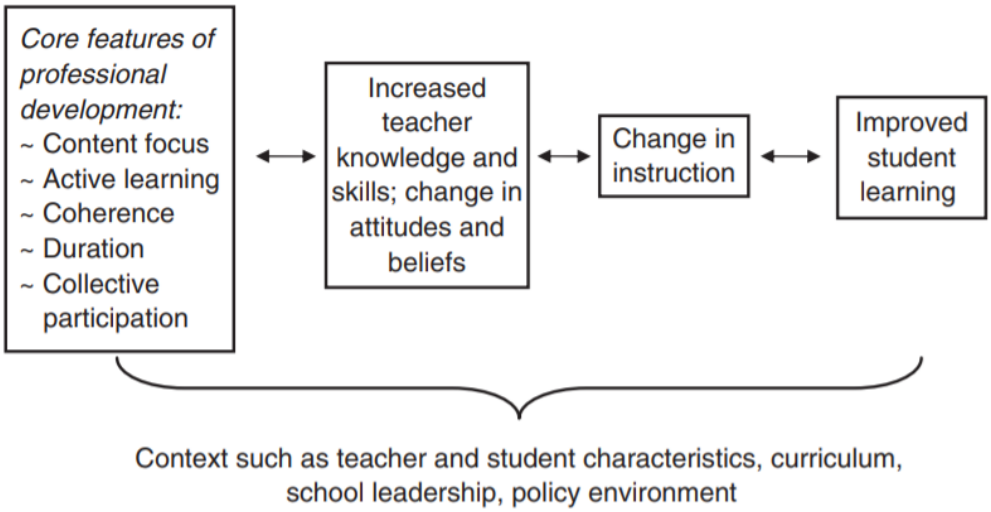

figure 1. Framework for studying the effects of professional development (as published in Desimone, 2009)

The core features of professional development describe the factors that are critical to professionalisation. These features can be seen in the professionalisation activities. Such activities can be active or passive, where personal interaction and one on one guidance is on the one end and passive listening to presentations is on the other one. Moreover, formal learning activities concern courses and study days, whereas informal learning activities is less structure and happens during regular work tasks and can look like onboarding or inter-colleague guidance (Runhaar, 2017). The duration, frequency and time spend on the professionalisation with regards to the innovation is also of influence, as some innovations are better suited for a one-time training session, and others require activities over time, or shorter but more frequent activities. Lastly, the target group of the professionalisation is of importance, as collective participation could make the innovation process more widespread throughout the innovation, with several stakeholders involved in it, while individual or group specific professionalisation allows the activities to be better suitable for those most actively involved with the innovation process.

3. *Innovation institutionalisation*

In the third innovation phase, institutionalization, the focus is on continuation and diffusion of the innovation. Continuation refers to the ongoing execution or impact of an innovation in an educational institute. This continuation can be threatened by a lack of interest, funds, professional development or staff turnover (Fullan, 2007). Continuation can influence the effectiveness of an innovation as it indicates whether or not an innovation was sustainably implemented and is embedded in its educational environment.

The diffusion of innovations concerns the spread of an innovation throughout an institution or beyond, where the impact of the innovation can be felt beyond its initial introduction environment. Unfortunately, diffusion is prone to being hindered by a resistance of change within the institution and departments, or through a lack of policy support (Brennan et al., 2014). It has been found that even if an innovation is successful on department level or for a specific course, the diffusion of these innovations through the organisation only takes place when the innovation at hand is an effective solution to a shared or frequent issue (van Vught, 1995). Therefore, even if an innovation is effective for the teacher or students it has been developed for and the governance approach of the institution is supportive, the innovation might not be effective for the organisation as a whole. The innovation may diffuse through informal contact with colleagues and through that gain a bigger following and support (van Vught, 1995).

Both continuation and diffusion can be seen as the vital steps in the institutionalization of the innovation within the education institute. The institutionalization phase as a whole plays a role in the long-term effectiveness of innovations. It determines the longevity of an innovation, where the innovation is not just effective because it had the desired outcome in one moment, but because it kept its momentum, stayed relevant and/or spread out beyond its initial setting.

In a similar vein, embedding of an innovation in educational institute is of relevance. Embedding of an innovation takes place when an innovation is formally accounted for in policies or through resource allocations, as well as if there is there is a critical mass to continue its execution as well as structures to support the process and introduce it to new staff (Huberman & Miles, 1984).

2.2.7 Takeaways

The different interpretations of effectiveness of innovation in education highlight the complexity of effectiveness and its context dependency. Whether an innovation is effective depends on the innovation content, the way it is implemented and on the context. Moreover, the effectiveness of an innovation cannot only be interpreted by study success in terms of student performance and organisational efficiency, but also as increased knowledge gain in students or student skill development. Moreover, student and teacher attitude improvement are another interpretation of effectiveness, where increased interest or motivation towards learning and/or teaching is gained through the innovation. Finally, goal attainment is seen as a common

understanding of the effectiveness of an innovation, where an innovation is deemed effective if the innovation attained the goals that it was set out for.

The complexity, scale and compatibility of an innovation play a large role in the process of innovation. The innovation process, through which an innovation is initiated, implemented and institutionalized, impacts the effectiveness of an innovation. If an innovation is not properly institutionalised, it might be more challenging to improve the organisational efficiency. Moreover, the goals of the innovation, professionalisation activities and the embedding of the innovation are relevant process factors. They can also shape the eventual effectiveness of an innovation.

The theorised relationship between the types of innovation, innovation factors, process factors and the five dimensions of innovation effectiveness are visualised in figure 2. This conceptual model shows the three steps in the innovation process and the factors that influence that process below it. The types of innovation and innovation effectiveness are shown to be the result of certain phases of the innovation process.

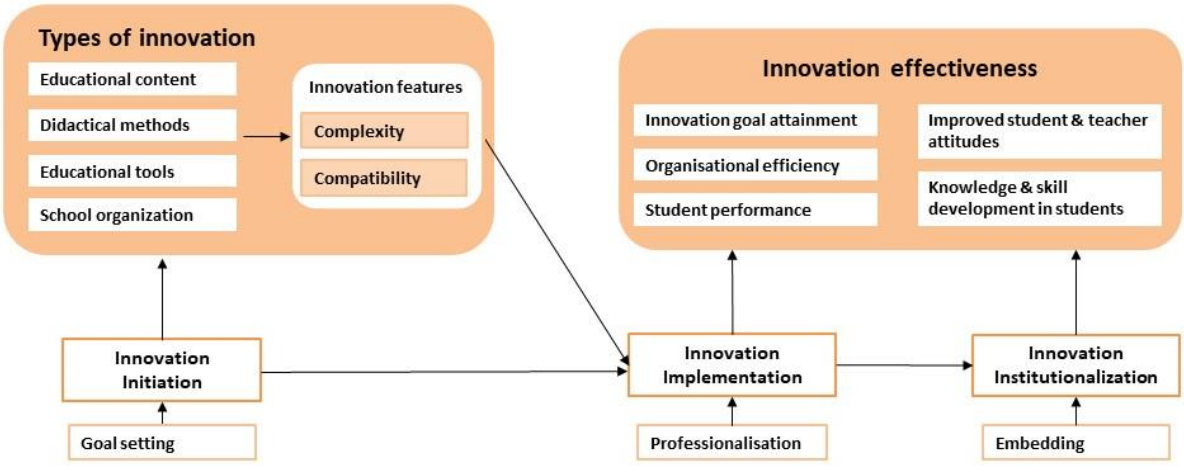

Figure 2. Conceptual model of types of innovation, innovation effectiveness and factors of influence.

2.3 Governance of innovations

Governance often refers to a process of governing, which can include rules, norms and hierarchies (Bevir, 2013). Some understand it as a dynamic process, in which decision making takes place (Tracey et al., 2016), while others view governance in education in terms of steering and monitoring (Florae & Hoareau McGrath, 2014). Put together, governance in education can

be understood as a dynamic process that includes creating, implementing and monitoring of rules and norms. Governance in the Dutch education system is complex, with many involved actors and high levels of autonomy and decision-making power for (secondary) school boards (Waslander et al., 2016). School boards are influenced by a large group of actors that operate between the government and the educational institutes (Waslander et al., 2016). However, decision-making power remains at the boards of the educational institutes. Due to this, the institutional governance of school organisations is of importance to innovation within the organisation.

Governance of education plays a large role in the diffusion of innovations (Florea & Hoareau McGrath, 2014), while the governance itself also needs to become more innovative to accommodate these innovations (Brennan et al., 2014). Governance plays a key role in the impact that innovations within an educational institute can have, as strong leadership and clear regulations, especially in terms of funding, positively influence the impact and quality improvement that the innovations had within the institute (Brennan et al., 2014). Moreover, Kolster (2021) identified several governance characteristics of innovation-focused departments in higher education to determine whether they are able to diffuse innovations. Some of these characteristics are relevant to the adoption and implementation of innovations as well. The first of these is integrated management, meaning that the leaders of the innovation project are strongly connected with or embedded in the management of the educational institute, which leads to a more successful innovation process (Dee & Leisyte, 2016). Another governance characteristic important for innovation is a supportive attitude from the institute's leadership (Kolster, 2021). The organisational culture also guides the educational governance for innovation (Hsieh, 2007). Other relevant governance dimensions are the organisational size and the organisational structure, as specific institutional features facilitate the innovation process (Brennan et al., 2014). The role of several organisational characteristics, such as size and structure, as well as organisational culture and leadership will be further explored below.

2.3.1 Organisational size

There are several organisational determinants for innovation according to economic literature, which include the size of the organisation (Haelermans, 2010). Faria et al. (2002) found a positive relationship between the size of an organisation and the spread and applicability of innovation, which is explained by the ability to have the financial means to take risks as well as the power position that such organisations can have. However, others found that smaller educational institutes had more support for innovations than larger schools (Huang,

2004 as cited in Chang et al., 2011; Yao, 2004, as cited in Chang et al., 2011). Chang et al. (2011) found that the school size did not have a large impact on the level of innovative teaching within the educational institutes.

2.3.2 Organisational structure

Educational innovation thrives in a supportive organisational structure, in which there is a clear strategy for innovation, guidance for implementing and adapting to innovation, and quality control of the education (Tondeur et al., 2009; MacBeath, 1999). These structures should all be documented and developed in the institute's policy to ensure consistent support (Tondeur et al., 2009). Planning and support can be seen as structural characteristics in an educational institute that contribute to the innovation (Tondeur et al., 2009). Here, planning constitutes policies that aim towards educational innovation, while support concerns the involvement of a number of actors in the innovation process that provide guidance and support.

An organisational structure of an education institutes can be flat, hierarchical or a mix of both. Flat organisations have little hierarchy and staff members and decision makers are closely tied together. Because of this, they could promote and facilitate innovation (Hall, 1982; Arad et al., 1997). Hierarchical organisations have a larger distance between the levels of employees and management. Organisational structures in which groups of staff within the educational institute are given a high level of autonomy and freedom, for example through limited restrictions on task planning and execution, stimulate and support innovative behaviour (Bysted & Hansen, 2013). High levels of autonomy of staff members, therefore, aids the initiation stage of the innovation process (Arad et al., 1997).

2.3.3 Organisational culture

While the structural factors mentioned above play a role in ensuring a suitable environment for innovations, the organisational culture also has an effect on the institutional governance as it constitutes the less obvious dynamics surrounding innovation in education. The culture of an organisation influences the life and development of an organisation and shows the routines and processes within an organisation (Eskiler et al., 2016). One of the ways an organisational culture can be understood is as a paradigm, in which there are shared languages, processes and references that form the building blocks for communication and problem-solving within the organisation (Atay, 2001). Others describe it as learning oriented, with norms and values that promote improvement (Hurley & Hult, 1998), where Li et al. (2018) adds that behavioural patterns should also be considered part of the organisational culture. Lastly, Schein

(2004) describes organisational culture as shared assumptions of a group that is based on their experiences with internal issues, for example with management, and external issues, such as demands from outside the organisation. The organisational culture can influence many aspects of the organisation (Widjaja & Kuslina, 2018), while also providing a mechanism for change.

Organisational culture can stimulate or inhibit innovation (Li et al., 2018). Some characteristics of organisational culture were found to stimulate innovation processes (Hurley & Hult, 1998), such as the presence of learning and development in which individual learning takes place. Another characteristic of an innovative culture is participative decision-making, in which many employees have a role in the decision-making process, as information flow from different perspectives stimulates innovation (Hurley & Hult, 1998). This characteristic is supported by Hargreaves (1999), who argues that teachers must be able to give input and shape their environment, through decision-making, in order for the educational institute to be innovative.

A third characteristic is support, through which fear of failure can be decreased and new ideas and taking risk is increased. An organisational culture in which employees can take risk is found to be a contributing factor to innovative behaviour within organisations (Bysted & Hansen, 2013). Supporting risk taking can be characterized by there being room to make mistakes within the organisation, supportiveness for taking up innovation projects and employees' willingness to take on the risk of doing such a project. More specifically in education, such a culture can stimulate the active participation of teachers in the innovation process, as they often facilitate it (Hmelo-Silver, 2004). On top of that, the psychological state of teachers can influence the adoption and impact of innovations (Huberman, 1988). This is the case because it can cause them to take action and persist, or to step back, which depends on the teachers' personality, previous experiences and career development (Fullan, 2007). An organisation culture that stimulates teachers to innovate and encourages risks can help in supporting the psychological state of the teachers.

Moreover, the stronger the interpersonal relationships between teachers, the better the implementation of the innovation (Fullan, 2007). To tie in with this, collaboration between educational staff is another characteristic of an innovative culture, as working together on innovative ideas and their execution enhances the likelihood of innovations being implemented (Hurley & Hult, 1998). These four characteristics of an innovative organisational culture stem from the values, norms and behaviours that form the basis of this culture and can be seen as a reflection of them in practice.

2.3.4 Leadership for innovation

School leaders can influence the likelihood of innovation taking place in multiple ways. First of all, they are in a position to positively affect the process of innovation if they give support to the innovators as they can legitimize certain innovations through active participation (Fullan, 2007). Next to this, leaders have the power to influence innovation processes through collaboration with both teachers and other institutional actors in order to get all parties in agreement and create optimal circumstances for innovation (Fullan, 2007). Lastly, an educational leader plays a vital role in ensuring that the innovation remains functioning and gets institutionalized, for example after external funding runs out. They can do this through appointing staff to the project or by funding necessary material with own funds (Fullan, 2007).

One of the ways this support could be seen in practice within educational institutes is through the active involvement of educational leaders in workshops or training sessions about the innovation (Berman & McLaughlin, 1977), as these build understanding from the educational leaders that allows them to support the people working on the innovation. In these ways, school leadership has the power to influence innovation while it is being implemented and beyond, with an important responsibility for them in ensuring the continuation and potential diffusion of the innovation. Some research even suggests that the failure of innovations can often be attributed to ineffective leadership (Deschamps, 2005; Alexander & McKenzie, 1998).

Diving deeper into their influencing role, various leadership styles can be discerned that influence the innovations in different ways. The leadership style of leaders in educational institutes plays a large role in the success of innovations, as they have the authority to set goals and encourage innovation (Garcia-Morales et al., 2008). These styles include transformational or transactional leadership. This duality of these leadership styles has been created by various scholars and they are generally seen as two main styles of leading for innovation.

Here, it is important to realize that the context in which the innovation is implemented, as well as the type of innovation affects the role of the leadership styles (Kesting et al., 2015). Whether or not a certain leadership style is conducive to the innovation process at hand does not only depend on the leadership style, but also on the innovation and its goals (Kesting et al., 2015). Therefore, the leadership styles discussed below will not only be discussed in terms of their role in the innovation process, but also with regards to other aspects of the innovation itself.

Transformational leadership is positively related to innovation, as it is shown to cultivate a culture of innovation within institutes (Sethibe & Steyn, 2015). Transformational leaders create a common mindset through influencing attitudes and assumptions within the organisation, and increase the organisation's focus on collective goals (Garcia-Morales et al., 2008). Transformational leadership focusses on long term goals and is visionary in nature and tend to stimulate personal development (Sethibe & Steyn, 2015). Transformational leadership can be characterized by four qualities that such leaders have in common. First of all, the leaders have charisma, which means the influence leaders have on their followers through admirable action (Judge & Piccolo, 2004). Secondly, transformational leaders have optimistic or visionary goals that inspire and provide meaning to followers, also named inspirational motivation. Thirdly, these leaders intellectually stimulate their followers, meaning that they challenge their thoughts and encourage ideas. Lastly, a main characteristic of transformational leaders is the consideration they have for each individual under their lead, which includes active listening, and taking their needs and concerns seriously (Judge & Piccolo, 2004).

Transactional leadership focuses on individual self-interest and stimulating followers through rewards (Sethibe & Steyn, 2015). The premise of this leadership style is clear communication and definition of work (Anderson & Sun, 2015). Transactional leadership does not necessarily focus on change. Important to the concept of transactional leadership is contingent reward, in which transactions are set up based on expectations and whether these are met (Anderson & Sun, 2015). These transactions are about reward and punishment. Another key dimension to transactional leadership is management by exception. According to this idea, the leader takes action based on transactions. This can be done actively, with the leader anticipating problems, or passively, where the leader resolves problems after initial failure (Anderson & Sun, 2015).

The main difference between the relationship of these leadership styles with innovation is that transformational leadership can improve an already existing culture of innovation, whereas an organisation with transactional leadership tends to be better at instilling a culture of innovation (Sethibe & Steyn, 2015). Similarly, Jamaludin et al. (2011) found that while transformational leadership can promote innovative activities, organisations under such leadership tend to only generate innovative ideas rather than executing and implementing such ideas. During an innovation process, transactional leadership is of most use during the implementation phase because of the structured way of communicating between leaders and followers (Kesting et al., 2015). On top of this, if innovations have straightforward goals, with

a set out scope and of more simple nature, transactional leadership could also work well. In cases where ideation of innovation takes place, transformational leadership would be a better fit.

2.3.5 Takeaways

The governance of educational institute for innovation can be understood in terms of organisational culture, organisational size and structure, and leadership. While organisational characteristics such as size and structure are deemed to be influential on the innovations within educational institutes, it is not as clear cut whether they are inhibiting or promoting that innovation. The autonomy of employees is also ambiguous in supporting or preventing innovation within education. The organisational culture is more clear in its role in stimulating innovation, more particularly a culture that stimulates risk taking and promotes the educational staff through learning and development, participative decision-making, active support, collaboration and psychological safety. Within the culture, leadership plays a large role in supporting innovation processes. Transformational leadership seems well suited for innovation that is institute-wide, while transactional leadership suits instilling a culture of innovation.

A conceptual framework was created to visualise these potential relationships and to provide a basis to study them.

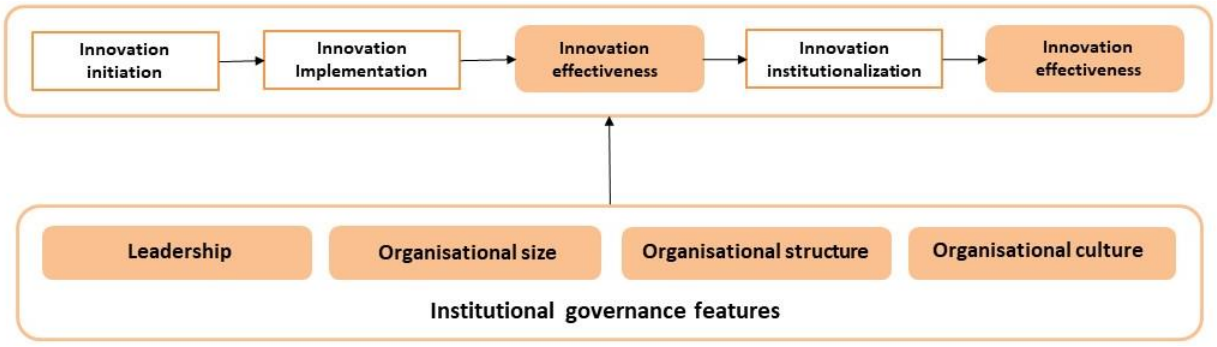

Figure 3. Conceptual framework of the relationship between the institutional governance features and the innovation process and effectiveness.

2.4 Conceptual model

In this chapter, a theoretical framework was created and conceptual models for the three main variables were presented. Below, the conceptual model of the three main variables of this study is presented. In this model, the relationship between the types of innovation, institutional

governance features and the innovation effectiveness is shown. The types of innovation can be effective in multiple ways, which is indicated by the horizontal arrow in the middle between these types of innovation and the five innovation effectiveness dimensions. The institutional governance features can influence this relationship between the types of innovation and their effectiveness. Whether this model holds true in practice will be explored in this study.

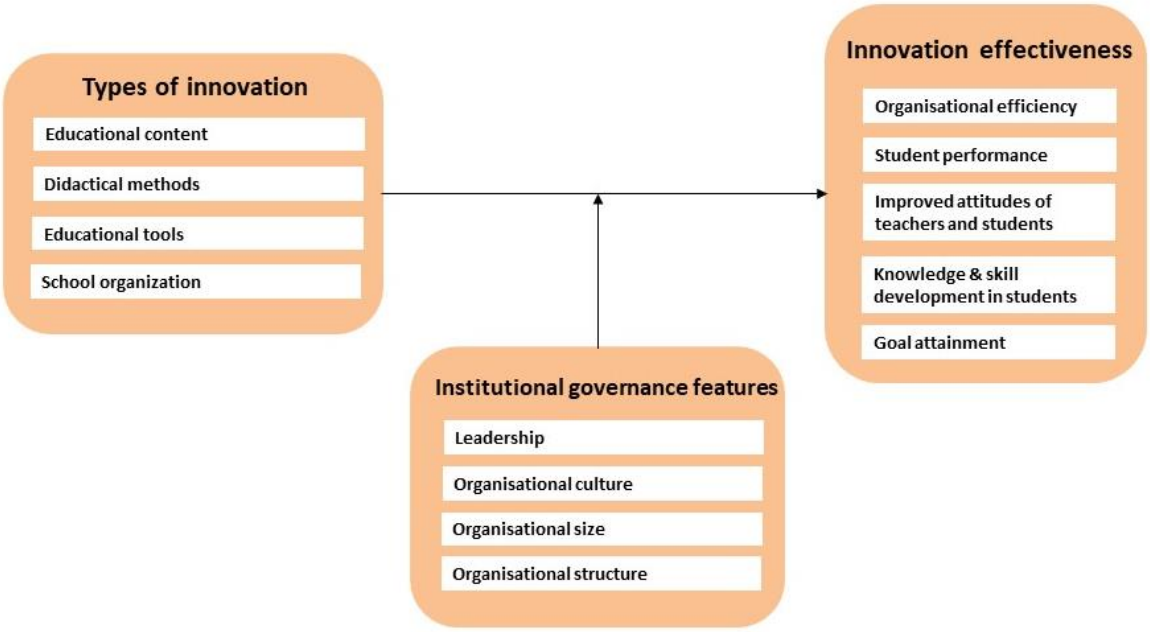

Figure 4. Conceptual framework of the main research question of this research, including types of innovation, institutional governance features and innovation effectiveness dimensions.

3. Methodology

In this section, the research design and operationalisation of the studied variables is presented. Next to this, the data collection and analysis is described and the ethical considerations are presented. Lastly, the validity and reliability of the methods are discussed.

3.1 Research design and case selection

This research was a qualitative study within secondary and higher education institutes, whose institutional governance features, types of innovations, and innovations' effectiveness were analysed. The several sub-research questions employed qualitative field research, drawing on data from semi-structured interviews as well as document analysis.

An in-depth analysis for innovation cases was done to allow for as many contextual factors as possible to be taken into account. Two national innovation programmes for secondary and higher education teachers were selected as a basis for comparison, which were LOF and the Comenius teaching fellow programme.

Both LOF and the Comenius teaching fellow programme had a publicly available website on which project descriptions of all the innovation projects that had grants awarded. These websites were used to select cases. The selection was based on the type of innovation that a project entailed. Next to type of innovation, the LOF cases that were selected focused on pre-university secondary education (VWO). The selected Comenius cases were teaching fellow projects in research universities. This was done to allow for the highest amount of similarity in the educational institute's environment, as the student population between pre-university education and research universities is relatively the same in terms of background. The educational environment was therefore expected to be most similar of all higher education and secondary education types (van Thiel, 2012).

Based on the description of the innovation project, inclusion and exclusion criteria were applied. If these were met, the innovation project was pre-selected. The inclusion criteria for the innovation projects were the following: the project (1) has received funding from either the Comenius teaching fellow or LOF innovation programme; (2) reached the end of its funding period; (3) was executed at a research university or in pre-university secondary education (VWO) in the Netherlands; (4) has a publicly available summary on the website of LOF/Comenius teaching fellow. These criteria were defined to ensure similar circumstances

for all selected cases. The exclusion criteria for the innovation projects in this research were: the project (1) has received less than 10000 euros in funding; (2) has received more than 60000 euros in funding; (3) could not be categorized as one of the four selected types of innovation. The financial criteria were included to ensure the innovation projects had a somewhat similar scope.

The categorization of the innovation projects based on the type of innovation was made according to the operationalization of the different types of innovation (Table 2). This was done for both secondary and higher education. Based on the categorization, the decision was made to study all four types of innovation, which are 'Educational content', 'Didactical methods', 'Educational tools' and 'Organisation', as these types were well-represented in both the Comenius teaching fellow and LOF programmes' databases.

After applying the inclusion and exclusion criteria, 44 LOF cases and 31 Comenius teaching fellow cases were pre-selected for this study. Then, for each type of innovation and its suitable cases, three secondary and three higher education innovation projects were selected and the project leader of these was approached for an interview (Table 1). Intentional selection was used to select the cases. This selection was done to ensure diversity of the innovation projects within each type of innovation and for similarity in terms of expected effectiveness. If no answer was received or the project leader did not wish to participate, other applicable cases were selected, and their project leader was asked to participate. The project leaders were asked for an interview as they had the most experience with the innovation and were usually involved in all the steps during the innovation process, which would therefore give the most accurate view of the process. In total, 40 project leaders were asked to participate in the research. Of these 40, 21 project leaders were part of LOF and 19 project leaders were Comenius teaching fellows. Eighteen project leaders accepted, resulting in ten LOF and eight Comenius teaching fellow cases. One student was also interviewed simultaneously with a project leader, as the project leader insisted the student could better share the experiences of the innovation than the project leader themselves.

Due to the limited number of cases that fit both the inclusion and exclusion criteria, not all types of innovations had the same number of cases. This makes comparison between the different types more complicated. However, it also highlights the representation of the actual case distribution within the innovation programmes.

Type of education // *Type of innovation*	**Secondary education (VWO)**	**Higher education (University)**	**Total number of cases**
Educational content	2	2	4
Didactical methods	2	1	3
Educational tools	3	3	6
Organisation	3	2	5
	10	8	18

Table 2. Overview of innovation cases selected per type of innovation.

3.2 Operationalisation of variables

Each of the concepts that were included in the theoretical framework were operationalised. Below, the dimensions and measurement criteria for each of the main three variables are shown.

This operationalisation is based on the theoretical framework set out in the chapter 2, with some additional literature used for various variables to use similar operationalisations as those studies. This was done if the measurement of concepts was deemed more complex, which was the case for the following variables: organisational size; complexity; compatibility. The operationalisation of these three variables was inspired by Premkumar & Robberts (1999). The categorisation of the organisational size was done based on the categorization used by the Dutch Central Bureau of Statistics (2021).

For each of the concepts, its measurement is presented. The indicators listed indicate when data in the documents is coded as one of the concepts. The questions listed indicate how the data is gathered in the interview.

3.2.1 Innovation types

	Types of innovations	**Measurement**	**Indicators**
1	Educational content	Change of topics or student skills that are taught in courses & creation of new courses	Knowledge or skills content within a course is created or changed
2	Didactical methods	Innovations in ways of teaching, e.g., that stimulate new ways of interaction	Teaching methods are changed for pre-existing content

3	Educational tools	Innovations in materials and means for teaching and learning, including IT and physical tools	Change in teaching or learning tools for students and/or teachers
4	School Organisation	Innovations in organisational structures or processes	Change in educational processes or structures of the educational institute

Table 3. Operationalisation of types of innovations in education

3.2.2 Effectiveness of innovations

	Innovation effectiveness	**Measurement**	**Questions**
1	Innovation goal attainment	The extent to which the innovation reaches the goals it set out for.	To what extent were the set goals for the innovation achieved?
2	Organisational efficiency	The innovation contributes to lower costs per student for the educational institute in terms of duration within the institute and retention.	Did more students graduate within the set time frame and on the level they were set out to do due to the innovation?
3	Student performance	The innovation contributes to the increase in grades for the affected courses / study programme.	Did the average grades of the students increase because of the innovation was implemented?
4	Improved learning & teaching attitudes	The innovation caused motivation and interest towards learning and/or teaching.	Did the innovation change the attitudes of the students and teachers towards learning & teaching respectively?
5	Skill & knowledge development of students	The learning skills and content knowledge of students increase due to the innovation.	Did the students gain more knowledge or create a different/more elaborate skillset due to this innovation?

Table 4. Operationalisation of effectiveness of innovations in education for five dimensions.

3.2.3 Innovation features of influence

	Innovation features	**Measurement**	**Questions**
1	Complexity	Extent to which additional training is needed	Was there a need for staff and students to receive training before they were able to work with the innovation? (e.g., in terms of preparation, collaboration or skill development)
		Scale of change that is needed to	Did the innovation impact the organisation as a whole and require various actors to change?

		accommodate innovation	
2	Compatibility	Fit of the innovation's norms and values with that of the organisation	Was the innovation compatible with the educational institute's norms and values?

Table 5. Operationalisation of innovation features.

3.2.4 Innovation process factors

These factors play a role in the various stages of the innovation process.

	Process factors	**Measurement**	**Question or indicators**
1	Goal setting	To what extent the goals of the innovation were formulated	If the set goals were specific, measurable, attainable, relevant and timely.
2	Professionalisation	Learning activity for teachers related to the innovation	Type of professionalisation activity (workshop, lecture, coaching, informal guidance)
			Duration, frequency and effective hours (time span of activities in weeks, number of activities over time, total hours spent on activities within this time)
			Focus of professionalisation activity (Skill, knowledge, attitude)
3	Embedding of the innovation in the institution	The position of the innovation in the organisation after the innovation process	How is the responsibility for and sustainability of the innovation arranged? E.g., in policies/through resource allocations

Table 6. Operationalisation of the innovation process factors.

3.2.5 Governance features

	Governance features	**Measurement**	**Questions or indicators**
1	Organisational size	Number of students at the educational institute.	Secondary education: small < 1000 students, medium 1000-2000 students, large > 2000 students. Higher education small<15000 students, medium 15000-30000 students, large > 30000 students.
2	Organisational structure	The hierarchy of the organisation in terms of levels of organisational units between the	Number of levels in the hierarchy between teachers and executive institutional leader.

		executive responsible leader and teachers.	
3	Organisational culture	The educational institute has a shared approach to communication and problem solving	Could you describe organisational culture of your educational institute? E.g., is there a lot of formal/informal contact, organized approach or more creative, consistent/ infrequent, collaboration or individual work, shared problem solving or sole responsibility.
		Staff members have similar behavioural patterns, e.g., in terms of collaboration	Could you describe the working relationship and collaboration with your fellow staff members? (E.g., collaboration, discussions, only coffee talks, active involvement)
4	Leadership	Reasons for being viewed as an educational leader	Who do you view as your leader in the educational institute? Why?
		The style of the leader towards educational staff	How would you describe their leadership style? (e.g., visionary, inspiring, direct, clear expectations)

Table 7. Operationalisation of institutional governance features.

3.3 Data collection

A combined approach of semi-structured interviews and document analysis was chosen for this research.

The questions for the semi-structured interviews were created based on the conceptualization and operationalization of the variables as can be seen in tables 2 to 6. The interviews took place one-on-one through online means. Semi-structured interviews were done to gather similar data about the innovations and their context, while also allowing for explorations of other topics if these were deemed relevant for the research questions or provided in-depth information that could not be found in the document analysis. The majority of the questions aim at measuring the variables. This was done by getting insight into the reasons and approach to developing a specific type of innovation, as well as the effectiveness and governance features of the educational institutes. A standard interview script was created that included all questions related to the variables. The aims of the interviews were to gather insight into the innovation processes and experiences that cannot or have not been put on paper.

Before the general data collection started, a pilot study with one innovation case was done to check if the interview script and coding schemes were reliable and to estimate the length of the interview. The pilot interview took 51 minutes, which was within the expected range of 45 to 60 minutes duration. Some changes were made to the interview script based on the interview to allow for a better flow in the conversation and to ensure all relevant concepts were discussed. The questions about the effectiveness of the innovation were moved after questions about the innovation process. This was done to discuss the innovation itself before discussing its effectiveness. As it often had been a few years since the interviewees went trough the innovation process, this was a good way of recalling details and experiences. Moreover, two questions were added, one about the embedding of the innovation and one concerning their perspective on whether or not the innovation was effective and why.

After the pilot was deemed successful and changes were made to the interview script, all other interviews were held. There was a total of 18 interviews with innovation project leaders, including the pilot case, lasting between 27 and 61 minutes, with an average of 40 minutes. Most of the interviews took place in Dutch as the majority of the innovative teachers were most comfortable in that language. One interview about a Comenius teaching fellow innovation was held in English to accommodate a non-Dutch speaking person. All interviewees about LOF innovations were held in Dutch.

The data collected from the interviews was supplemented by the data from the document analysis to allow for data triangulation. For this analysis, documents on the innovations and educational institutes were analysed. Documents from each educational institute of the respective selected innovation projects were collected. An average of four to five documents per institute were assembled, including documents like the institute's long-term vision, their policies for innovations within the organisation and potentially other relevant document that concern innovation. Next to this, the innovation programmes were approached to provide evaluation forms and other data about the innovations that were developed within the programme. For each of the 18 analysed innovations, the aim was to get their project proposals, mid-term reports and evaluation reports. In total, the following documents were aimed to be collected for each of the innovations:

1. Project proposals for LOF/Comenius teaching fellow programme
2. Evaluations and reports of the innovation projects
3. Policy of the institutes
    a. Long term vision

   b. Policy on innovation and change
4. Organisation charts of the educational institutes
5. Presentations and flyers describing or promoting to innovation to externals
6. Research papers concerning the innovation

The interviews and document analysis together aimed to provided a thorough overview of the types of innovation, effectiveness, and governance features that were present in the educational institute. Moreover, the information from gathered through each method could be cross-checked.

3.3.1 Procedure

An interview protocol was used for the semi-structured interviews (Appendix B). First, the purpose of the interview and their rights as interviewees were stated and consent was asked to record the interview. Then, questions were asked about the innovation, the innovation process, the effectiveness of the innovation and the governance features of the educational institute respectively. This was followed by a moment in which the interviewee could provide additional information that they deemed useful but had not been touched upon yet. Lastly, the interviewees could ask any questions they had about the interview or research and were asked to provide the researcher with documents on the innovation and the educational institute. Then, the interview was finished and the recording stopped. During the interview, a coding scheme was used in which each answer was coded in pre-set categories, and where additional notes and explanations for these codes were added. The combination of a coding scheme and the recording of the interview allows for accurate analysis of the data.

As stated above, the interview data was supplemented by data from documents. This data was gathered in multiple ways. First, all relevant documents from and about each educational institute were collected. This will be done by searching the institutes' websites and contacting the educational institutes about additional documents if the website provided insufficient information. Documents about the innovations themselves were also collected trough websites of the innovation programmes, LOF and Comenius teaching fellow, and their affiliated organisations, such as NRO, NWO, Schoolkracht and Eddie. Once collected, the documents were coded and analysed.

3.4 Data analysis

All interview data was coded using a coding scheme (appendix C) during the interviews. The initial notes and codes were improved after a review of the interview recordings. All relevant comments for each of the variables were written out verbatim and added to the interview data overview. This was done for each of the interviews.

The filled-out coding schemes and gathered documents were uploaded to ATLAS.ti 22. To check whether the codebook could be reliably used, inter-coder analysis was done. The main researcher and a second coder both coded cases 1 and 14 with the same codebook in June 2022. The documents were coded deductively, working with a code book that is based on the operationalization of the variables (tables 2-6). This codebook entailed what each code meant and when a unit should be coded (Appendix D). Then, inter-coder analysis was run by ATLAS.ti and Krippendorff cu Alphas were calculated for each semantic domain, which were process variables, innovation characteristics, effectiveness variables, institutional governance features, and general information & type of innovation. The alphas for all variables indicated good reliability of the codebook, which could therefore reliably be used by a single coder.

The cu-Alpha of the effectiveness variables and institutional governance features were both 0.77 (table 7), which was slightly lower than desired. The inconsistencies between the effectiveness variables concerned the skills development and knowledge development of students. One coder coded this only as an outcome of the innovation, while the other coder also coded for those variables when there was mention of it being an expected outcome. This discrepancy was cleared up and the code book was adapted to only entail the effectiveness variables as an outcome of innovation. For the institutional governance features, this could be explained by the different interpretation of leadership style codes. These inconsistencies were discussed and the codebook adapted to be clearer in the distinction between the different codes for leadership style.

Semantic domain	**cu-Alpha**
Process variables	0.90
Innovation characteristics	1.0
Effectiveness variables	0.77
Institutional governance features	0.77
Type of innovation & general information	1.0

Table 8. Inter-coder reliability of semantic domains and their corresponding Krippendorff cu-Alpha.

After this initial round of coding, all cases were coded based on the codebook. Deductive coding was employed using the codebook, followed by axial coding in which categories of similar codes were created (van Thiel, 2012), such as a group of codes regarding a transformative leadership style. Moreover, in this step, the codes of the interviews and codes of the documents of each case came together in these categories. Therefore, extra attention was paid to finding inconsistencies or discrepancies in the data.

Finally, the categories of codes were used to look for patterns and relations between the different cases. Here, the codes were compared for each type of innovation, for each type of school level, for the organisational characteristics and governance features, and for the types of effectiveness. The goal of this step was to find themes within the codes that can explain certain phenomena, such as the effectiveness of the innovations.

3.5 Ethical considerations

The interviews were recorded to allow for as accurate as possible transcriptions. Consent was asked for these recordings. It was ensured that the participants know they are free to stop the interview at any time without having to explain their behaviour and can retract their consent for the recordings at any given moment. The interviewees were made aware of their rights at the beginning of the interview and all interviewees confirmed they were aware of these (Appendix A). After the thesis project finished, all recordings were removed, as stipulated in the GDPR. This study was presented for ethical approval to the ethical committee of the faculty of behavioural, management and social sciences, which was granted (request number 211062).

3.6 Validity & reliability

In this study, triangulation was applied through diversifying the date sources. By using both interview data and documents, the data could be checked with one another, which increased the internal validity of the study. Moreover, the studied variables were measured in similar ways as was done in previous research. This can indicate high construct validity of the research.

The selected cases were somewhat representative of all innovation projects within LOF and Comenius teaching fellow. However, because the sample was small and the case selection was not randomized nor explicitly representative, the external validity of the study cannot be guaranteed.

A codebook was used to try to increase the reliability of this research. This codebook was used for analysing the data and was subject to inter-coder analysis before use to measure the level of agreement per semantic domain. The inter-coder agreement was sufficiently high, which indicated that the codebook could be reliably used for data analysis.

Moreover, the reliability of the data collection was ensured through the use of an interview script. By asking all interviewees the same questions, although in a changing order, the data collection was as reliable as possible for each case and the collected data was mostly similar each time. Potential follow-up questions were defined up-front. That way, the reliability was as high as possible while still creating an environment in which necessary information could be gathered.

4. Results

In this section, the results for each of the research questions are presented. First, a description of the studied research population is given. The following sections all cover one of the (sub-)research questions as posed in the first chapter.

4.1 Population characteristics interview respondents

A total of 18 interviews were held, interviewing nine male and nine female innovation project leaders and one female student. Most of the LOF project leaders were teachers. The Comenius teaching fellow project leaders often had a double role as teacher and researcher. One interviewee was programme director of a bachelor's degree as their main job function, while another interviewee was the course coordinator for the course in which the innovation was implemented.

The interviews took place between the 10th of May and 13th of June 2022, with the majority of the interviews being held at the end of May. All innovation project leaders received an innovation grant, which were awarded over a period of five years, with two innovation projects starting in 2016, four in 2017, five in 2018, three in 2019, and three in 2020. 10 innovation projects from within the LOF programme were studied, and eight from the Comenius teaching fellow programme.

In addition to the interview data, 76 documents were analysed. These documents included 18 project descriptions, 12 institutional strategic plans, five organograms, eight school guides, seven research papers on the innovation projects, eight grant proposals, two final reports on the innovation process, nine news articles about the innovation project, four teaching material examples and three sets of presentation slides.

Below, the results relevant for each (sub-)research question will be presented. First, the innovation types are described, followed by the process and innovation features and the effectiveness of the innovations. The fifth and sixth section presents the institutional governance features that were studied and how these relate to the effectiveness results. In the seventh section, the results of sections are combined. In this chapter, the data is referenced where relevant, referring to the document number and quotation in ATLAS.ti that the results are based on.

4.2 Innovation types

In this section, the results of the study of the innovation types are presented, in which each case that fits to a certain type of innovation is discussed.

Three innovation projects were categorized as educational content innovation, four as didactical method innovation, six as educational tool innovation and five as organisation innovation (Appendix A). One innovation (#17) was initially categorized as an educational content innovation. Their initial idea had been to revise the content, but their focus changed due, where instead a new method was created for existing philosophy content. As was discovered during the interview, the innovation was now fitting with the criteria for didactical methods and was labelled as such.

Educational content innovation

Two innovations in secondary education and one in higher education fit in the 'content' category of innovation. One of these concerned creating a 'wetenschapsoriëntatie', introduction to science, course for upper secondary school students (#18). The second project was about creating a robotics course in secondary education (#6). In higher education, the studied innovation was about a co-created course between students and teachers on development and diversity in international studies (#13).

These innovations had in common that they all created a course for students to follow, which was taught over the duration of multiple years. Moreover, while each innovation focused on different content, the goal of the innovation was similar, as each filled a perceived gap in the curriculum (94:33; 46:2), as was clearly described by project leader of the introduction to science course: ".. goal was to create a multi-disciplinary course in which big topics that were too large to cover in a single course could be discussed" (105:5). All the content innovations covered a multi-disciplinary topic, where #6 included physics, math & programming, #13 international relations, development & intercultural studies, and #18 scientific research and information technology (59:3; 65:1; 94:5).

Didactical method innovations

Two innovations in secondary education and two in higher education were part of the 'didactical methods' category. The first innovation studied was a didactical method for project work, where socio-technical analysis of technologies was done through role-play (#1). The second innovation project in university was a reverse engineered philosophy method. There,

the canon for modern philosophy was critically discussed and evaluated through starting in the now and working their way through modern history (#17). Innovation 14 focused on teaching physics interactively and with a research focus. The other didactical innovation in secondary education concerned a didactical method for teaching art, in which students learned to discuss and perceive art different through interactions and specific questions (#16).

For all didactical innovations, the goal of the innovation was to create more interaction of students with the course or project materials (56:2; 64:3; 66:3; 79:2). For the role-play innovation, this was desired to increase interdisciplinary learning (37:1). The interactive physics innovation (#14) wanted to stimulate students' ownership of their own learning through more interaction (103:6). The philosophy innovation (#17) stimulated more interaction due to the desire to teach students to question the status quo (85:6). Lastly, the art innovation (#16) desired a teaching method to connect student with one another and art, and this interaction facilitated that (97:4).

Educational tool innovations

Three educational tool innovations were implemented in secondary education and three in higher education. The first innovation in tools in higher education concerned a writing tool for students to improve their writing process and improve their strengths and weaknesses (#3). The second university tool innovation was a learning analytics tool that focused on providing feedback to students and guiding their learning process through prompts in the tool (#5). A teamwork monitoring tool was the third higher education innovation. Weekly reporting in an app was used to monitor the group dynamics and stimulate early intervention of teachers (#8).

One of the tool innovations in secondary education was the creation of an online database with information, teaching materials, and tests about Chinese culture. This innovation was created to create a central information source for teachers, as this did not exist yet (#4). Another innovation was the creation of a tool in which teaching materials for philosophy classes were made available, after they were proposed and redacted (#10). The last educational tool innovation in secondary education was the creation of an online history museum, in which each time period in history was visualised (#15).

Multiple innovations shared the goal to ease the learning process for students, which the group monitoring app tried by targeting team dynamics and the writing innovation tried to do through providing insight into the writing process. The history museum tried to ease the learning process through visualising history while the learning analytics app did so by providing

feedback and guidance (54:6; 57:5; 58:2; 61:3). The other two innovations also had a similar goal, which was to provide a tool that could ease the teaching process for teachers, especially new teachers, by creating a database of potential lesson plans and inspiration (69:4; 73:2).

Organisational innovation

Three organisational innovations were implemented in secondary education and two in universities. One of the innovations in higher educations focused on strengthening ties with secondary schools to create a transfer of academic and research knowledge to secondary school teachers (#9). The other organisational innovation in higher education concerned a buddy programme during the selection process for medicine students (#7).

Within secondary education, an innovation project was created that reorganized the career counselling within a secondary school to be integrated with a social science course (#2). Another innovation focused on collaboration between teachers at various secondary schools to develop Chinese final exams (#11). Lastly, the final organisational innovation was about teacher development and collaboration within a secondary school, in which ideas and perspectives on education were discussed to further develop the teachers as well as the school policy (#12).

All five innovations had the goal of knowledge sharing. For some innovations this sharing was with other educational institutes, which was the case for the Chinese exams, buddy programme, and the collaboration project (72:3; 55:3; 60:2). The other two innovations tried to share knowledge within the organisation itself, through the idea café or career counselling relocation (67:6; 70:18).

4.3 Effectiveness of innovation types

The results of the data analysis into innovation effectiveness are presented in this section and summarised in appendix E. The effectiveness of each innovation is discussed, per type of innovation and for each effectiveness dimension.

Looking at the effectiveness dimensions in general, a few things stand out. The majority of the innovations attained several or all goals (+ and ++). Only seven innovation projects attained all goals they set out for. Only two innovations did not attain any goals and one innovation attained only a few. Goal attainment was an important dimension of effectiveness as it determines whether or not another dimension of effectiveness would be achieved. Of the

innovations that achieved all goals, four innovations were effective in terms of both student and teacher attitudes and improved skill and knowledge development in students.

Two innovations that attained all their goals were also effective in terms of improving student and teacher attitudes, and improved students' skill development. One innovation that attained all goals was effective in one other effectiveness dimension, which was improving teacher attitudes. This indicates that some innovations are not effective for all dimensions, but as the innovation did attain all their goals, the innovation only aimed for one type of effectiveness.

Only one innovation was effective in terms of increasing student grades and creating a higher throughput of students in the organisation, which was innovation 5. The student and teacher attitudes were improved in the majority of the innovations, with only innovation 2 and 8 not improving at least one. One innovation saw a decline in teacher attitude after implementing the innovation, which was innovation 8.

Most of the innovations in educational content and didactical methods helped the students gain more knowledge and skills. Innovations in educational tools and the organisation were less effective in terms of students' skill and knowledge development. In total, 14 of 18 innovations were effective in terms of student skill development, while only 10 of 18 innovations were effective in knowledge development of students.

Effectiveness of educational content innovations

All three educational content innovations gained all goals they set out for. Moreover, the three innovations improved teacher and student attitudes as well as skill and knowledge development in students.

	#	Goal attainment	Improved attitudes		Student development	
			Students	Teachers	Knowledge	Skills
Education al content	6	++	+	+	+	+
	13	++	+	+	+	+
	18	++	+	+	+	+

Table 8. Results effectiveness dimensions for educational content innovations.

The skill and knowledge development of students in innovation 6 was that the students seemed to become more creative and learned to collaborate (94:13). They also gained knowledge in programming (71:4). While the innovator did not have evidence of increased

student performance, the students did have the feeling that the skills and knowledge within the robotics course was transferable to their other beta courses and that it improves their performance there (94:9). Student attitudes improved through the innovation as the course motivated students and got them more interested in the robotics.

The improved students' attitudes and skill and knowledge development through innovation 13 was based on the innovator's data, which was gathered over the years. Their own research indicated that students gain skills through the course. Moreover, the course motivates them (101:5). The improved attitude and skills were also found to stay with the students on the long run (101:5). The teachers got a better attitude towards teaching and take that experience with them to other courses too (101:8).

Innovation 18 was effective in teaching new content, and "there is growth and development in both the staff and the students that can be attributed to the innovations" (105:7). Students mainly gained skills in research, presenting and debating (65:14; 105:14)

Effectiveness of didactical method innovation

The four didactical methods innovations were all effective in terms of improving student attitudes, and skill development of students. Three of the four innovations were also considered effective in terms of improving teacher attitudes and knowledge development in students. There was variety in their extent of goal attainment.

	#	Goal attainment	Improved attitudes		Student development	
			Students	Teachers	Knowledge	Skills
Didactical methods	1	-	+	+	+	+
	14	++	+	+	+	+
	16	+	+			+
	17	+	+	+	+	+

Table 10. Results effectiveness dimensions for didactical method innovations.

Students' knowledge development in innovation 1 was seen in an increased understanding of socio-technical topics in students (87:20). Students gained skills in improvising, scenario writing (87:22) and critical thinking (40:12). The innovation also aided the development of teachers (40:18) and improved their attitude towards learning as it enhances joy and motivation in teaching (87:29). Not all goals for the innovation were reached, which was mainly the case due to change in orientation and goals during the process (87:3).

Innovation 14, in which a didactical method for physics was developed, seemed to enhance student and teacher attitudes. This was done through the stimulation of interaction and interactive forms of working, which was perceived positively and as an improvement (102:1; 103:10; 103:11). Moreover, the students gained more understanding of the course through working with the materials in a different way (102:9). The skill development of students was seen in their improvement in working both independently and collaboratively, and critical thinking and problem-solving skills (102:17; 103:13).

The innovation within art classes (#16) improved students' skills, as they were able to better express themselves through this method and learned to look at and discuss art better (97:8). Teachers found the method useful and enjoyed teaching the students in this manner. The innovation made the art classes more interesting to students and increased their attitudes (97:9).

Innovation 17 seemed to stimulate skill and knowledge development of the students. The innovator said: "the innovation made the course go from bad to good. The grades and evaluation from students were positive" (85:9). The students found the course more interesting with this method, while the teacher also found increased interest in it, which spread to other courses as well (85:14; 85:15). This was considered to improve student and teacher attitudes.

Effectiveness of educational tool innovations

There was a large variety regarding effectiveness between educational tool innovations. One innovation seemed to be effective for all dimensions, including organisational efficiency and student performance, while another innovation did not achieve any goals and decreased teacher attitudes. Most innovations did lead to development of skills in students and improved teacher and student attitudes.

	#	Goal attainment	Improved attitudes		Student development	
			Students	Teachers	Knowledge	Skills
Educational tools	3	++	+	+		+
	4	+	+	+	+	+
	5	+	+	+	+	+
	8	--		-		+
	10	++	+	+		+
	15	+	+	+		

Table 11. Results effectiveness dimensions for educational tool innovations.

Innovation 3 was somewhat effective, but not as effective as it set out to be. While all goals were reached, there was an initial overestimation of students' knowledge of writing, which made it hard to reach the desired effectiveness (88:7). This showed in the minimal increase in learning attitude and skill development.

Innovation 4 reached most of its goals, with the few goals that were not attained being minor goals that were not vital to the innovation (89:6). The innovation stimulated some knowledge and skills development in students. It was considered effective in terms of improving student and teacher attitudes, as both students and teachers enjoyed and got motivated by using the innovation (89:9; 89:10).

Innovation 5 was the only innovation that scored positively on the efficiency and the student performance measure, as well as all the other measures. Through the monitoring in the app, potential drop-out of students could be spotted through lack of participation or lowering grades, and an intervention by the teachers would target those students and help them back on track (19:8; 92:3). Moreover, students learned more through the diverse formats and gained skills in self-regulation (19:5; 90:11). Additionally, their own research experiment with a control group and a group that used the tool indicated that the students who used the innovation performed significantly higher on certain aspects of the taught content (90:5).

Innovation 8 did not attain any of its goals (96:5). The innovation worsened the teaching attitudes and only led to small gain in student skill development.

During the innovation process of innovation 10, teachers developed their expertise and knowledge further, which made them better teachers (99:5). This result is also shown in the effectiveness measures, where the student and teacher attitudes improved. Students seemed to gain more skills through this innovation as well as the use of the database increased the quality of lessons across the Netherlands and resulted in skills development.

Innovation 15 improved teaching and learning attitudes when it was used. However, because the innovation was only used during the pilot phase of the innovation process, no effectiveness was attributed to the innovation (104:24).

Effectiveness of organisational innovation

The effectiveness of the organisational innovations differed between cases, with one innovation considered effective in five dimensions and another in none (Table 11). Three innovations improved teacher attitudes. Two innovations led to more skill and knowledge

development among students. One innovation did not attain any goals, three attained several and one attained all.

	#	Goal attainment	Improved attitudes		Student development	
			Students	Teachers	Knowledge	Skills
Organisational innovation	2	-				
	7	+	+		+	+
	9	+	+	+	+	+
	11	++		+		
	12	+		+		

Table 12. Results effectiveness dimensions for organisational innovations.

Innovation 2 did not attain any of its goals and was not considered to be effective in any of the other dimensions (93:5).

While innovation 7 attained the majority of its goals, it could not be said that this was solely due to the innovation, as it was impacted by too many other (95:5). However, the innovation was perceived positively by the involved parties, leading to a perceived improvement of student attitudes. The students gained motivation and confidence, and felt represented (9:8; 95:7). Moreover, the innovation was considered effective in terms of skills and knowledge development, as students gained coaching skills and knowledge about diversity and social inclusion (55:2; 95:8; 95:9).

Innovation 9 improved the student and teacher attitudes through stimulating different kinds of interactions and exchanging knowledge (98:9; 98:10). There seemed to be some knowledge and skill development in the students that could be attributed to the innovation, mainly with regards to teamwork and collaboration skills (98:11).

The innovators of innovation 11 attained all the set-out goals and was therefore deemed effective in terms of goal attainment. Moreover, the interactions between teachers were very effective and efficient, the method of working was enjoyable (86:5; 86:6) and the method of working increased motivation and inspired teachers (86:10). Therefore, the innovation was effective in terms of teacher attitudes.

Innovation 12’s project leaders attained the majority of their goals and was therefore deemed effective in terms of goal attainment. The teachers became involved in the development of the school and an increased focus was put on teacher development (100:7), which was

considered to improve teacher attitudes. As the innovation did not affect the students directly, there was no active development of their skills or knowledge, nor an improvement of attitudes.

4.4 Process and innovation features

In this section, the process factors and innovation features are presented per type of innovation for each individual case. This aims towards sub-question 3. The process factors were goal orientation, professionalisation, and embedding. The innovation features were the complexity and compatibility of the innovation. After the process and innovation features are discussed, an analysis of the relationship to the effectiveness of innovation is presented.

Educational content innovation

The complexity of the educational content innovations differed per case. The innovation process for innovation 18 was complex for the project leader. This was because of the multidisciplinary nature of the course, which was very new and required a different approach that the leader had to learn (105:16). Others involved with the innovation did not find it complex. For innovation 13, the innovation process was not complex for the innovator, but was found to be complex for students due to the co-creation nature of the course (101:11; 101:13).

#	Fit	Low Complexity			Embedding		Professionalisation	Goal setting
		Innovators	Students	Teachers	Policy	Responsibility		
6	+	+		+	+	+	–	+
13	+/–	+	–		+	–	–	+
18	+	–	+	+	+	+	–	+

Table 13. Innovation and process features of educational content innovations. Plus indicated the variables were positive for the innovation process and minus negative for innovation process.

The innovation project leader of innovation 6 had some experience with innovating in education and therefore focused on the innovation process and ensuring students and fellow colleagues were on board (94:32). This made the complexity low for the innovator himself as well as for the teachers involved (94:14). Moreover, the project leader collaborated with other teachers from other schools to ensure the innovation could be used elsewhere as well (94:21).

All educational content innovations were mostly compatible with the organisation on the basis of their content. Innovation 6 was fully compatible with the school's vision and norms. The innovators of innovation 13 experienced some resistance during the innovation process. Moreover, the co-creation aspect of the course did not fit well with the norms and values of the organisation as this was untraditional (101:14). However, the acceptance of the innovation increased over time and was deemed more compatible once it was implemented. Innovation 18 fit well with the organisation, which could be attributed to the felt need for the course throughout the educational institute (105:17; 105:20).

All educational content innovations were at least partially embedded, with the innovation being formally documented in policy for all innovations. Innovations 6 and 18 were embedded in both policy as well as in formal responsibility within the school (105:28; 105:29). Innovations 13 was embedded in policy, but the responsibility of the innovation was still with the innovator.

None of the innovation processes of educational content innovations included professionalisation activities for the innovators. In each of the three cases, the need for the innovations matched with the goals set out for the innovation, indicating good goal setting.

Regarding the innovation process, project leader of innovation 6 emphasized the importance of a connection with students and involving them in the process (94:6). All project leaders collaborated with others on the innovation (101:12; 105:35; 94:21), and this was deemed important as it helped shape the process and improved it (101:12). Students were involved and updated during the innovation process (45:2; 94:6; 105:24).

During the innovation process, a focus was given to the next steps for the innovation in all the innovation cases, with the adaptability of the developed content being highlighted in two cases (94:32; 101:26), and the diffusion among other peers being highlighted in the other (105:30).

Didactical methods innovation

The didactical methods innovations had varying degrees of complexity. For innovations 1 and 17, the innovators had a lot of experience with, and a vision of, their innovative teaching method and the innovation process therefore was not complex for them (85:18; 87:30). The students were kept in the loop during the innovation process of innovations 1, 14 and 17. This made their experience not complex (85:19; 87:31; 103:17). The teachers involved in

innovations 1 and 14 the innovation often more complex to work with than the innovators themselves (103:14; 87:32). Innovation 16 was found to be complex for both the project leader and the students, as it required a very different mindset and view on art, which neither group were used to (97:12).

#	Fit	Complexity			Embedding		Professionalisation	Goal setting
		Innovators	Students	Teachers	Policy	Responsibility		
1	+	+	+	-	+	+	-	+
14	+	+	+	-	+	-	-	+
16	+	-	-		-	-	+	+
17	+/-	+	+		-	-	-	+

Table 14. Innovation and process features of didactical methods innovations

Three of the didactical method innovations fit well with the norms and values of the organisation. The fourth innovation of this type was the philosophy innovation (#17), which was a good fit within the philosophy department, but less so within the institution as a whole, where diversifying education was not deemed important at the time (85:22). Therefore, this innovation was only a partial fit.

The embedding of the didactical innovations was not complete for most innovations, with only the theatrical technology innovation being fully embedded (table 10). Innovation 14 was taken up in the institute's policy and was therefore partially embedded. Innovations 16 and 17 were not embedded at all.

During the innovation process, only one project leader participated in a professionalisation activity (#16). She followed a course to gather skills and knowledge on art-based learning before implementing the innovation for her students (97:28). The other innovators in didactical methods did not participate in professionalisation activities.

All didactical method innovations set relevant goals before their innovation process. Innovation 14 had a need for innovation as they felt the students were too passive and needed to be otherwise stimulated (103:6). Their goal for the innovation was to do stimulate research learning and this therefore is well oriented goal setting (66:3). This was similar for innovation 16, where there was a need for more interaction between students and to interact with art in a different way (64:2; 97:6). These needs were put into practice in their goals. Innovation 1 also set good goals, were needs for integrating different disciplines was met with the goals for the

didactical methods (37:4; 56:2). Lastly, innovation 17 was created after a need for diversifying the teaching materials, and the goal of the innovation was to radically change the current methods, which is aligned (79:2; 83:1).

The project leaders of the four didactical innovations all discussed the short time span for the innovation process, as they found a single year too short to go through the entire innovation process (87:44; 103:35; 97:31; 85:45). Moreover, three out of four cases highlighted the importance of collaboration during the innovation process (87:37; 103:34; 83:6), with one stating: “you never do innovation alone” (87:11).

The project leader of innovation 16 felt that there was a lack of accommodation for the innovation during the innovation process (97:14). This innovation did not diffuse and neither did innovation 14, which encountered difficulties with the willingness of other teachers to use it, as many had developed their own methods as well (103:37). This was contrary to the other innovations, which did spread out within the educational institutes and beyond (85:46; 87:43;).

Educational tools innovation

The complexity of the six educational tool innovations differed highly between the cases. Innovation 3 was deemed complex to all parties involved. This was attributed to the process-oriented focus, where both students and teachers were more accustomed to result-oriented writing and therefore struggled with using the tool (88:14; 88:15). This was somewhat similar for innovation 8. During that innovation process, a tool was developed that was perceived as complex by both students and teachers using it. Teachers had to put in extra work to use it and this was perceived too high of a barrier (96:10), whereas students tended to forget about it and found it redundant and complicated (96:12). The innovator found the innovation process straightforward and relatively easy.

In contrast, the use of the tool developed in innovation 5 was perceived doable and easy for both students and staff, but the creation was challenging to the innovator. The project leader found the transfer of knowledge to others especially difficult (90:15). Similarly, the Chinese cultural database innovation (#4) was challenging to the project leader as the coordination of all involved people and redacting the information was complex (89:30; 89:31). Students and teachers involved in this innovation process perceived it as easy (89:14; 89:15).

Innovation 10 was challenging for the project leader due to the central position in the innovation process and the involvement of many teachers (99:11). The teachers creating the

materials did not find the process complex, as they had a single task, with which they were already familiar (69:3). Lastly, innovation 15 was not complex for any party involved. Students and teachers found the innovation easy to use (104:10; 104:11). Moreover, the innovator already had experience with the equipment needed to make the tool and was knowledgeable in history (104:9).

#	Fit	Complexity			Embedding		Professionalisation	Goal setting
		Innovators	Students	Teachers	Policy	Responsibility		
3	+/-	-	-	-	-	-	-	+
4	+	-	+	+	-	+	-	+
5	+	-	+	+	-	-	-	+
8	+/-	+	-	-	-	+	-	+
10	+/-	-	/	+	+	+	-	+
15	+	+	+	+	-	-	-	+

Table 15. Innovation and process features of educational tools innovations.

The innovation 4, 5 and 15 were a good fit with the needs and values of the organisation. Innovation 5 fit with the already existing vision on increased use of learning analytics within the organisation (90:17). The educational institute in which innovation 15 was innovative and desired more digital learning tools. Innovation 15 was therefore a fit with the norms and values (104:14).

Innovations 3, 8 and 10 were a partial fit with their organisations. The format of innovation 3 was not compatible with the work vision of the organisation, but the content of the innovation was a good fit with their norms and values (88:17). Innovation 8 was only partially compatible for similar reasons. The content of the innovation aligned with the university's vision, but its format as a digital tool was a poor fit. Lastly, innovation 10 was a good fit with the norms and values of the educational department it was implemented in. However, it did not align with the vision of the organisation as a whole and was therefore only partially compatible (99:13).

Most educational tool innovations were not well embedded. Innovations 3 and 5 were not embedded at all. Innovation 3 was not embedded as the project was heavily attached to the innovator themselves and the educational institute did not feel nor assume responsibility for it (88:31). Innovation 5 was not embedded for different reasons, because it was newly implemented and still in development (90:29). However, there is the expectation that it will be

embedded in the future. Innovation 15 was also not embedded at all, as its existence was forgotten quickly after the innovation grant was used (104:24).

Innovator 8 struggled afterwards with the embedding of the innovation, where getting the funds to keep it up after the grant ran out was complex (96:22). However, the responsibility for the innovation was taken up by the educational institute (96:23). Innovation 4 was also partially embedded, with the responsibility for the innovation taken up by the national Chinese language organisation (89:27). The innovation was however not embedded in the school policy (89:26). Innovation 10 was fully embedded through the national philosophy association (99:20).

None of the project leaders of the educational tool innovations followed professionalisation activities. The goals and needs for the innovations aligned for each educational tool innovation.

Three innovators mentioned the short time frame of working on the innovation and that that was bothersome (90:30; 96:24), with one saying "I got LOF for 2.5 years due to maternity leave. This extended the LOF grant and because we still had money left, we could work on it longer, which was useful as the project got better as well" (99:24).

Students were not actively involved in the innovation process, but did get to try some of the innovations (#3, 5, 15) out during a trial run (47:11; 54:4; 90:32). For the other innovations, the students were not informed about the innovation until the tool was already developed and implemented.

Most of the innovations in educational tools diffused beyond their initial contexts, spreading to other organisations (47:17; 89:32; 90:32; 99:4) or to other parts of their own organisation (96:23). Innovation 15 did not diffuse, as it was discontinued after implementation.

Organisational innovation

Three of the innovations (#7, 9, 11) were not complex to the innovators, which they explained was due to their familiarity with the topic (98:14; 86:13). The other two project leaders (#2, 12) did find the innovation process complex, which was due to the large involvement of other stakeholders (93:8), one project leader stating that "getting others involved and participating was a challenge" (100:10). Students found it challenging to work with the renewed career counselling structure (93:9), as well as to work with a secondary school student while in university (95:10; 98:13).

#	Fit	Complexity			Embedding		Professionalisation	Goal setting
		Innovators	Students	Teachers	Policy	Responsibility		
2	+	-	-	-	-	-	+	-
7	+/-	+	-		-	-	+	+
9	+/-	+	-	+	-	-	-	+/-
11	+	+		+	+	-	-	+
12	+	-		+	+	-	+	+

Table 16. Innovation and process features of organisational innovations.

Three organisational innovations were a fit with the organisation's norms and values. Innovation 2 was in line with the school vision of personal connection and was therefore compatible with the organisation (93:11). Similarly, innovation 11 fit with the schools needs and vision (86:15), and innovation 12 was created due to the school vision and was therefore compatible (100:14). Innovation 7 and 9 were both a partial fit with the organisation. While their organisations' vision being a fit with the innovation, this vision is not being implemented in practice and, therefore, caused some tension (95:13; 98:17).

The embedding of the innovations in the organisation happened only partially for some cases, and not at all for others. The innovation about collaboration between secondary and university teachers (#9) and the innovation about the career guidance for students (#2) both stopped after their first year, and were therefore not embedded at all. Innovation 7 was not embedded in policy and the responsibility for the innovation remained with the initial project leader. Innovations 11 and 12 were integrated with the organisation's policies and plans, but the responsibility stayed with the innovator. These innovations were therefore partially embedded.

Three innovation project leaders (innovation 2, 7, 12) followed a professionalisation activity, through workshops, individual coaching or training sessions (2:8; 15:1; 100:27). The other two innovators did not participate in professionalisation activities.

The goal setting of innovation 2 did not match the needs that the school had for the innovation. There was a lack of alignment and if the goals were achieved, this would not solve their problem or meet their need. The innovator of innovation 9 set out multiple goals, some of which were aligned with their needs and were clearly defined and attainable, while others were abstract and not clear-cut (98:7). Innovation 7 had a strong alignment between the needs and goals they were trying to fulfil, as did innovation 11 and 12 (55:3; 67:6; 72:2).

It was noted in three of the cases that the time given for using the grant was too short and became a constraint within the process (9:4; 86:32; 98:27). Collaboration with others took place in all of the innovation processes, with other teachers, student associations, administration department and communication employees named as important contacts (15:3; 86:20; 95:19; 95:30; 98:21). Innovations 2 and 7 actively involved students in the innovation process to ensure a fit with their needs, while the other innovations did not (70:9; 95:19).

Two innovations were discontinued after the innovation process (#2, 9). Innovation 9 was discontinued after the initial grant year due to a lack of funds (98:6). The other innovations diffused through the organisation, with other teachers taking up similar initiatives (72:1; 95:31) and new innovations inspired by the LOF innovations being implemented (100:34).

4.4.1 Process and innovation features & effectiveness

With the process and innovation features presented above, the potential connection between the effectiveness of innovations and their process and innovation features was studied. The results of this are presented below.

Four innovation project leaders were involved in professionalisation activities before or during the innovation process. Of these four, three project leaders were involved in an organisational innovation and one in a didactical method innovation. There was variety on all dimensions of effectiveness for the innovations whose project leaders participated in professionalisation activities. A relationship between the effectiveness of innovations and professionalisation was therefore not found.

Regarding goal setting, in 16 of the 18 innovation projects the goals that were set at the beginning of the innovation process matched the needs that the innovation was meant to meet. As almost all innovations had good goal setting, no relationship with innovation effectiveness could be found.

It was found that the complexity of an innovation decreases when an innovator has experience or familiarity with the topic of the innovation before the innovation process. Lastly, a larger scope of innovation, in which multiple stakeholders were involved, can increase the complexity. All innovations that were not complex for any stakeholder improved both student and teacher attitudes and caused a gain in student skill development, with two out of three non-complex innovations also improving knowledge development in students. Two innovations

were complex for all parties, and both innovations were not effective in any measure of effectiveness, and attained no goals. The innovations that were partially complex, for either one or two of the stakeholders, did not have a clear pattern in their effectiveness.

Three of the four innovations that were fully embedded were also a full fit with the organisations in terms of compatibility, indicating that good embedding in the organisation might follow if there is a fit of the innovation with the norms and values in the organisation. However, no link between the compatibility and the effectiveness of the innovations could be found for student and teacher attitudes, goal attainment or student skill and knowledge development.

Only a few innovations were fully embedded in the organisation. Four innovations were fully embedded in the educational institute, and six innovations were partially embedded. The innovations that were fully embedded in the organisation were almost all fully effective for goal attainment, student skill and knowledge development, and teacher and student attitude, with the exception of one case. The innovations that were partially embedded achieved all or several goals. There, therefore, could be a connection between the embedding of an innovation and the effectiveness of an innovation in terms of goal attainment, as goal attainment of an innovation is higher if the innovation is partially or fully embedded in the organisation.

Embedding of the innovation typically took place after the innovation was implemented in the organisation and in the institutionalisation phase. Because of that, the time period of implementation could play a role in the level of embeddedness of an innovation. It was found that all innovations that started the innovation process in 2020 were not embedded at all. Innovations started in 2019 were either not embedded or partially embedded. The amount of time that has passed could, therefore, influence the level of embeddedness of an innovation.

4.5 Institutional governance features

In the following section, the found institutional governance features are presented, as well as a description of how they interact with one another. In the table below, the four institutional governance features and the type of school are presented per innovation case. Then, each feature is discussed separately.

Innovation type	#	School type	Innovative culture	Structure	Size	Leadership	
						Style	Appraisal
Educational content	6	SE	+/-	Hierarchical	Medium		+
	13	HE	+	Hierarchical	Big		+
	18	SE	+	Hierarchical	Medium		+
Didactical methods	1	HE	+/-	Hierarchical	Small	Transactional	+
	14	SE	-	Flat	Big		-
	16	SE	-	Flat	Medium		-
	17	HE	+	Hierarchical	Medium		+/-
Educational tools	3	HE	+/-	Hierarchical	Big	Transactional	+
	4	SE	-	Flat	Small		+
	5	HE	+/-	Hierarchical	Big		+/-
	8	HE	+/-	Flat	Big		+/-
	10	SE	+/-	Flat	Medium		+/-
	15	SE	+	Flat	Medium		+
Organisational innovation	2	SE	+/-	Flat	Medium		-
	7	HE	+/-	Hierarchical	Medium	Transformative	+
	9	HE	+/-	Hierarchical	Big	Transactional	-
	11	SE	+	Flat	Medium		+
	12	SE	+	Hierarchical	Medium	Transformative	+

Table 17. Institutional governance features for all 18 innovations, per type.

Organisational culture

An organisational culture was deemed innovative if at least three aspects of an innovative culture could be identified. A culture was deemed semi-innovative if only one or two aspects of an innovative culture were present in the organisational culture and maximum of one aspect of an innovation inhibiting culture. The organisational culture was deemed not innovative if two or more cultural aspects were identified that hindered or inhibited innovation processes. The innovation supportive cultural aspects that were identified in the research were the following: Strong inter-personal ties and collaboration between colleagues, support between colleagues, personal development stimulated, a sense of freedom, progressive and open culture, and a creative culture. Innovation hindering cultural aspects were conservative mindsets,

controlling environment, limited contact between students and staff and between colleagues, individualistic focus and high work pressure. This categorisation was mostly made based on the interview and document analysis outcomes, with some direction given by the theory of innovative culture as presented in the theoretical framework.

Six cultures could be characterized as innovative, nine as semi-innovative and three as not innovative. The three organisations that did not have an innovative culture, were all flatly structured, secondary schools. Two with negatively appraised leadership styles and one positively. Nine organisations had a semi-innovative culture, of which six universities and three secondary schools. Three leaders within a semi-innovative culture had a transactional style and one transformative. Six organisations had an innovative culture, five with positive leadership appraisal and one with neutral. Of these six organisations, five were medium-sized and one was large. Three of the organisations had an innovation that achieved several goals, while the other three achieved all goals. Four organisations with an innovative culture were secondary schools and two were universities.

Organisational size

Looking at the size of the institutes, two organisations were considered small size, ten medium-sized and six large-sized. No patterns could be found in the goal attainment for each of the different sizes, but it was found that both innovations that were implemented in small-sized organisations improved student and teacher attitudes, and helped the development of knowledge and skills for students. Medium-sized innovations had a large variety in their effectiveness, with three innovations improving on all attitudes, knowledge development and skill development for students, while other innovations were not effective at all. This was similar for large organisations, where all innovations did lead to more skill development, and most improved student and teacher attitudes.

Organisational structure

The organisational structure of the educational institutes was hierarchical or flat, with organisations with three or less degrees of separation between the teachers and upper management being seen as (relatively) flat organisations, and four or more degrees of separation as hierarchical. Eight organisations had a flat organisational structure, with the other then organisations having a hierarchical organisation. Of the eight organisations that had a flat structure, seven were secondary schools, with only one university having a flat structure. Only

three secondary schools were hierarchically structured. Seven universities were hierarchically structured.

In flat organisations, three leadership styles were negatively appraised, two neutral and three positive. Three flat organisations had a non-innovative culture, three a semi-innovative culture and two an innovative culture. Within the organisations with a flat structure, there were two large organisations, five medium-sized organisations and small organisation.

The hierarchical organisations contained four large, five medium, and one small organisation. In hierarchical organisations, one leader was appraised negatively, two neutral and seven positively. Of these ten organisations, six had a semi-innovative culture and four an innovative culture.

Leadership

A division was made for leadership characteristics based on the interviews. This division determined the negative, neutral, and positive characteristics of a leadership style. Negative leadership characteristics were: Absent leadership, controlling leadership, hindering innovation, and a lack of trust in employees. Positive leadership characteristics were: Collaborative leadership, supportive leadership and bottom-up leadership. If a leader had characteristics of both negative and positive leadership, it was deemed neutral. Four leadership styles were negatively appraised, four neutrally and ten positively.

Moreover, it was analysed whether a leadership style could be seen as transformative or transactional, or neither. This was done based on the characteristics as identified in the literature. If the leadership style was described as inspiring, stimulating ideas and innovation, and visionary, and at least two of these elements were present, it was deemed transformative. Leaders with two or more of the following characteristics were deemed to have transactional leadership style: passive leading, trust in employees, providing freedom. Two organisations had a leader with a transformative leadership style and three organisations had a transactional leader. The other 13 organisations were led by a leader that did not have either of these leadership styles.

All organisations with a transactional leader were universities with a semi-innovative culture and a hierarchical structure. The size, appraisal, and person in the leadership position were different from one another in these three cases, with two large organisations, and one small-sized organisation. The two organisations with a transformative leader were both

hierarchically structured and medium-sized. Transactional and transformative leadership styles were only found in hierarchical organisations, and not in flat organisations. The two leaders with a transformative style were both appraised positively, while the transactional style was appraised positively in two cases and negatively in one case.

4.6 Institutional governance features & effectiveness

Here, each institutional governance feature is discussed individually in relation to the innovation effectiveness measures. First, each governance feature is reviewed separately to search for relations between the feature and innovation effectiveness, after which the features are combined to search for overarching patterns (Appendix F).

School type & effectiveness

Reviewing the goal attainment of the innovations per school type, it was found that four secondary school innovations and four university innovations attained several goals; One university and one secondary school innovation did not achieve any goals; Five secondary school and two university innovations achieved all goals; One university innovation attained a few goals. This distribution of goal attainment is quite even for the two types of schools, with secondary school innovations attaining more goals that the innovation set out for than university innovations.

Regarding student attitudes, one university innovation and three secondary school innovations did not improve student attitudes. Of these four innovations, two did not attain any of their goals, one achieved several and one all. The other fourteen innovations (seven secondary school and seven university innovations) all improved student attitudes.

Two secondary and one university innovation did not improve teacher attitudes. These attained none or several of the goals of the innovation. One innovation worsened the teacher attitudes, which was a university innovation. This innovation attained none of the goals it set out to. The other 14 innovations all improved teacher attitudes, which were eight secondary school innovations and six university innovations.

Eight innovations did not lead to a gain in knowledge of students, which were six secondary school and two university innovations. Of these eight innovations, three attained all goals, three attained several and two attained no goals. Ten innovations did cause students to gain knowledge, which were six university and four secondary school innovations. As more

secondary school innovations were studied than university innovations, it is noteworthy that secondary school innovations were less effective in this measure than university innovations.

All innovations in universities caused a gain in skill development. Within secondary schools, four innovations did not lead to a gain in skill development. Of these four innovations, two achieved several goals, one none and one attained all goals, with three of the four innovations being organisational innovations.

Leadership style, position and appraisal & effectiveness

Two innovations had the administration as a leader (#2 & 8), both achieved none of the goals, did not improve student attitudes and did not lead to gain in knowledge development. One innovation did cause a gain in skills, but also worsened teacher attitudes, and had a neutrally appraised leader. The other leader was appraised negatively.

One innovator had the department leader as leader (#14). This innovation gained all goals and scored high on all aspects of attitudes and development. The leader was appraised negatively.

Two (#7 & 9) innovations had the head of research leading their organisation. These innovations both attained several goals and improved student attitudes, knowledge and skills development. Both innovations concerned organizational innovations. While similar in effectiveness and type of innovation, one leader was appraised negatively, while the other positively.

Five innovations had a programme director as leader. These innovations all improved student & teacher attitudes and cause gain in skill development, and 4 out of 5 also improved knowledge development. Two innovations attained all goals (#3 & 13), two attained several goals (#5 & 17) and one gained a few goals (#1). Innovations that reached several goals had leaders that were neutrally appraised, while the others were positively appraised.

Six innovations were implemented in organisations led by a rector. Three innovations (#6, 10, 11) attained all goals, three attained several goals (#12, 15, 4). All innovations improved teacher attitudes, while three out of five also improved student attitudes. Two caused knowledge and three skills gain. Five of the leaders were appraised positively (#11, 12, 15, 4, 6), and one neutrally (#10).

There were two innovations in organisations led by both the rector and department leader, where one gained in skill & knowledge development and attitudes, and achieved all

goals (#18) and had a positively appraised leader, while the other gained skill development and student attitudes and achieved several goals (#16) and negatively appraised the leader.

The organisations with a transactional leader all had innovations effective in teacher and student attitudes as well as student skill development. The innovations of the organisations with a transformative leadership style did not have overlap in effectiveness criteria.

Size of the school organisation & effectiveness

Two innovations were implemented in a small-sized organisations. Both improved student & teacher attitudes and increased knowledge and skill development. One of the innovations attained a few goals (#1), while the other one attained several of its goals (#4).

Ten innovations were implemented in medium-sized organisations. Five innovations attained several goals, four attained all goals and one did not attain any of its goals. No patterns could be found in the effectiveness measures.

Six innovations were part of large organisations. Of these six, three innovations attained all goals, two several and one no goals. All innovations in large organisations caused skill development and almost all improved student attitudes.

Organisational structure & effectiveness

Eight organisations with a flat structure were found. Regarding the effectiveness of organisations with a flat structure, three innovations attained all goals, two did not attain any, and three attained several. Moreover, five of the eight innovations in flat organisations improved student attitudes, teacher attitudes, and skill development. Two of the eight innovations improved knowledge development. One worsened teacher attitudes.

Ten hierarchical organisations were studied, of which seven were universities. Looking at the effectiveness of the innovations in hierarchical organisations, four innovations attained all goals, one attained a few goals, and five attained several. Nine of the ten innovations improved student attitudes, teacher attitudes and students' skill development. Knowledge development of students happened in eight of the ten cases.

Innovation culture & effectiveness of innovations

Three organisations did not have an innovative culture. Two achieved several goals and one achieved all goals. All non-innovative culture innovations improved student attitudes and

gained student skill development, and two also improved teacher attitudes and knowledge development in students.

Nine organisations had a semi-innovative culture. Goal attainment was very diverse for the innovations in organisations with a semi-innovative culture, three achieved all goals, three achieved several goals, two did not attain any goals and one attained a few goals. With the exception of the innovations that did not attain any goals, the other seven innovations all improved student attitudes and caused a gain in skill development. Moreover, almost all of them improved teacher attitudes. However, the two innovations that did not meet the goals, did not improve on these aspects.

Six organisations had an innovative culture. All innovations improved teacher attitudes, while half of the innovations caused a gain in student knowledge and skill development. Four of the six innovations led to an improvement in student attitudes.

4.7 Institutional governance features per type of innovation

In this section, the institutional governance features are discussed per type of innovation. The purpose of this is to uncover the relationship between the two variables.

Educational content innovations

The three content innovations are all part of an organisation with an hierarchical structure, with multiple degrees of separation between the teachers and school leader (table 15). For the secondary school innovations, this leader is the rector, while the project leader of the innovation in the university had a programme director as leader. The three leaders did not have a particular style of leading, but all leaders had in common that they stimulated ideas and innovation and that they were supportive of their employees, with one interviewee stating that "Leaders are open for new ideas and supportive of innovation" (105:27).

	#	School type	Innovative culture	Structure	Size	Leadership	
						Style	Appraisal
Educational content	6	Secondary	+/-	Hierarchical	Medium		+
	13	University	+	Hierarchical	Big		+
	18	Secondary	+	Hierarchical	Medium		+

Table 18. educational content innovations and the institutional governance features

The culture of the organisation with an innovation in robotics (#6) was semi-innovative, while the other organisations were deemed innovative. Organisations 13 and 18 both had a progressive culture (101:16; 105:23), while organisation #6 had a more conservative culture (94:17). Organisation 13 had an innovative culture, with the aim to stay ahead of other universities in terms of development of teaching (17:1). The culture of organisation 18 was also described as open and diverse, with a diversity of students and teachers and an open mindset to change (75:1; 76:2). All three organisations had a culture in which there was collaboration between colleagues, and close contact between students and teachers (94:18; 101:18; 105:25).

In general, the educational content innovations had a positive leadership appraisal, a hierarchical organisational structure and mostly an innovative culture.

Didactical methods

The structure of the organisations is flat for the secondary schools (14 & 16) and hierarchical for the universities in this category of innovations (1 & 17). The organisations differ in size, with one being a small organisation, two medium and one large. The secondary school organisations both have a non-innovative culture, which shows through their conservative approach to education (97:21; 103:20), the low degree of collaboration (97:22; 103:24), and as the interviewee of innovation 16 stated there is a "lack of a developmental culture" (97:20) and high work pressure (97:18).

	#	School type	Innovative culture	Structure	Size	Leadership	
						Style	Appraisal
Didactical methods	1	University	+/-	Hierarchical	Small	Transactional	+
	14	Secondary	-	Flat	Big		-
	16	Secondary	-	Flat	Medium		-
	17	University	+	Hierarchical	Medium		+/-

Table 19. Didactical method innovations and the institutional governance features.

Both universities have an innovative culture, with a focus on collaboration (85:25; 87:35) and innovation (39:1; 85:27). Moreover, there is "easy, informal contact" (85:24) between colleagues and a close connection with students at the university of innovation 17 (85:20). At both universities, the programme director of the relevant programmes were the

leaders of the interviewees, while at the secondary schools these were the team leaders and the rector.

From this, it can be seen that the two secondary schools of didactical innovations were highly similar to one another and the two universities as well. The universities had (semi)innovative cultures, hierarchical structures and neutral or positive leadership appraisal. The secondary schools were the complete opposite of the universities in those three variables.

Educational tools

The organisations in which educational tool innovations were developed and implemented were three universities and three secondary schools. The universities (#3, 5, 8) all had a semi-innovative culture and were large-sized. This semi-innovative culture could be seen through the collaboration that was valued highly in all three organisations (88:24; 90:22; 96:18). The organisations of innovation 3 and 8 were also described as free, with one innovator stating that there was a "mostly free culture where everyone could explore and work together towards their own goals" (88:21). The organisation of innovation 8 was, however, also seen as controlling with an increased focus on centralisation, which "this change in vision of the university limits personal freedom" (96:17).

The leader, with a transactional leadership style, was seen as a positive influence in the university of innovation #3, whereas it was seen as neutral in the other two universities. The transactional leader gave freedom to the employees and took on a passive role "only when I approached the leader did we discuss my work" (88:28). However, the leader was also supportive and collaborative, and was therefore appraised positively (88:25). The other two leaders had a neutral influence, with the innovator of innovation 5 being a programme director himself and, therefore, taking up the majority of the leadership aspects without others involved (90:26). The structure of the organisation of innovation 8 was flat, with a matrix structure (96:21). Therefore, there was no direct leadership for the innovation project leader, and this role was mostly given to the administrative staff (96:19), and their role was deemed neutral, with limited interactions (96:20).

	#	School type	Innovative culture	Structure	Size	Leadership	
						Style	Appraisal
Educational tools	3	University	+/-	Hierarchical	Big	Transactional	+
	4	Secondary	-	Flat	Small		+
	5	University	+/-	Hierarchical	Big		+/-
	8	University	+/-	Flat	Big		+/-
	10	Secondary	+/-	Flat	Medium		+/-
	15	Secondary	+	Flat	Medium		+

Table 20. Educational tool innovations and the institutional governance features.

The secondary schools (4, 10, 15) differed in their culture, with one school having an innovative, one a semi-innovative, and one a non-innovative culture. Two of the secondary schools were medium-sized, and one was small-sized. The organisational structures of the secondary schools were all flat. The organisation of innovation #4 is a small-sized, flat, and non-innovative organisation, which has an individualistic culture with a high-work pressure, with some collaboration taking place (89:20; 89:21). The leader in this organisation is the rector, who had a supportive leadership style, and gave freedom to the staff to do what they needed (89:24; 89:25), which had a positive influence.

Innovation #10 was implemented in a flat, medium-sized, semi-innovative organisation, where the culture was focused on collaboration and informal contact, both within staff (27:1) and between students and teachers (26:1). The rector, who was the school leader, gave freedom to the staff members (99:18), and was a neutral influence on the work of the staff. The last innovation in the educational content category was innovation 15, which was implemented in a secondary school with a flat structure, medium size and innovative culture. This culture was collaborative and creative, with freedom for the employees in their tasks (104:16; 104:19), "young teachers collaborate based on their interests in innovating" (104:20). The leader in the school was the rector, who stimulated ideas and innovation, and promoted bottom-up working, stemming from the idea that change should come from within (104:23). This approach to leadership was appraised positively.

From this, it can be taken that the institutional governance features differed for the educational tool innovations. The only pattern that could be distinguished was that of the semi-innovative culture that existed in all universities of educational tool innovations.

Organisational innovation

Five innovations focused on organisational aspects, of which three were implemented in a secondary school, and two in a university. The organisations of innovations 7 and 9 are both universities, with a hierarchical structure and a semi-innovative culture. The culture of organisation #7 was characterized by collaboration and a high degree of autonomy within the work, while also being individualistic (7:1; 95:16; 95:18). The organisation is medium-sized and the project leader of the innovation was led by the head of research of their department. Their leader had a transformative leadership style, who was inspiring and stimulated ideas and innovation (95:22). Moreover, the leader provided freedom and support to the employees (95:21), which was a positive influence on their work. The organisation of innovation 9 was also semi-innovative and hierarchical, but was large-sized. The culture of this organisation emphasized collaboration and was innovative, with "lots of collaboration between teachers in education, and also in innovation" (98:19). The head of the research group was the leader of the innovator, and had a transactional leadership style, with autonomy provided, while a passive role was taken, but this was not always appreciated and instead interpreted as absence "very little attention" (98:24). This leadership style was therefore negatively appraised.

	#	School type	Innovative culture	Structure	Size	Leadership	
						Style	Appraisal
Organisational innovation	2	Secondary	+/-	Flat	Medium		-
	7	University	+/-	Hierarchical	Medium	Transformative	+
	9	University	+/-	Hierarchical	Big	Transactional	-
	11	Secondary	+	Flat	Medium		+
	12	Secondary	+	Hierarchical	Medium	Transformative	+

Table 21. Organisational innovations and the institutional governance features

Two of the three secondary school organisations were implemented in schools with innovative cultures (#11, 12), and one in a semi-innovative organisation (#2). Organisations of innovations 2 and 11 were both flat, while organisation 12 was hierarchically structured. All three secondary schools were medium-sized. Organisation #2 had a culture that focused on innovation, with innovation and change happening throughout the organisation. However, this also made the culture competitive, as "due to innovation, there was also competition between all the new ideas" (93:15). Staff was given autonomy to do their tasks, but not fully, as there

were external controls (93:18). The organisation was mainly led by the administrative staff, with the rector operating in the background (93:16). The leaders stimulated innovation, but were also controlling and did not provide support for the innovation processes, which caused problems as they did continue to stimulate the uptake of new projects (93:17). The leadership style was a negative influence on the teaching staff.

Organisation #11 had an innovative culture, in which teachers collaborated with one another and with a very diverse student population (86:17; 86:19). Moreover, teachers were provided the freedom to innovate (32:2). The leadership position was taken up by departments heads and the rector, who stimulated innovation and promoted doing so bottom-up (32:1; 86:24). Moreover, the leaders were supportive of new ideas and provided active support for this, and took on a collaborative stance towards teachers (86:25; 86:26). Therefore, the leaders were seen as a positive influence. The last innovation (#12) in this category also had an innovative culture. There was a large diversity in types of education and student background, and an open, transparent culture (100:16; 100:17). Teachers had freedom within their tasks and were described as creative. The organisation was led by the rector, who had a transformative leadership style and supported and stimulated new ideas, was an inspiration to the school staff, provided active support and was visionary (100:20; 100:24; 100:25; 100:26), and had a positive influence on the school.

The two universities in which an organisational innovation was implemented were quite similar in terms of institutional governance features. They both had a semi-innovative culture and a hierarchical structure. All schools with organisational innovations had either a semi-innovative or innovative culture.

4.8 Summary

Based on the presented results, the conceptual model was adapted and presented below. The found innovation and process features of influence were added as influences on the relationship between the types of innovation and the effectiveness of innovations. Moreover, the institutional governance features that were found to not influence this relationship were removed. Lastly, the two innovation effectiveness dimensions that were not applicable to most innovations were removed.

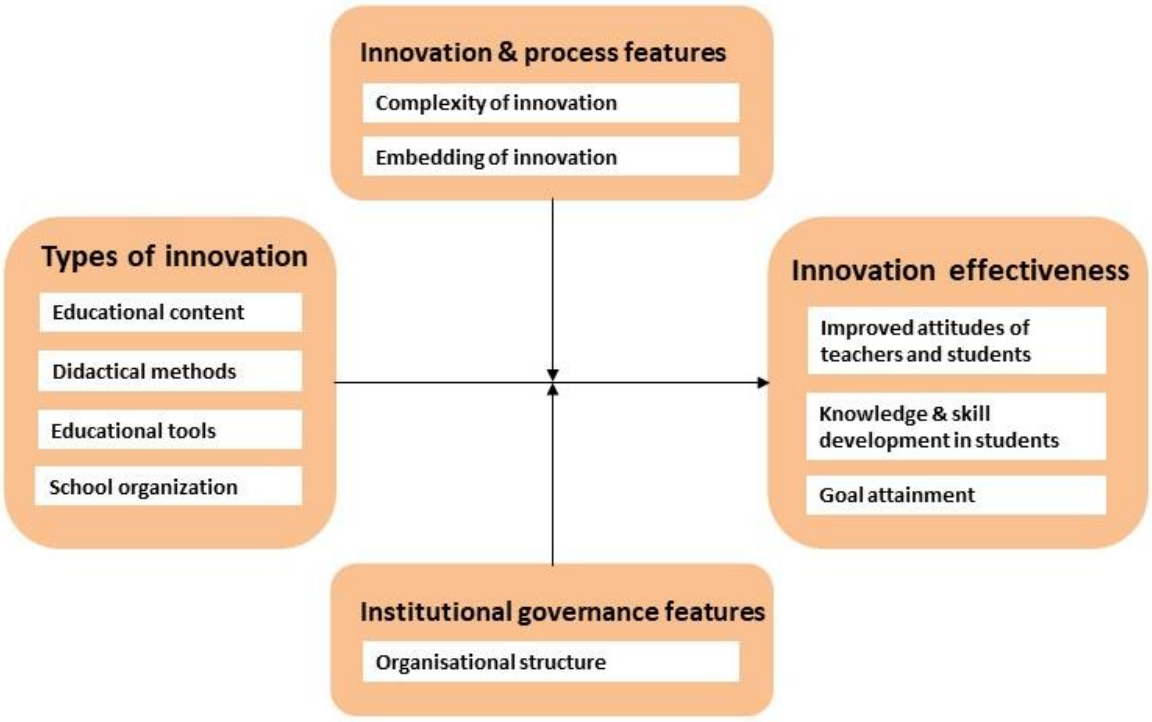

Figure 5. Adapted conceptual model based on research outcomes.

5. Conclusion

In this chapter the main research questions are answered. First, the answer to the research question of the educational science & technology part of the research is presented. Second, the public administration research question is answered. Lastly, the overarching research question that ties the two parts together is answered.

5.1 Types of innovation & Effectiveness

The main research question for the Educational Science & Technology side of this research was: "What is the difference in effectiveness of types of innovations in Dutch secondary and higher education?" This question was answered based on the answers of three sub-questions.

The answer to the first sub-question "What types of innovations are prevalent in Dutch secondary and higher education?" is the following. Based on Chapter 2, four of seven types of innovations were found to be present and relevant in both secondary and higher Dutch education and these were therefore studied. These four types were 'Educational content innovation', 'Didactical method innovation', 'Educational tool innovation' and 'Organisational innovation'. Within these types, there was diversity in the content of the innovation, but each innovation type had similarities in the goals. The educational content innovations all aimed to fill a perceived gap in the curriculum. The goal of the didactical methods innovations was to stimulate more or different interaction of students with the learning content. The educational tools innovations either wanted to ease the learning or the teaching process. All organisational innovations had the goal of knowledge sharing, either within their own organisation or with peers elsewhere.

The second sub-question was: "What is the effectiveness of different types of educational innovations in Dutch secondary and higher education?" This question can be answered based on the results presented in Chapter four. All educational content innovations were effective in terms of goal attainment, student and teacher attitude improvement, and students' skill and knowledge development. The didactical method innovations were somewhat effective on the attitude and development measures, but were less effective in attaining their goals. Within educational tool innovation, there was a large variety in effectiveness, some were highly effective and others not at all. Most of the organisational innovations were not effective at all. However, some organisational innovations were effective on one single measure of

effectiveness. Therefore, organisational innovations were more targeted and specific for certain effectiveness dimensions while the other types of innovations tended to be effective in multiple dimensions.

The third sub-question was "Which process and innovation features influence the effectiveness of educational innovations?" The studied innovation features were the complexity and compatibility of the innovation and the process features were goal setting, professionalisation, and embedding. The role of the complexity of an innovation was unclear according to the literature, and this study was able to clarify some aspects of this. Highly complex innovations were not effective and non-complex innovations were highly effective. For an innovation that was partially complex, the complexity did not seem to matter for the effectiveness. Therefore, this study found that the complexity of an innovation is a determinant for the effectiveness of an innovation.

The effectiveness of an innovation and the compatibility of an innovation with their organisation did not correlate. The embedding of an innovation in the organisation was found to be a determinant for the effectiveness of innovation, where innovations that were better embedded in the organisations had attained more goals and were therefore seen as more effective. The goal setting before the innovation process and whether or not innovation project leaders participated in professionalisation activities did not seem to influence the effectiveness of the innovation.

Bringing the answers of the three sub-questions together, the conclusion to the main question is that there is a difference in the effectiveness of innovations. Some innovation types were more effective on multiple effectiveness dimensions than others. Educational content innovations were effective across most effectiveness dimensions. This type of innovation also had a low complexity and high embeddedness in the organisation. The other three types of innovation were less effective across the effectiveness dimensions. Organisational innovations tended to be effective for single effectiveness dimensions while didactical method innovation and educational tool innovation had a lot of variety in the effectiveness.

5.2 Institutional governance features & effectiveness

The main research question for the Public Administration side of this research was: "What is the effect of institutional governance features in Dutch secondary and higher education institutes on their education innovations' effectiveness?" One sub-question was answered first.

This sub-question was “What institutional governance features play a role in educational innovation processes in Dutch secondary and higher education?”. According to the literature (Chapter 2), the organisational culture and size could be of influence, as well as the organisational structure and leadership. Within leadership, leadership styles could be influential in the innovation process as well.

The main research question was answered by studying the four institutional governance features for 18 innovation projects and reviewing them in combination with the effectiveness dimensions (Section 2.2). Innovations in flat organisations were not as effective for the effectiveness dimensions as innovations in hierarchical organisations. The organisational structure therefore seems to correlate with the effectiveness of innovations. This conclusion ties in with what was found regarding the school type. Innovations implemented in universities tended to be more effective in knowledge and skills development for students, compared to secondary school innovations. This links together with the results of the organisational structure, as it was found that secondary schools were more often organised in a flat structure, while universities were more likely to be hierarchically structured. Innovations implemented in hierarchical organisations and universities tended to be more effective than those implemented in flat organisations and secondary education.

Innovations implemented in organisations with innovative cultures tended to be more effective in terms of improving teaching attitudes goal attainment than innovations implemented in organisations with semi-innovative or non-innovative cultures. At the same time, innovations implemented in organisations with a semi-innovative and non-innovative culture were more effective in terms of improving student attitudes and student skill development compared to innovations implemented in organisations with innovative cultures. The effectiveness of an innovation did therefore not seem to correlate with a specific type of innovative culture.

Leadership position and leadership appraisal had no correlation between the position of the leader in the organisation with the effectiveness of an innovation implemented in that organisation. All leadership styles that were positively appraised were in organisations with innovations that achieved a few, several or all goals. However, some innovations that were effective on multiple measures had negatively appraised leaders and vice versa. The position or appraisal of the leader was, therefore, not found to influence the effectiveness of innovations.

An organisation with a leader with a transformative leadership style did not lead to a certain type of effectiveness, and was, therefore, not a determinant for the effectiveness of innovations. Transactional leadership led to innovation effectiveness in multiple effectiveness measures, and could, thus, be a determinant of innovation effectiveness. However, as the transactional leadership style was only be found in universities in this study, this could also partially explain that relationship.

The organisational size did not correlate with the effectiveness dimensions. Moreover, the size of an organisation did not relate to any of the other institutional governance features. Therefore, the size of an organisation was not a determinant for effectiveness of innovation.

To answer the main research question, the effect of institutional governance features on the innovations' effectiveness is that innovation in universities can be more effective than innovations in secondary schools, which might be due to the organisational structure. The structure of an organisation could also influence the effectiveness of innovations, as organisations with a hierarchical structure were more effective than innovations with flat structures. No other determinants for innovation effectiveness were found amongst the institutional governance features.

5.3 Overarching conclusion

This study searched for an answer to the question: "What is the effect of different institutional governance features and types of innovation on the effectiveness of innovations in Dutch secondary and higher education?" A qualitative study into innovation projects at secondary and higher education was done to study the factors of influence on the effectiveness.

To answer the overarching research question, a fifth sub-question was studied. This question was the following: "What is the relationship between the institutional governance features and types of innovation in Dutch secondary and higher education?" Some patterns were found within some of the types of innovations. However, within each type of innovation, these similarities in institutional governance features mostly correlated with the school type, i.e., whether it was implemented in a university or secondary school. Therefore, the type of innovation does not seem to be influenced by the institutional governance features or vice versa.

It was found in the results that only one of the institutional governance features could have an effect on the effectiveness of innovations. The organisational structure is of influence, where innovations implemented organisations with a flat structure tended to be less effective

for the five effectiveness dimensions. The school type also influenced the effectiveness of innovations. The innovations implemented in universities were found to be more effective than those implemented in secondary education.

The effect of the types of innovations on the innovation effectiveness was the following. Innovations in educational content were effective for multiple effectiveness dimensions. Other types of innovations were not all effective for the same dimensions and had a large amount of diversity in the effectiveness of the individual innovations within the categories. Almost all the found determinants for effective innovation where applicable to the educational content innovations. For the other types of innovations, this was not the case. This difference explains the high degree of effectiveness in educational content innovation compared to the other types of innovations.

The type of innovation and one institutional governance feature can therefore have an effect on the effectiveness of innovations through the found determinants for innovation. These determinants for innovation were two innovation features, the complexity and embedding of an innovation, and one institutional governance feature, the organisational structure.

6. Discussion

In the section, the results and conclusions will be discussed and reflected upon. The findings of this study are put in a larger context to interpret their meaning and create a further interpretation of their implications. Moreover, the limitations of this research are discussed and the practical, scientific and societal implications of this study are described. Lastly, recommendations for future research are presented.

6.1 Discussion of results

In this section, the conclusions of each research question will be reflected upon. First, a short summary of the results will be presented, after which these will be discussed.

6.1.1 Types of innovation

Regarding the types of innovations that were relevant in Dutch secondary and higher education, four types of innovation were studied and it was found that one type of innovation, educational content innovation, seemed to be more effective than the others. The results for the types of innovation and their effectiveness were as expected. According to the literature, educational content innovation was the most effective type of innovation, and this study found this to be true as all educational content innovations were effective on three effectiveness dimensions.

The main finding that stood out was a large diversity in effectiveness of organisational innovations. An explanation for the diversity and lower degree of effectiveness in organisational innovation could be found in the goal and scope of the studied innovation incentives. Within the organisational innovations, governance plays a larger role with many stakeholders that need to be involved to make the innovation work for the organisation as a whole. This set-up does not align well with LOF and the Comenius teaching fellow programme, as the provided support and funds are granted to an individual. With the responsibility of an innovation in the hands of an individual, it becomes challenging to impact and change the organisation as a whole, which was the goal for organisational innovation. Therefore, this misalignment could explain the low degree of effectiveness of organisational innovation. Moreover, an organisational change tends to be a long process that stretches over an extended period of time. LOF and the Comenius teaching fellow programme only provide funds and

support for the maximum duration of one year. This is most likely too short for organisational change, and this could also explain the lower effectiveness of this type of innovation.

Organisational innovation therefore seems to be a poor fit with the goals and scope of LOF and the Comenius teaching fellow programme, and for short, small scale innovation projects in general. The three other types of innovation, with educational content innovation in particular, might be better suited for these types of innovation projects and can lead to a higher effectiveness.

6.1.2 Innovation effectiveness

It was found in the results that of the five effectiveness dimensions, goal attainment was achieved by the majority of the innovations, while only one innovation was effective in terms of student performance and organisational efficiency. Student skill & knowledge development took place in the majority of the innovations as did students and teachers' attitudes improvement.

According to previous research, student performance effectiveness is rarely achieved in practice in innovations. The results of this study seem to confirm this, as only one innovation was associated with an increase in student grades. However, it was also found that for seven out of 18 innovations, the innovation project leaders reported that they did attain all goals they set out for. This indicates that for these seven innovations, improving student performance was not the goal of the innovation, because all innovation goals were achieved regardless of the fact that the student performance did not improve. Therefore, this study could provide an explanation as to why student performance effectiveness is rarely associated with innovation. This could be because innovations do not aim to improve student performance. The lack of innovation effectiveness in terms of organisational efficiency could be explained through the same mechanism of it not being a goal of the innovation. This can explain why only one innovation was effective in terms of organisational efficiency.

However, while some of the innovations did not set out to improve student performance or organisational efficiency, other project leaders did. The innovation goals to improve in these effectiveness measures were not achieved by all but one innovation. This could be explained by the small scope and aim of the studied innovations. All innovations had a focus on improving single courses, projects or interactions. These innovations would therefore rarely make an impact on the organisational efficiency in terms of graduating of students on time or for improving the student performance, as this is too large scale for the typical scope of the studied

innovations. This can explain why organisational efficiency and student performance effectiveness was rarely achieved and shows that these results are in line with the literature.

Some innovations might still become effective in terms of organisational efficiency after they have been implemented for a few years. This dimension of effectiveness could perhaps come to be after the institutionalisation of the innovation in the organisation. Especially the innovations that were developed and implemented in the past three years were influenced by the covid-19 pandemic. The institutionalisation of these innovations could therefore take longer as there were other priorities during this period of time. However, once the innovation is institutionalised, the efficiency of the organisation could change due to the innovation and the effectiveness of the innovation could therefore still improve.

The results for the other three innovation effectiveness dimensions were as expected. Goal attainment was an important dimension of effectiveness that also influenced the other dimensions, as was discussed in the paragraphs above. The effectiveness dimensions of student and teacher attitudes, and students' skill and knowledge development were reported to be the outcome in the majority of the studied innovation projects. This was also in line with the goal setting and attainment of the innovations, which geared towards improving attitudes and enhancing skill and knowledge development of students. These results were therefore in line with the expectations and indicate that these dimensions of innovation effectiveness are relevant in practice.

6.1.3 Process & innovation features

The goal setting, professionalisation, embedding, complexity and compatibility of innovations was studied. It was found that the complexity of an innovation could influence innovation effectiveness. Compatibility of an innovation with its institution did not seem to play a role. The embedding of an innovation could correlate with effectiveness. Goal setting did not seem to play a role while professionalisation rarely happened but could have a positive effect on the effectiveness of innovation. These findings add to the existing knowledge about influencing factors of innovations' effectiveness.

The embedding of an innovation was found to correlate to the effectiveness, which can be understood in two ways. An innovation could be embedded after it was found to be effective for the organisation it was implemented in, and therefore it was decided to continue working with the innovation and ensure its continuation. Another explanation could be that if an

innovation has become integral to the organisation through being embedded in it, it becomes important to ensure that it is effective, and the organisations carries the effort to do so.

Very few innovators participated in professionalisation activities e.g., workshops, training courses or presentations on the topic of innovation. This could be explained by the time restraints that were in place due to LOF and the Comenius teaching fellow programme. Many innovators mentioned the short time period that they had to develop and implement their innovation and how this was too short to do everything as they desired. Professionalisation activities take time and tend to happen over the course of a period (Desimone, 2009). This therefore could have been a challenge to fit in the one- or 1.5-year time period available.

It was, however, also found that an innovation is less complex for the innovation project leader if they have experience with the topic of innovation. Therefore, professionalisation activities that build that experience could have reduced the complexity of the innovation and increased the effectiveness.

As was indicated in the literature, more stakeholders in the process made the innovation process more complex for innovators as well as other teachers. This seemed to lead to a lower effectiveness of the innovation. Previous research was unclear about the effect of complexity on innovation effectiveness. The results of this research indicate that for relatively small-scale and teacher-led innovations, lower complexity goes together with higher effectiveness. The goals of LOF programme and the Comenius teaching fellow programme target small scale change. More complex innovations tended to aim for larger scale change, with higher risks and a larger scale. As this was beyond the scope of the innovation programmes, this did not seem to lead to effective innovations.

The compatibility of an innovation with its organisation did not influence the effectiveness of the innovations. As previous research also found, lower compatibility did lead to more tension between the innovators and organisation. However, the possible effect of this on the effectiveness was not found as all innovations included in the analysis were at minimum partially compatible.

6.1.4 Institutional governance features

Only one institutional governance feature was found to potentially influence the effectiveness of innovations, which was organisational structure. It was expected that the organisational culture, size or leadership would impact the effectiveness of innovations.

However, this was not found to be the case. This is a surprising finding as the institutional governance has a large impact on educational decisions and was therefore expected to influence the innovation process and effectiveness.

There are a few possible explanations for these features lack of influence. The studied innovations were funded and supported externally, through LOF and the Comenius teaching fellow programme, and this could have had an impact. The studied innovations were projects by individual project leaders. The educational institutes could have not interacted with or be involved in the innovation process at all, as all matters surrounding the innovation were arranged through the innovation programmes. Because of this, the institutional governance features do not matter, because regardless of these features, the organisations did not interfere or interact with the innovation. However, this explanation seems somewhat unlikely, as some results indicate that there was active participation of the educational institutes during the innovation process. A lack of care or interaction is therefore not the most likely explanation for the non-existent influence of most of the institutional governance features.

A second explanation could be that innovations could be effective regardless of the institutional governance features because of the influence of the innovation programmes. With the creation of LOF and the Comenius teaching fellow programme, the Ministry of Education employed financial incentives to steer education and simulate innovation. Traditionally, the government gives policy incentives and exerts influence through the various involved actors. This then could affect the educational institutes, for example stimulating them to innovate. The educational institutes would have a large say in how, when, and who innovates, which could impact the innovation process and the eventual effectiveness of the innovation.

However, with these innovation programmes, the actors in between the government and boards of the educational institutes are bypassed. Instead, the incentives directly impact teachers, which allows teachers to work on their innovation bottom-up. Through the direct involvement of teachers, the institutional influence is limited and the traditional governance mechanisms, both within the institute through management and the organisational culture, and outside of the institute through the influencing role of educational actors, are not applicable in the context of this research. Instead, innovations are (largely) developed out of view and influence of their educational institutes. Any circumstances that would normally be a negative influence on the innovation process, such as certain leadership decisions or the organisational culture, are not as impactful, as the innovation process will continue regardless of this. The role of innovation programmes has therefore minimised the influence of institutional governance

features. While educational institutes can be actively involved in the innovation process, as was found in this study as well, their influence on the process and outcome of the innovation was limited.

This is one explanation for the limited influence of institutional governance features on the innovation effectiveness. However, as there were many factors at play within most innovation projects, other explanations are also possible. More research is needed to fully understand and explain this phenomenon. Thus, while this study was able to clarify some aspects of the mechanism between institutional governance and educational innovations' effectiveness, some aspects still remain unclear.

Importantly, this explanation of the limited influence of institutional governance is only applicable to LOF and Comenius teaching fellows innovations. Other types of Comenius innovations are developed and implemented with a larger role and influence of the educational institutes. That could also mean that the institutional governance features will be of larger influence for those innovation projects. However, because both LOF and Comenius teaching fellow innovations are individual projects with a small scale, the governance mechanisms are disrupted by the bottom-up approach of the innovation programmes.

Therefore, the support through leadership and the organisational culture did not play a fundamental role in the innovation process, as this support was provided by LOF and Comenius teaching fellow programme. This could indicate that as long as there is a form of support provided to the innovation, innovations can be effective regardless of the organisational culture or leadership of the organisation. Thus, the institutional governance features that would normally impact innovations, do not have the same effect for the innovations that were incentivised by LOF or the Comenius teaching fellow programme.

Interestingly, it was found that a hierarchical structure within an organisation could positively influence the effectiveness of innovations implemented in that organisation. This was contrary to what the literature suggested, where flat organisations were found to facilitate innovation through close connections between staff and decision makers. This could also be linked to the role of LOF and the Comenius teaching fellow programme, where the close connections were less vital for innovations to be effective. Therefore, these small-scale innovations could thrive regardless of their organisational structure, which ended up with hierarchical innovations having more effective innovations by chance. However, large-scale innovations might be more affected by the organisational structure, and this could provide

different insights into effectiveness and the influence of the organisational structure. The effect of organisational size on innovations and their effectiveness was unclear according to the literature, and this research is unable to clarify this role.

Moreover, school types were found to influence the innovation effectiveness. It could be that this was merely the case because universities were more likely to have a hierarchical structure than secondary schools, which would mean that this is tied to the organisational structure and not the actual school type. However, the school type could influence innovation effectiveness through the role of LOF and the Comenius teaching fellow programme, as there are some differences between the two innovation programmes.

All secondary school innovations were part of LOF and all higher education innovations were part of the Comenius teaching fellow programme. The two programmes were highly similar on most aspects, but differed in the approval process of proposed innovations. LOF granted subsidies to all innovations that fit their inclusion criteria, whereas the Comenius teaching fellow programme granted subsidies based on four themes per year, and had specific quality standards for the project proposals. The innovations within the Comenius teaching fellow programme therefore had to have a specific scope and well thought out plan. For LOF innovations, these criteria were less strict and therefore were less thought-out.

These differences could explain the differences in effectiveness of innovations that were implemented in secondary schools or higher education institutes. Comenius teaching fellow innovations could have been more thought out and therefore had a lower fail rate. Moreover, differences in guidance and support from the innovation programmes to the innovation project leaders could play a role in this as well. This is beyond the scope of this research, but the selection and support of the innovation programmes could possibly explain the relationship between school types and innovation effectiveness.

6.2 Limitations

There were limitations to the chosen methods and study as a whole. These limitations are discussed in this section.

This study had a relatively small sample size, which could be disadvantageous as it does not allow for generalization to all secondary and higher education institutes. However, a smaller

sample size did allow for in depth research and a deeper dive into the details of the innovation process and effectiveness. Therefore, the chosen sample size fit with the goals of this research.

Another limitation that builds upon the small sample size is that this research was done in a case study format, studying a specific, limited number of cases for innovation. The results of the study cannot be generalized for all educational innovations in secondary and higher education, as the sample size was too small to be representative for LOF and the Comenius teaching fellow innovations. Moreover, the studied innovation projects were all part of the LOF & Comenius teaching fellow programmes, and the results can therefore not be generalized for innovations in Dutch education in general.

Another limitation is that some project leaders refused participation in an interview as their innovations had not come to completion or stopped immediately after funding ran out. Therefore, the selected cases are not representative for all innovations and is skewed more positively, including a relative high number of continued innovations after the LOF or Comenius teaching fellow programme.

The data collection through interviews was only done with the innovation project leaders. As they were the main person responsible for the innovation and executed the entire innovation process, their perspective on the process and outcome is subjective. The self-reporting as was done in the interviews does not provide an objective view of the innovation process and outcomes. While documents were used to cross-check their information, some of these documents were also written by the innovation project leaders. It is highly likely that some of the results presented were not an accurate representation of the actual innovation process and this should be kept in mind.

The document analysis was done with an uneven distribution of documents per case, where for some cases four documents were analysed, and for others as many as nine. While the researcher does not think this led to a gap of knowledge due to the overlap often found between the documents and the interview data, it is still a limitation as some information could not be cross-checked and some other information might be missing.

This study focused on upper classes of VWO for the secondary school innovations, and on universities for higher education innovations. The outcomes of this study are therefore not representative for all LOF and Comenius teaching fellow innovations, but also not for Dutch secondary and higher education. This is a limitation of the study, and the results might have been different had these other sectors of secondary and higher education been studied as well.

Lastly, the COVID-19 pandemic changed the innovation process for innovations still in development and also impacted the institutionalization of other innovations. It is unclear which innovations were more impacted by this, and which one less, and it is therefore a limitation of this research.

6.3 Practical implications

Some of the findings of this study have implications for the involved stakeholders, in particular within the innovation programmes or for the innovation project leaders.

Organisational innovation does not seem to be a good fit with the scope, goals and set-up of LOF and the Comenius teaching fellow programme. The effectiveness of organisational innovations tends to be lower than the other innovations. A large number of stakeholders and a large scope, as is typical for organisational innovations, is highly complex to work with and could lead to lower effectiveness. Therefore, it would be worthwhile to reconsider providing funds and support to innovation projects that gear towards organisational change in the context of LOF and the Comenius teaching fellow programme. These programmes might be too small-scale to support the entire process of organisational change, which is highly complex. Therefore, a practical implication could be that it might be more effective if the studied innovation programmes support low-complexity educational content, didactical methods and educational tool innovation instead of organisational innovation. Other innovation programmes, with higher funds available, might be more suited in supporting highly complex organisational innovations.

LOF, the Comenius teaching fellow programme and innovation project leaders themselves could benefit from the result that having previous experience with the content of the innovation could make the innovation more effective. For LOF and the Comenius teaching fellow programme, this means that they could promote and grant funds to innovation project leaders that want to implement innovation because of their previous experiences. Another option would be to promote and support building such experience before starting the innovation process. For innovation project leaders, it might be useful to create familiarity and build experience with the topic of the innovation before starting the change process. These changes could help make innovations more effective.

For innovation project leaders, an implication of this study is that the embedding of the innovation in the organisation is important, and this should therefore be done deliberately.

When an innovation is embedded in the policy of the educational institute and the organisation takes responsibility for the innovation, the effectiveness of the innovation could be higher. Therefore, the innovation project leader should keep the organisation and the importance of embedding of the innovation in mind and after implementation push for adoption in policy and shared responsibility. This can be done starting from the initiation phase of the innovation process where the educational institute is actively involved and kept aware of the innovation. This might help ensure later acceptance of the innovation and therefore ease the embedding process of the innovation.

6.4 Scientific implications

This study also has some implications for the scientific field. The purpose of the study was explorative, and to gain more insights into the potential relationships between innovation effectiveness, types of innovations and institutional governance. As presented in Section 4.8, a new model was formed based on the results of this study (figure 5). The conceptual model that formed the basis of this study (figure 4), was adapted to fit the results. A new theoretical model was proposed, and the implications of this are the following.

There seems to be a relationship between the types of innovation and innovation effectiveness as certain types of innovations were found to be less effective than others. This builds on the existing research that certain types of innovations could potentially be more effective than others (Haelermans, 2010). Now, it has become clear the educational content innovations are the most effective, follow by didactical method and educational tool innovations.

Moreover, this study was able to clarify some of the influencing factors on the effectiveness of innovations, which were the complexity of the innovation and the embedding of the innovation within the educational institutes. It was expected that these factors would be determinants for effective innovation, and this study was able to confirm that. However, several other potential factors of influence, i.e., the compatibility of the innovation, goal setting and professionalisation, were not found to correlate with the effectiveness of innovations. It is unclear why these factors did not seem to influence the effectiveness of innovations, as literature suggested they would lead to higher effectiveness of innovations. One possible explanation could be that it is due to the heterogeneity of the results. Almost all innovations set clear goals, while almost no innovation project leader participated in professionalisation

activities and the compatibility of the innovation with the educational institute was either a partial or full fit for all innovations. The lack of variety in the results for these innovation and process features might explain why no possible effects of these factors on the innovation effectiveness was found.

Another implication of this study is that institutional governance has less impact on the effectiveness of innovations than expected. Only on institutional governance feature had an influence on the effectiveness of the studied innovations. This result did not fit with the theory as presented in Section 2.3, where it was expected that organisational size, organisational culture and leadership would influence the effectiveness of innovations as well (Brennan et al., 2014). However, this was not supported by the results of this study. This could be due to the influence of the innovation programmes or because innovations are generally hard to steer. The outcomes of this study were therefore mostly unable to clarify the relationship between institutional governance and the effectiveness of innovations, but the results have provided some starting points for further research into this relationship.

It was also found that LOF and the Comenius teaching fellows programme both work in successfully stimulating effective innovation, which is an important implication as it was previously unclear whether such subsidy programmes led to effective innovations (Hanushek, 2005; Waslander, 2007). This study provides some indications that spending public funds through innovation programmes does have the desired effect.

6.5 Societal implications

This study started with the premise that education is important for society and should use funds appropriately. Investments in education should pay off for students or teachers. This study into effectiveness of innovations and the role of institutional governance should therefore be used to look at the implications for society.

In this study, several factors were found to influence the effectiveness of innovations. This knowledge could be used by innovation project leaders and innovation programmes to increase the effectiveness of innovations. A higher effectiveness of innovations can be seen as important to society as it ensures effective utilisation of the public funds.

Insight into institutional governance indicated that the governance of an educational institution is less important when innovations are implemented through external innovation

programmes. As was described in Section 6.1, the impact and role of institutional governance changed with the involvement of LOF and the Comenius teaching fellow programme. This outcome is of societal relevance because the impact of the policy efforts to stimulate innovation can increase due to the innovation programmes. Knowing that innovation programmes are effective in stimulating innovation can encourage their role in the educational landscape.

However, it is also an important implication because it can change government efforts to steer education. Now that it is known that the government can directly stimulate innovation through creating and subsidising innovation programmes, a new way of policy steering that might have not been previously known can be used. This is therefore also an important implication for policy steering efforts in the future.

Another implication of the institutional governance features is that the innovation programmes can create a space within the educational institute where teachers can experiment with their education with room for failure. Such time and space might not normally be available for teaching staff due to influence the organisational culture, size or leadership. However, for the quality of education, innovation is important to try out new ideas and concepts to discover what does and does not work. The outcomes of this research have shown that innovation programmes stimulate this and create a risk-free space for experimentation. As was described in Chapter one, secondary and higher education has typically been regarded as conservative. Therefore, it is an important societal implication that innovation programmes can successfully stimulate innovation there, because this knowledge can help change the conservative nature of the education sector and lead to more development.

Moreover, it was found that innovations developed within the innovation programmes have different levels of effectiveness depending on the type of innovation. This research outcome is societally relevant as it could give direction to innovation efforts and stimulate innovation project leaders to work on innovations that tend to be more effective.

6.6 Recommendations for future research

The outcomes of this study have indicated possible new directions for future research. First of all, it was found that the studied institutional governance features could not explain the difference in effectiveness of the different innovation projects. As was discussed, this could possibly be attributed to the different influence of the institutional governance due to the role of LOF and the Comenius teaching fellow programme. It would be important to study this

phenomenon to further understand the changed influence institutional governance as well as external governance influences on innovation effectiveness. Insight into this would be valuable for future policy steering efforts as well as increased understanding of the innovation process and the influence of innovation programmes on this.

Secondly, this study mapped various variables that could be of influence on the innovation process and effectiveness. This was done after the innovation already took place. It would be relevant to do research before and during the innovation process in an experimental setting to gain further insight into the role of professionalisation, complexity and embedding, which were the found factors of influence in this study.

Thirdly, it is recommended to do a quantitative study based on the core findings to validate them further and expand on the explorative nature of this research. This could possibly support the findings of this study as well as provide generalizability that this study could not as it had a small, unrepresentative sample size.

Lastly, it would be valuable to do more research into the diffusion of the innovations. This study mapped the innovation process and effectiveness, but only slightly touched upon the diffusion of innovations. It could be interesting to further expand the diffusion and dissemination theory of innovations in the context of Dutch education. The main reason for this is because diffusion was perceived as a difficult step for some of the innovation project leaders. However, effective innovations should be shared and implemented elsewhere to increase the general effectiveness of Dutch education. Therefore, studying diffusion and how this can be better facilitated in the context of LOF and the Comenius teaching fellow programme would be valuable to improve the quality of Dutch education.

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Appendices

Appendix A: Selected cases descriptions

Type	#	Description of innovation	School type	Grant year
Education content	6	Robotics course in secondary education for all 6 years of VWO	VO	2018
	13	2-year Elective course in diversity & development in master programme	HO	2017
	18	Introduction to science course for all 6 years of VWO	VO	2016
Didactical methods	1	Theatrical scenario making for technology during bachelor studies	HO	2018
	14	Interactive physics modules to replace traditional book methods, upper three years of VWO	VO	2017
	16	Visual thinking strategies for discussing and creating art in secondary education, all years of VWO	VO	2018
	17	Reverse engineering of philosophy teaching methods, first-year bachelor course	HO	2020
Educational tools	3	Tool for improving writing process, used throughout university studies	HO	2020
	4	Tool with materials for lessons on Chinese culture, upper VWO	VO	2019
	5	Learning analytics tool for feedback & monitoring student learning, university bachelor	HO	2020
	8	Wellbeing tool for monitoring group projects, university master studies	HO	2019
	10	Database of teaching materials for philosophy courses, all years of VWO	VO	2018
	15	Online history museum for orientation of each period of history, lower years VWO	VO	2016
Organisation innovation	2	Career orientation integrated with social sciences for upper years of secondary school	VO	2017
	7	Buddy programme within the selection process for medicine studies	HO	2019
	9	Collaboration between secondary school and university teachers on complex international teaching topics	HO	2018
	11	Collaboration of secondary school teachers to develop Chinese exams, upper years of VWO	VO	2016
	12	Monthly collaborative sessions within a secondary school to stimulate teaching and course development	VO	2017

Appendix B: Interview script

Introduction (5 minutes)

1. Thank participant for joining the interview

Welcome, thank you for participating in this interview.

2. Introduce myself and the research project & share the goal of the interview

The purpose of this interview is to gain insight into the innovation process and effectiveness of innovations that were executed by innovative teachers in Dutch secondary and higher education. More specifically, I am researching different types of innovation, as well as the influence of policy, organisational culture and leadership on the effectiveness of such innovation. I hope to find out how and why the effectiveness differs between different innovations. This research is done in light of my master thesis in public administration and educational science at the University of Twente, under the supervision of Adrie Visscher and Renze Kolster.

3. Discuss the ethics of this research

I approached you for this interview as you have experience in the innovation process and I hope to get useful insights from these experiences. Your answers will be fully anonymised, which means that the outcomes of this research will not be able to lead back to your educational institute, yourself, or your innovation project. This research has been examined and approved by the ethics committee of the faculty of behavioural, management and social sciences at the university of Twente. All information that is gathered within this research will be safely stored. There are no risks attached to your participation in this study. You do not have to answer any questions that you don't wish to answer. Your participation in this research is voluntarily and you are allowed to stop and withdraw at any time, without questions asked.

4. Give a rough time indication and ask for recording permission

This interview will take around 45 to 60 minutes and I would like to record it to ensure I can properly process the information later. Do you give permission for this?

I have now turned on the recording device which you have given permission for. Before we start, do you have any questions about the research?

Questions (30-40 minutes)

First of all, I would like to know a bit more about your innovation. As I understood from the project description, your project is about ….. Is that correct? Could you elaborate a bit on it?

First, some questions about the innovation features and innovation process.

1. Was there a need for staff and students to receive training before they were able to work with the innovation? (e.g. in terms of preparation, collaboration or skill development) (innovation features, complexity – influences innovation implementation)
2. Did the innovation impact the organisation as a whole and require various actors to change? (innovation features, complexity – influences innovation implementation)
3. Was the innovation compatible with the educational institute norms and values? (innovation features, compatibility – influences innovation implementation)

I have a few questions about the effectiveness of the innovation. First of all:

4. Do you think the innovation is effective? Why and in what way? (effectiveness)
5. To what extent were the set goals for the innovation achieved? (effectiveness – goal attainment)
6. Did more students graduate within the set time frame and on the level they were set-out to do due to the innovation? (effectiveness – organisational efficiency)
7. Was there an increase in students grades because of innovation was implemented? (effectiveness – student performance)
8. Did the innovation change the attitudes of the students and teachers towards learning and teaching respectively? (effectiveness – Improved learning and teaching attitudes)
9. Did the students gain more knowledge or create a different skillset due to this innovation? (effectiveness – Skill & knowledge development of students)

Moving towards the role of the educational institute in the innovation process.

10. Could you describe organisational culture of your educational institute? E.g. is there a lot of formal/informal contact, organized approach or more creative, consistent/infrequent, collaboration or individual work, shared problem solving or sole responsibility. (institutional governance features, organisational culture)
11. Could you describe the working relationship and collaboration with your fellow staff members? E.g. collaboration, discussions, only coffee talks, active involvement (institutional governance features, organisational culture)
12. Who do you view as your leader in the educational institute? Why? (institutional governance features, leadership)
13. How would you describe their leadership style? (e.g. visionary, inspiring, direct, clear expectations, lot of autonomy) (institutional governance features, leadership)

Then, a question about the innovation process and the future of the innovation.

14. What is the current state of this innovation, after the LOF/Comenius teaching fellow funding ran out? Is it still running now, did it change? (innovation institutionalization)
15. How is the responsibility for and sustainability of the innovation arranged? E.g. in policies/through resource allocations (Innovation process – embedding)
16. Any remaining questions or comments from their side?

Closing (5 minutes)

1. Thank you for your input
2. Within my research I am also interested in documents about the school and school visions. Could you provide me with a year plan, a 5 year plan, an organogram and/or a school guide? And I would also be very interested in your project plan and project evaluation reports. Would you be able to send these to me?
3. Explain again what I am going to do with this interview
    a. Your input will be anonymized
    b. Analyse it and use it to create an good image of innovations and effectiveness
4. End the conversation and stop the recording.

Appendix C: Code scheme

Background info	
Name	
Gender	Man / woman / other
School type	Vo / HO
Grant awarded	2016 2017 2018 2019 2020 2021
Other	

Types of innovations	**Look for:**	**Notes**
Educational content	C: Knowledge or skills content within a course is created or changed	
Didactical methods	C: Teaching methods are changed for pre-existing content	
Educational tools	C: Change in teaching or learning tools for students and/or teachers	
School organisation	C: Change in educational processes of the educational institute	

Dimensions of innovation effectiveness	**Measurement**	**Codes**	**Notes**
Their understanding:			
Innovation goal attainment	Extent of reaching goals	Achieved: All, several, a few, none	
Organisational efficiency	Lower costs per student	More students graduate in set time frame: yes/no At same level: yes/no	
Student performance	Increased / higher grades	Yes/no	
Improved learning & teaching attitudes	Increased willingness towards learning / teaching	Learning: Yes/no Teaching: yes/no	
Skill & knowledge development of students	Increased skills and content knowledge	Gained knowledge: Yes/no Gained skills: yes/no	

Innovation features	**Measurement**	**Questions**	**Notes**
Complexity	Extent to which additional training is needed	For innovators: For students: For other teachers:	
	Scope of impact on organisation	# of actors requiring to change	
Compatibility	Fit with norms and values	Yes/mostly/a bit/no	

Governance features	**Codes**	**Give number/category**	**Notes**
Organisational size	VO: Small < 1000, medium 1000-2000, large> 2000 HE: small<15000, medium 15000-30000, large>30000	Small medium large	
Organisational structure	# of levels between teachers and executive institutional leader		
Organisational culture	Ways of interaction and behaviour patterns	formal/informal contact organized/creative collaboration/individualistic shared problem solving/sole responsibility other:	
	Relationship with fellow staff & frequency of interactions	Collaboration yes/no daily/weekly/monthly/annually	
Leadership	Who is viewed as educational leader	Rector/ Vice rector education/ dean/ vice dean education/ programme director/ head of research group/ peer / other:	
	Leadership style/ characteristics	Charisma / visionary/ stimulates ideas and innovation/ consideration for individual/ clear expectations/ passive leading, only in exceptional cases active/other	

Process factors	**Codes**		**Notes**
Goal setting	If the set goals were SMART	Yes/no: specific, measurable, attainable, relevant and timely	
Professionalisation	type of professionalisation activity	workshop, lecture, coaching, informal guidance, other:	
	Duration, frequency and effective hours	time span of activities in weeks: amount of activities over time: total hours spent:	
	Focus of professionalisation activity	Skill, knowledge, attitude	
Embedding	responsibility for and sustainability of the innovation is arranged	Responsibility arranged yes/no Sustainably in policy yes/no	

Appendix D: Codebook

Code	**Comment**
○ Comenius teaching fellow	Code when a comment is made about Comenius teaching fellow that is not otherwise relevant to the innovation/process/effectiveness/ governance
● Compatibility	Fit with norms and values
○ compatibility: fits with norms	
○ Compatibility: No fit	
○ Compatibility: partial fit	
● Complexity	Extent to which additional training is needed for innovators themselves, for students who experience it and for staff within the institute to take it up
○ Complexity: easy for innovators	code when words are used such as: doable, not so bad, little effort etc. experienced the innovation process.
○ Complexity: easy for students	code when words are used such as: doable, not so bad, little effort etc with regards to how the students experienced the innovation process.
○ Complexity: easy for teachers	code when words are used such as: doable, not so bad, little effort etc. with regards to how other teachers,

	such as colleagues of the innovator, experienced the innovation process.
○ Complexity: hard on innovators	code when words are used such as: hard, complicated, difficult, lot of effort, not easy, challenging with regards to how they experienced the innovation process.
○ Complexity: hard on students	code when words are used such as: hard, complicated, difficult, lot of effort, not easy, challenging with regards to how they experienced the innovation process.
○ Complexity: hard on teachers	code when words are used such as: hard, complicated, difficult, lot of effort, not easy, challenging with regards to how other teachers, such as colleagues of the innovator, experienced the innovation process.
○ Complexity: large scope of change	Code when a lot of change or adaptation is needed to accommodate or accept the innovation
○ Complexity: small scope of change	Code when little change or adaptation is needed to accommodate or accept the innovation
● Culture of organisation	Ways of interaction and behaviour patterns, shared spirit within the school
○ culture: close contact with students	
○ culture: collaboration	Code when a collaborative culture is described, aside from the innovation process
○ culture: conservative	
○ culture: controlling	
○ culture: creative	
○ culture: distant	
○ culture: diverse backgrounds	
○ culture: formal	
○ culture: freedom	
○ culture: individualistic	
○ culture: informal	

○ culture: innovative	
○ culture: open	
○ culture: organized	
○ culture: progressive	
○ culture: too busy	
● Didactical methods	Innovation that concerns teaching methods are changed for pre-existing content
● Educational content	Innovation that concerns knowledge or skills content within a course is created or changed
● Educational tools	Innovation that concerns change in teaching or learning tools for students and/or teachers
○ Educational tools: app	
○ Educational tools: website	
● Efficiency of organisation	Lower costs per student. More students graduate within 3 years bachelor or from high school in the set time; less students graduate at a different level than they started.
○ Efficiency: graduate at expected level	
○ Efficiency: graduate on time	
● Embedding	responsibility for and sustainability of the innovation is arranged
○ Embedding: not sustainably in policy	
○ Embedding: responsibility at innovator	
○ Embedding: responsibility of innovation elsewhere	
○ Embedding: sustainability put in policy	
● Gender	Gender of the interviewee
○ Gender: Female	
○ Gender: Male	

● Goal attainment	Extent of reaching goals that the innovation set out for.
○ Goal attainment: a few	Extent of reaching goals that the innovation set out for, several goals were achieved. (10 to 49% of the goals)
○ Goal attainment: All	Extent of reaching goals that the innovation set out for, all goals were achieved. (90 to 100% of the goals)
○ Goal attainment: none	Extent of reaching goals that the innovation set out for, basically no goals were achieved. (0 to 9% of the goals)
○ Goal attainment: several	Extent of reaching goals that the innovation set out for, several goals were achieved. (50 to 89% of the goals)
○ goal of innovation	Code if the goal of the innovation is mentioned
● Goal setting	If the set goals were SMART
○ Goal setting: SMART	Add when goals that were set for the innovation are specific, measurable, attainable, relevant and timely
● Grant awarded	When the LOF/Comenius teaching fellow grant was awarded to the interviewee
○ Grant: 2016	
○ Grant: 2017	
○ Grant: 2018	
○ Grant: 2019	
○ Grant: 2020	
○ Grant: 2021	
● Improved learning attitudes	Increased willingness towards learning. more motivation; joy; enthusiasm; interest in learning.
● Improved teaching attitude	Increased willingness towards teaching. more motivation; joy; enthusiasm; interest in learning.
● Innovation effectiveness	code when people mention an innovation is successful, interpretations of what people understand as effectiveness of an innovation
○ innovative, active people	

○ Institutionalization: continuation	code when there was continuation of innovation after grant money ran out
○ Institutionalization: diffusion	code if the innovation spread beyond its initial place of implementation. e.g. in different courses, programmes, teachers, schools.
○ Institutionalization: discontinuation	code if there the innovation stopped after grant money ran out
● Knowledge development of students	Students gain more knowledge due to the innovation. learn new perspectives, delve into a different field, have a better understanding of a specific topic.
● Leader position	Who is viewed as educational leader
○ leader: dean	
○ Leader: department head	
○ Leader: other	
○ leader: programme director	
○ leader: rector	
● Leadership style	characteristics of how leader leads
○ leadership: absent	
○ leadership: active	
○ leadership: bottom-up	
○ leadership: collaborative	
○ Leadership: controlling	
○ Leadership: freedom	
○ leadership: hinder innovation	
○ leadership: inspiring	
○ leadership: lack of trust	
○ Leadership: other	
○ leadership: passive	
○ Leadership: stimulates ideas and innovation	
○ leadership: supportive	
○ Leadership: trust	
○ Leadership: visionary	

○ LOF	Code when LOF is mentioned but it is not about any other aspect of this codebook
○ Need for innovation	Code if the reason why the innovation was created is mentioned.
● Organisational structure	is the number of levels between teachers and executive institutional leader in terms of steps in the hierarchy. code when this is made explicit or visualized.
○ Organisational structure: 1 degree of separation	
○ Organisational structure: 2 degrees of separation	
○ Organisational structure: 3 degrees of separation	
○ Organisational structure: 4 degrees of separation	
○ Organisational structure: 5 degrees of separation	
○ Organisational structure: 6 degrees of separation	
○ Organisational structure: 7 or more degrees of separation	
● Process	
○ Process: different than expected	Code when mentioned that the innovation process went in a different way than planned for/anticipated
○ Process: Implementation phase	Development, execution and evaluation of the innovation project
○ Process: initiation phase	initial planning for innovation and evaluation of current circumstances
○ Process: institutionalization phase	steps undertaken to maintain and sustain the innovation after it has been created.
○ process: never finished	Code when mentioned that innovation is never finished/the process never ends

○ Process: not alone	code when emphasized that the innovation process is not done alone, others are needed or collaboration during the process needs to happen.
○ process: too short	Code when mentioned the innovation process was too short, the grant period was too short, they needed more time
● Professionalisation	code if there is mention of training or workshops done by the innovator during the innovation process.
● School organisation	Innovation that concerns change in educational processes of the educational institute. can be innovation that concerns collaboration with other schools/institutes, changes in admission & marketing processes, the structuring of the school.
● School type	Type of educational institute the interviewee works at in terms of student level (either university or secondary school)
○ School type: secondary school	
○ School type: University	
● Size of the organisation	VO: Small < 1000, medium 1000-2000, large> 2000 students
○ size: large	Vo: large >2000higher education: large > 30000 students
○ size: medium	Vo: medium 1000-1999 higher education: medium 15000 - 29999
○ size: Small	VO: Small < 1000higher education: small<15000
● Skill development of students	Increased skills, students develop skills because of the innovations. can be a large variety (e.g. collaboration, self reflection, writing)
● Student performance	Increased / higher grades due to the innovation for the course or in general in the programme.
○ teacher development	Code when the teacher learning or developing skills through the innovation process is mentioned

Appendix E: Effectiveness dimensions per type of innovation

	#	Goal attainment	Organi-sational efficiency	Student perfor-mance	Improved attitudes		Student development	
					Students	Teachers	Knowledge	Skills
Educational content	6	++			+	+	+	+
	13	++			+	+	+	+
	18	++			+	+	+	+
Didactical methods	1	-			+	+	+	+
	14	++			+	+	+	+
	16	+			+			+
	17	+			+	+	+	+
Educational tools	3	++			+	+		+
	4	+			+	+	+	+
	5	+	+	+	+	+	+	+
	8	--				-		+
	10	++			+	+		+
	15	+			+	+		
Organisational innovation	2	--						
	7	+			+		+	+
	9	+			+	+	+	+
	11	++				+		
	12	+				+		

Appendix F: Studied variables overview

	#	School type	Innovative culture	Structure	Size	Leadership		Goal attainment	Improved attitudes		Student development	
						Style	Appraisal		Students	Teachers	Knowledge	Skills
Educational content	6	Secondary	+/-	Hierarchical	Medium		+	++	+	+	+	+
	13	University	+	Hierarchical	Large		+	++	+	+	+	+
	18	Secondary	+	Hierarchical	Medium		+	++	+	+	+	+
Didactical methods	1	University	+/-	Hierarchical	Small	Trans actional	+	-	+	+	+	+
	14	Secondary	-	Flat	Large		-	++	+	+	+	+
	16	Secondary	-	Flat	Medium		-	+	+			+
	17	University	+	Hierarchical	Medium		+/-	+	+	+	+	+
Educational tools	3	University	+/-	Hierarchical	Large	Trans actional	+	++	+	+		+
	4	Secondary	-	Flat	Small		+	+	+	+	+	+
	5	University	+/-	Hierarchical	Large		+/-	+	+	+	+	+
	8	University	+/-	Flat	Large		+/-	--		-		+
	10	Secondary	+/-	Flat	Medium		+/-	++	+	+		+
	15	Secondary	+	Flat	Medium		+	+	+	+		
Organisational innovation	2	Secondary	+/-	Flat	Medium		-	--				
	7	University	+/-	Hierarchical	Medium	Trans formative	+/-	+	+		+	+
	9	University	+/-	Hierarchical	Large	Trans actional	+/-	+	+	+	+	+
	11	Secondary	+	Flat	Medium		+	++		+		
	12	Secondary	+	Hierarchical	Medium	Trans formative	+	+		+		