

# Designing for scale:

## Linking actors for successful curriculum development

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08/2012, Enschede



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**Cover:** *In May 1869, San Francisco found itself to be on the wrong side of the bay and the fear of many San Franciscans was that the city would lose its position as the regional center of trade. The bay bridge was built to provide a permanent link with the communities around the bay in order for the city to grow as their growth rate was below national average. As this bay bridge is connecting San Francisco to Berkeley, where data collection was done for this study, it serves as a nice metaphor for the strategies used by the SEEDS-team in involving other actors to improve the development and sustainable implementation of their innovative curriculum product.*

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*Maaïke Heitink, August 2012*



## Summary

Large-scale curriculum development has been an ongoing challenge and increasingly experts call for better consideration of the educational system as a whole to inform the development of large-scale innovations. A major problem is that the curricular products related to the innovation are insufficiently aligned to the system in which it has to be implemented. Conclusions in literature suggest that designing and testing curricular products on a small scale and then scaling up to a large scale is a flawed approach because issues of working at scale need to be factored into curriculum development from the start. This report describes a case study that explored the salient actors and their roles in the context of a curriculum project that aims to develop lesson materials to be used at scale, from the curriculum developers' perspective. Both the perspective of curriculum developers on the interaction with external involved actors and the perspective of external actors directly involved in the curriculum development project were investigated.

The selected case for this study is the Seeds of Science/Roots of Reading program (SEEDS), operating at the Lawrence Hall of Science, University of California, Berkeley (USA). SEEDS is a large-scale curriculum development initiative which aims to help children in primary school develop the inquiry skills needed to make sense of the physical world while building fundamental literacy skills. Their products are highly praised as a result of the good alignment with the system in which it is implemented. Also the SEEDS-team's design process fits this study very well as the SEEDS-team factors in issues of working at scale from the start. The SEEDS program started in 2003. At the point of this study the development team produced grade 2 to 5 SEEDS curriculum materials (SEEDS elementary) and is working on middle school curriculum (grades 6 to 8) materials.

An illustrative case study was employed to study the SEEDS-project. The units of analysis are actors involved in the SEEDS-project team, like members of the development team and actors externally involved to the project, e.g. publishers (external actors). Eleven respondents were selected through a snowball strategy. Data was collected through interviews, field notes in a reflective journal (based on participant observation), and documents. The criteria credibility, transferability, dependability, and confirmability were operationalized to maintain quality and authenticity (or rigor) in the study. Directed content analysis was done to analyze the data, in which codes were developed inductively and deductively using the constant comparative method.

Results show that different actors are involved in the main development processes, needed to go to scale and to consider different contexts. The development processes resembles those included in most instructional design sequences: plan/writing, pilot-testing, polishing, field-testing, polishing, publishing/implementation. Before, during and after the development process, the following actors are involved. Involved during development of the product are: publishers, teachers and students, professors/scientists (content experts) and the Graduate School of Education. Involved to set conditions for development are: researchers, funding agencies (private and public) and assessment agency. Involved to set conditions for (sustainable) implementation are: Teacher education providers, national science teacher association, policy makers and (although not that much) media. Most motives from the SEEDS-team to involve the external actors in the project focus on: establishing links with practice, setting conditions for sustainable implementation (e.g. alignment with different contexts, dissemination), ensuring substantial correctness/relevance and keeping their work up to date. External actors' motives to be involved in the SEEDS-project are mostly focused on supporting their ability to develop curriculum, forming a link between research and practice and supporting local capacity building. Actors related to the SEEDS-team are situated in all three systems of the linkage model.

Conclusions show that the SEEDS' development process for large-scale curriculum design infuses strategies into well-known models for curriculum development that enables 'rolling out' their curriculum product on a large scale. These strategies are mainly focused on the involvement of specific actors before, during and after the development of the curriculum program. A team with multidisciplinary backgrounds enables to develop curriculum based on mindsets of research, teaching and development. These different mindsets help to choose and understand relevant actors in the development process. Actors the SEEDS-team involves in their curriculum development process are publishers, teachers and students, research organizations, funding agencies and assessment boards, professional associations, policy makers and media. The actors identified in the SEEDS case

correspond to the actors identified in other literature as highly influential. The publisher is, according to the SEEDS-team, the most important means by which they reach actors in the field. Comparing the motives and roles from the curriculum developers' perspective and the perspective of the external actors shows that although motives are not the same or have a different focus, they complement each other. Most roles identified from both perspectives are the 'supportive', 'consulting' and 'responsible' roles. Based on the data gathered in this study, the actors with these roles and motives are situated in the linkage model, which shows the different influences of the connections. The four dimensions important in large-scale curriculum development ('depth', sustainability, 'shift in ownership' and 'spread') emerge in this study as well and are linked to more explicit examples in the SEEDS case. Finally recommendations for further research are provided as well as recommendations for designing for scale.

## 1. About this study

*This chapter introduces the subject and the focus of this study. Large-scale curriculum development has been an ongoing challenge and increasingly experts call for better consideration of the educational system as a whole to inform the development of large-scale innovations. Conclusions in literature suggest that designing and testing curricular products on a small scale and then scaling up to a large scale is a flawed approach, because issues of working at scale need to be factored into curriculum development from the start. A major problem is that the curricular products related to the innovation are insufficiently aligned to the system in which it has to be implemented. Large-scale curriculum development concerns a lot of different parties that thus exert influence over the curricular product or intervention. The actors that influence decisions made in curriculum development are different in every context. This study will explore the actors and their roles in different phases of a large-scale curriculum development process.*

### 1.1. Introduction

Over the last decades, curriculum development has been an important topic and it was, and still is, the subject of many studies. Although literature about curriculum development uses the term ‘development’ in different ways, in this study ‘development’ concerns the whole process curriculum developers go through while creating a curricular innovation: analysis, design and realization<sup>1</sup>, implementation and evaluation. Different models have been developed to guide curriculum development. However, often, these models and resulting curriculum products have a small-scale focus and when implemented affect only a few classes or schools. Scaling these (successful) products to new settings mostly fails as necessary changes are adopted but not sustained once curriculum developers leave the scene (Coburn, 2003; Fullan, 2001; Blumenfeld, 2000; Elmore, 1996). The issue of ‘scale’ emerges as one of the key challenges of educational reform.

Large-scale curriculum development concerns development for scale, for generic curricula, intended for many settings and at the same time flexible enough to be able to adapt to the needs of local settings. Literature to date shows few successful examples of comprehensive large-scale curriculum development. The last decades much money has been spent on large-scale curriculum projects that failed (e.g. see Commissie Parlementair Onderzoek Onderwijsvernieuwingen (2008) for examples from The Netherlands). To develop curriculum products for use at scale, developers have to cope with multiple factors that influence the implementation and sustainability of the curriculum innovation. The purpose of this study is to gain insights about the factors that contribute to successful in large-scale curriculum development.

### 1.2. Problem statement

Literature on large-scale curriculum development points to organizational culture, capability, and management & policy as three areas that have influenced the adoption and sustainability of the innovative curriculum (Cuban, 1992; Blumenfeld, 2000). Theories focus on the importance of building capacity and working on different fronts simultaneously (Hall & Hord, 2006; Coburn & Stein, 2003). This is consistent with the wave of research that combines the implementation and understanding of reform by using collaborative teams of researchers and school personnel, involving actors like teachers in the curriculum development process to foster implementation. Next to the teachers’ professional development, teachers’ ownership is promoted as well. A lot of studies show that not the policy makers’ plans but teachers are the key in curriculum development as they adapt programs to fit in their context and values (e.g. McLaughlin, 1987; Healey & DeStefano, 1997; McKenney & Reeves, 2012).

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<sup>1</sup> Realization is in some models also addressed with the term ‘development’, however in this study the term is used for the whole process.

The identification of curricula that can reliably work in a wide variety of settings, so that these curricula can be scaled up to improve system level outcomes, is an enduring goal in research (Penuel, Fishman, Cheng, & Sabelli, 2011). However, effects of such programs vary significantly from setting to setting (Burkhardt, 2009; Coburn & Stein, 2010). Conclusions in literature suggest that designing and testing curricular products on a small scale and then scaling up to a large scale is a flawed approach (Burkhardt, 2009; Healey & DeStefano, 1997). Many innovations are not focused on changing a whole system (Fullan, 2009), and the curricular products related to the innovation are insufficiently aligned to the system in which it has to be implemented. Essentially, unless curriculum developers explicitly address system wide implementation issues, scalability will be limited. Therefore, issues of working at scale need to be factored into curriculum development from the start. Whole system change requires more than the adoption of effective programs, it demands alignment and coordination of the actions of people, teams and organizational units within a complex institutional ecology (Rowan 2002). The actors that influence decisions made in curriculum development are different in every context. Since large-scale development concerns a lot of actors and impacts a lot of different people, this study focuses on the actors involved in the different phases of a large-scale curriculum development process and their roles.

### 1.3. Goals of this study

Clearly, variation in the success of large-scale curriculum development is a function of a variety of factors interacting at multiple system levels and is dependent on many different actors. A lot of different parties have an interest in curriculum development and thus exert influence over the curricular product or intervention. Constructing relationships with these actors from different parts of the system, bringing together these actors in productive ways can foster the large-scale curriculum development process and sustain whole system change. The goal of this study is to identify the actors important in curriculum development for scale and the nature of these linkages by exploring the roles and motives actors have in the large-scale curriculum development process. This study took place in the context of a curriculum project aiming to develop lesson materials to be used at scale and was studied from the perspective of the curriculum developers.

### 1.4. Perspective

Obviously the issue of large-scale curriculum development can be viewed from many different perspectives and analyzed from different angles. This study will be done from the perspective of the curriculum developers. Goodlad (1994) distinguishes between three different perspectives:

- *Substantive*, focusing on the classical curriculum question about what knowledge is of most worth for inclusion in teaching and learning;
- *Technical-professional*, referring to how to address tasks of curriculum development;
- *Socio-political*, referring to curriculum decision-making processes, where values and interests of different individual and agencies are at stake.

This study will not so much discuss the substantive perspective, but will combine the technical-professional and social-political perspectives of curriculum, as key actors involved in the curriculum development process and their roles/responsibilities will be identified.

### 1.5. Relevance

Large-scale curriculum development has been an ongoing challenge and increasingly experts call for better consideration of the educational system as a whole to inform the development of large-scale curriculum innovations (cf. Fullan, 2000). When it comes to guiding the large-scale development of curriculum materials and frameworks, existing literature is lacking (Heitink, 2012; Coburn & Stein, 2010; Burkhardt, 2009). Studying essential elements needed in understanding the large-scale curriculum development process is relevant for scientific and practical reasons.

Comparing literature to Goodlad's (1994) perspectives shows that there is literature more related to the technical professional perspective and literature more related to the social political

perspective, but no literature that that brings these perspectives together. However, the importance of involving different actors in large-scale curriculum development implies there is a need for these perspectives to come together. Given the scant prior research and limited theoretical development in this area, a case study for the purposes of exploring this subject in more depth was chosen for this study. This study therefore contributes to science by starting with exploring first essential elements needed in understanding the large-scale curriculum development process by collecting new data to gain more insight regarding the identification and involvement of key actors.

Practically this study is relevant because it contributes to an improved, more effective way of designing curriculum for large scale. Curriculum developers aiming to develop curriculum materials to be used at scale can inform their approaches with the results of study. Additionally it gives practical insights about the ways to make connections between the ‘research world’ and the ‘practice world’ in the sense of curriculum development, and sustaining those connections. Expectations about the role of the ‘research world’ in improving educational practice are high and educational research focuses on tackling meaningful, practice-based questions and problems (e.g. Coburn and Stein, 2010).

### **1.6. Overview of the following chapters**

In the next chapter, Chapter 2, the theoretical framework is fleshed out describing the theoretical underpinnings on which this research is based. This chapter will end with the research questions of this study. Chapter 3 will start with an impression of the Seeds of Science/Roots of Reading program and curriculum department, the selected case for this study. The methods used in this study the case are described in Chapter 4, and Chapter 5 focuses on the results that emerged from data collection and analysis. Chapter 6 present and discusses the conclusions of this research. Each chapter starts with a short summary to help the reader.



## 2. Theoretical framework

*This chapter describes the theoretical framework for this study. The framework focuses on the concept of large-scale curriculum development, the actors involved in large-scale curriculum development and the roles and responsibilities of these actors. A lot of different parties have an interest in large-scale curriculum development and thus exert influence over the curricular product or intervention. Although the kind of actors involved in curriculum development and the amount of influence certain actors can exert depends on the context, a certain group of actors is similar in a lot of different contexts. The actors that are considered as 'highly influential' in large-scale curriculum development are presented in a spider's web. In every educational level, actors may take on different roles during the curriculum development process. Based on the existing RASCI model, the responsible, accountable, supportive, consulting and informative roles are defined, applied to curriculum development. Roles are often influenced by how people perceive their roles in this system and by how others expect their roles to be played. A way to look at how actors in curriculum development are situated in a system is the linkage model. This model suggests the resource system' interacts with the 'user system', through a, often temporary, 'linkage system' that aids curriculum development by facilitating the exchange of information and ideas. The framework ends in three research questions focused on the actors and their roles and responsibilities in the context large-scale curriculum development, from the perspective of the curriculum developers.*

### 2.1. Defining large-scale curriculum development

Many studies predominantly limit the definition of 'scale' to the amount of schools, districts or actors involved in the curriculum initiative at the same time (e.g. Fullan, 2009; Hall & Hord, 2006). However, 'large' is a relative concept depending on the context it applies to. In this section large-scale curriculum development is defined in a more substantial way, which will be used in this study. A detailed discussion about this concept can be found in the literature review corresponding to this study (Heitink, 2012).

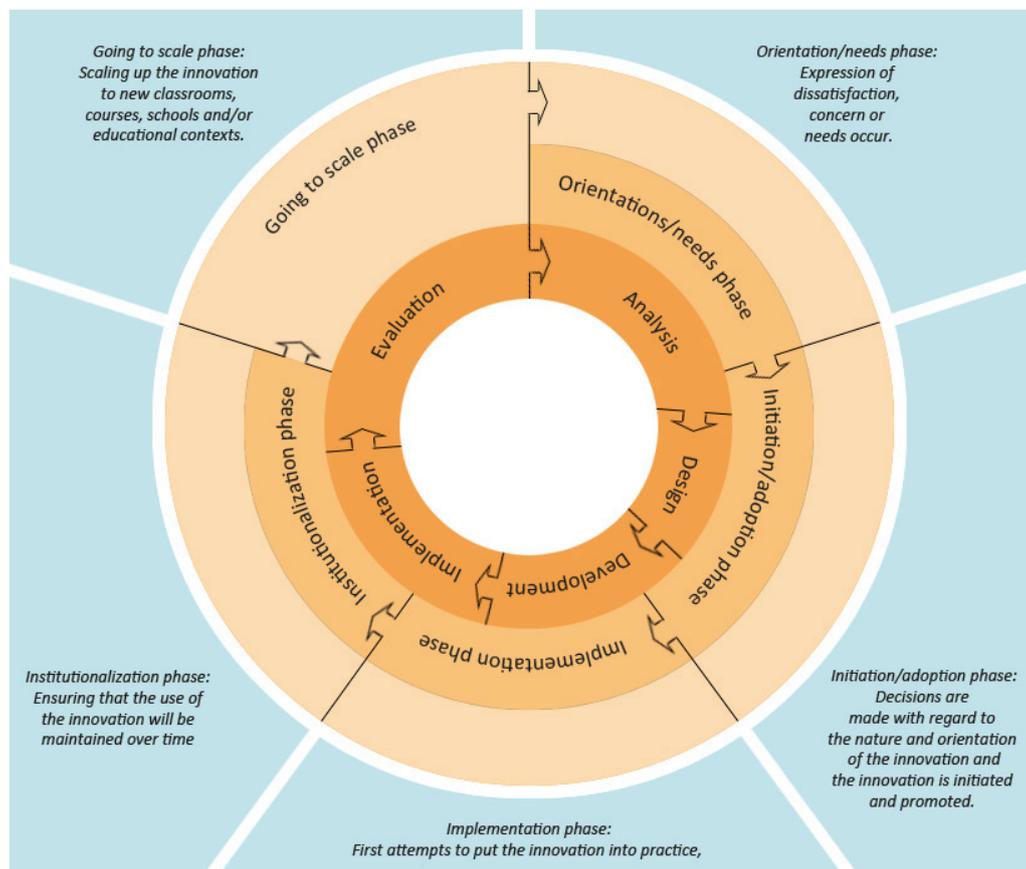
Large-scale curriculum development may occur in two ways. One way is that the curriculum initiatives intended for a particular setting can be expanded to a large scale, intended for many settings. Another way is that the development of the curriculum already goes on at large scale whereby schools are encouraged to adapt reform models to the needs of their local context (Stringfield, Datnow, Ross & Snively, 1998; Healey & DeStefano, 1997).

Either way, designing in the context of large-scale curriculum development implies working towards Coburn's (2003) four interrelated dimensions:

- *Spread* of norms, beliefs and principles corresponding to the innovative curriculum,
- *Shift in ownership* from the innovative curriculum, controlled by a support agency, to a curriculum product with authority held by schools and teachers,
- *Sustainability* to sustain the innovative curriculum in a multilevel system characterized by multiple and shifting priorities as distributions and adoption of innovative curricula are only significant if its use can be sustained,
- *Depth* of the change, beyond surface structures or procedures, focusing on altering the knowledge, skills, attitudes and beliefs of teachers.

Since large-scale curriculum development suggests educational change, the four-stage process of educational change (cf. Fullan, 2007; Marsh, 2009) can be distinguished (shown in yellow in Figure 1). A fifth stage can be added that refers to "going to scale" of the innovative curriculum where the product is 'rolled out' to new classrooms, courses, schools and/or educational contexts. This five-stage process indicates the bigger picture large-scale curriculum developers work in. While curriculum developers need to consider this 'bigger picture' in their development process their design work particularly concerns the processes of analysis, design, development, implementation and evaluation (Gustafson & Branch, 2002), displayed in the middle of Figure 1. In their design the 'implementation' and 'evaluation' stage is initially focused on improving the design, not on full implementation of a

final product. The picture emphasizes that during the ‘going to scale’ phase development goes through the same stages, only in terms of broader contexts (classrooms, courses, schools and/or educational contexts) and that successful innovations/curriculum products can’t just be multiplied, as is suggested in the dimensions described above. Rather than multiplying curriculum products to other settings, going to scale should involve the underlying beliefs, norms, and principles to new classrooms and schools and other actors in the curriculum development process (Coburn, 2003; Healey & DeStefano, 1997). This suggests that actors play an important role in the success of large-scale curriculum development.



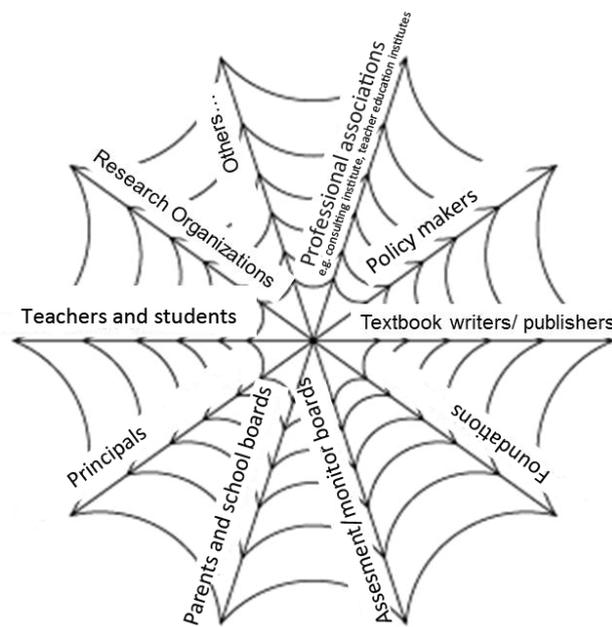
**Figure 1** Process in large-scale curriculum development (inspired by Fullan (2007), Marsh (2009) and Gustafson and Branch (2002)).

## 2.2. Actors in large scale curriculum development

Van den Akker (2003) states that “curriculum decision making and enactment usually involves a long and cyclic process with many actors; in which motives and needs for changing the curriculum are formulated; ideas are specified in programs and materials; and efforts are made to realize the intended changes in practice”. This is also manifested on a large scale in which there are far more actors than on a small scale. Fullan (2007) reasons that in implementing curricular interventions, the perspectives, values and motives of the different actors involved are influencing the process and chance of success. A lot of different parties have an interest in curriculum development and thus exert influence over the curricular product or intervention. Therefore, the needs of actors acting at different educational levels play a role in the large-scale curriculum development process.

It is difficult to plot out with precision the various interactions and points of leverage actors have, operating from various educational levels (macro, meso, micro) (Marsh, 2009). The way these interactions will eventually play out will always be unpredictable to some degree. Although the kind of actors involved in curriculum development and the amount of influence certain actors can exert

depends on the context, a certain group of actors is similar in a lot of different contexts. Based on many overviews, a limited set of actors is considered as ‘highly influential’ (Marsh, 2009; Cuban, 1992; Van den Akker & Letschert, 2004) in large-scale curriculum development. Figure 2 presents these actors in a spider’s web to emphasize the underlying metaphor of balance and interconnectivity. Imbalance in the spider’s web will cause the system to break. Efforts to develop or implement curricula must therefore pay attention to balance and linkages between its components. Although educational levels are not directly visible in the spider’s web, the relevance of these actors differs across these levels and gives a superficial idea of different needs and the expectations exerted by actors from other levels. Beyond actors involved in curriculum development at different educational levels most authors (Cuban, 1992; Marsh, 2009; McNeil, 2009; Westbury, 2008) also identify actors in society that impact curriculum decision making more indirectly by influencing one or more of these actors.



**Figure 2** Groups of actors (based on van den Akker, 2012).

This is a simplified account of reality; there is obviously no clear line between these groups, sometimes organizations or individuals participate in more than one actor group. Next to that, there are temporary groups that exist because of the call for advice on, for example, a certain content or type of education. Yet for the purpose of analysis it is useful to have a tentative list of actors.

Walker (1990) contends that a better understanding of actors is obtained if consideration is given to their ‘needs’ and their potential areas of ‘control’. An interaction between actors is depended on the perceptions of the actors involved in the interaction. Since this study takes on the perspective of curriculum developers, an inside out and an outside in perspective is distinguished. The inside-out perspective is the perspective of curriculum developers on the interaction with external involved actors and an outside-in perspective is the perspective of external actors involved in a curriculum development project. The interactions amongst the many actors can become quite complex and produce unexpected results. New actor-groups or coalitions of groups keep on occurring. Success factors in one period and in a particular context do not necessarily provide success at other times and in other contexts (Marsh, 2009). This suggests it is useful to get an idea of the roles and responsibilities actors have in the large-scale curriculum development process.

### 2.3. Roles and responsibilities of these actors

In every educational level, actors may take on different roles during the curriculum development process, depending on the phase of the project. While some actors for example may play

an important role in the initiation of curriculum innovations, others may become more influential during implementation and institutionalization. A way to look at these roles and the system these roles are played in is proposed in this paragraph.

### 2.3.1. Roles and responsibilities in curriculum development

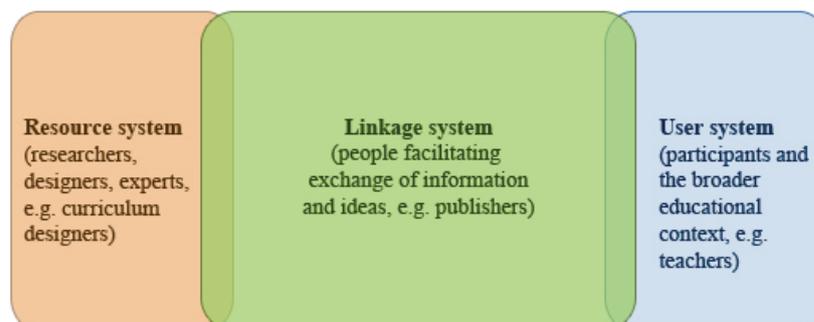
Literature does not describe clear-cut roles specifically for large-scale curriculum development. The RASCI model is a responsibility assignment methodology that is primarily used in project management particularly for identifying roles and responsibilities (Baker, 2009; Hightower, 2008). This model could be applied to distinguish specific role(s) across the different stages of the curriculum development process as well. Based on the existing RASCI model, the following roles are defined, applied to curriculum development:

- *Responsible*: Those who contribute to/make sure that the curriculum innovation gets implemented and sustained over time (e.g. teachers).
- *Accountable*: Those who must approve before the work is to be effective.
- *Supporting*: Those who provide resources or play a supporting role during the implementation of a curriculum innovation (e.g. textbook publishers).
- *Consulting*: Those who provide information and/or expertise necessary to complete the project (e.g. academics).
- *Informing*: Those who need to be notified of results or progress, often only on completion of the task or deliverable, but need not necessarily be consulted.

Identifying the main roles of each actor at the various educational levels will contribute to gain a better insight into the multiple and complex ways in which actors at one level may influence curriculum developing processes at other levels. This also suggests roles are played in a system full of perceptions and expectations about how roles should be played in the different phases of the development process.

### 2.3.2. Roles and responsibilities in a linkage system model

Often research about certain roles or ‘tasks’ neglects these roles are ‘played’ in a system. Roles are often influenced by how people perceive their roles in this system (and also by how others expect their roles to be played). A way to look at how actors in curriculum development are situated in a system is the linkage model suggested by Havelock (1971) and Bartholomew et al. (2006) in McKenney and Reeves (2012). The model shows that the ‘resource system’ interacts with the ‘user system’, through a, often temporary, ‘linkage system’ that aids curriculum development by facilitating the exchange of information and ideas. Coburn and Stein (2010) call this the ‘interactive space’. Within this linkage system, different actors are involved with various interests/agendas, grounds and concerns in terms of intervention goals. Figure 3 shows the linkage model with examples of actors in the three systems. Placing actors with their different roles in the linkage model gives understanding about the way these roles are situated in the system the role is ‘played’ in and motives actors might have for relationships with other actors.



**Figure 3** Linkage model, adapted from McKenney and Reeves (2012).

## 2.4. Research questions

As emerged from the earlier sections, the involvement of actors (see Figure 2) is an important factor in the process of large-scale curriculum development. Actors' roles and their influence often change depending on the stage of the curriculum development process. While some actors may play an important role in, and have a strong influence over, the initiation of developments, others may become more influential during implementation and institutionalization.

Identifying the main roles of each actor at various educational levels will contribute to gain a better insight into the multiple ways actors at one level may influence curriculum-developing processes at other levels. In the same way, becoming aware of their role at each phase of the curriculum development process will contribute to understand how this role shifts in time, and thereby enable to determine the degree of involvement and support required from each group at different moments of the curriculum development process. Accordingly, the following research questions were formulated:

*From the perspective of the curriculum developer, what actors are particularly salient in large-scale curriculum development across different stages of the curriculum development process, and how do they perceive their own roles as well as those of others?*

The answer to this question was found through answering the sub questions:

1. How can the curriculum development process of an organization concerned with designing for scale be characterized?
2. What actors are particularly salient in the different stages of a large-scale curriculum development process?
3. How do curriculum developers perceive their own roles and those of external actors in the different stages of the curriculum development process?
4. How do external actors perceive their own roles and those of the curriculum developer in the different stages of the curriculum development process?

In these questions, 'perception of roles' includes: ideas about the task the different actors do and their motives for engagement.

Both an inside-out perspective and an outside-in perspective were investigated. The inside-out perspective is the perspective of curriculum developers on the interaction with external involved actors and an outside-in perspective is the perspective of external actors involved in a curriculum development project. To explain the roles and responsibilities of the actors the linkage model is used as visualized in Figure 3.

This chapter clarified the concept of large-scale curriculum development, provided insights in actors important in large-scale curriculum development and different roles actors take on during the curriculum development process. The next chapter describes the context of a curriculum project that aims to develop lesson materials to be used at scale.



### 3. Developing curriculum for scale: a case in the USA

*The selected case for this study is the Seeds of Science/Roots of Reading program (SEEDS)(<http://scienceandliteracy.org/>), situated in the Lawrence Hall of Science (LHS), University of California, Berkeley, USA (<http://www.lawrencehallofscience.org/>). This chapter will provide an impression of the Lawrence Hall of Science and the SEEDS curriculum development department. Additionally, since the SEEDS program is situated in the context of the USA, a short overview of the US educational system is given. The Lawrence Hall of Science is a public science center for learners of all ages. In addition to the hands-on center, LHS develops many resources for preschool through high school science and mathematics education, which have been used by millions of teachers and students nationally and internationally. SEEDS is one of the LHS's newer programs. SEEDS is a large-scale curriculum development initiative which aims to help children in primary school develop the inquiry skills needed to make sense of the physical world while building fundamental literacy skills. Development of the SEEDS program started in 2003. Elementary school materials have been developed and published. At the point of data collection the SEEDS-team is working on middle school curriculum materials. The SEEDS program is developed for the educational system of the USA. The USA has an educational system in which decisions are mostly decentralized to states and school districts. While there is no national curriculum, states and school districts do require that certain standards be used to guide school instruction. Policies and regulations are in general uniform across all schools within a district but may vary amongst districts. This means that while on state level and school district level autonomy is relatively high, and as well as choosing what to study, schools can also choose how and the curriculum materials they will be using, as long as it meets the standards set by the state or region the school functions in. The purpose of this chapter is to provide a description of the SEEDS-project and the context in which it functions.*

#### 3.1. Lawrence Hall of Science

The Lawrence Hall of Science was founded in 1968 and is a public science center established at the University of California, Berkeley (USA). Learners of all ages can visit the LHS's hands on learning exhibits and on-site programs (either through school or informally). The LHS employs designers, researchers and support staff to be able to research, develop, and evaluate educational materials and methods, professional development programs, and hands-on learning experiences for different environments (from informal to afterschool to formal K-12 classrooms and high school). The curricula, professional development programs, exhibits, and partnerships all have the purpose to support the goal of advancing the quality of science and math education.

Examples of actors the LHS partners up with are: scientists, researchers, disciplinary experts, developers, funders and practitioners (e.g. teachers) who collaborate to design learning materials and to foster the alignment between research and practice (cf. the linkage model). Additionally their research group focuses on assessment and evaluation, playing an integral role in the development and sustainability of innovative programs, proposals to fund and develop programs, and improving or scaling established programs (corresponding to characteristics of scale and actors described in the previous chapter). Their programs are being used by millions of teachers and students nationally and internationally. Programs that proved effective are scaled up to make it accessible to reach as many learners as possible. One of the LHS's newer programs is called Seeds of Science/Roots of Reading (SEEDS).

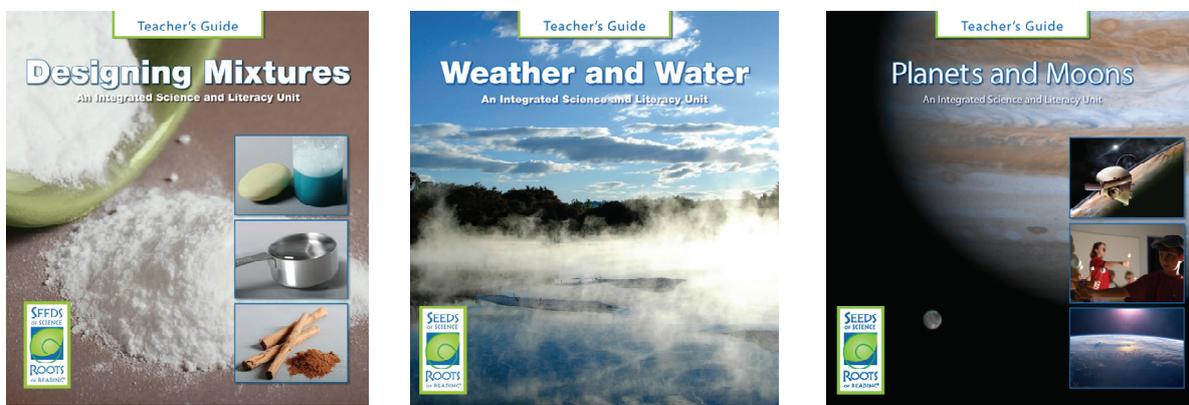


**Figure 4** Children at the LHS learning about water streams (left) and a professional development activity (right).

### 3.2. Seeds of Science/Roots of Reading

SEEDS is a large-scale curriculum development initiative which aims to help children in primary school develop the inquiry skills needed to make sense of the physical world while building fundamental literacy skills. Their products are highly praised as a result of the good alignment with the system in which it is implemented. Also the SEEDS-team’s design process fits this study very well as the SEEDS-team factors in issues of working at scale from the start.

The SEEDS program started in 2003. At the point of this study the development team produced grade 2 to grade 5 SEEDS curriculum materials (SEEDS elementary) and is working on middle school curriculum (grades 6 to 8) materials, which additionally incorporates a technology component. These materials consist of student resources (e.g. books) and teacher resources (e.g. teacher guide, assessment booklet). Examples of books are shown in Figure 5. Additionally the middle school curriculum materials include computer simulations and other technology components, like a flexible teacher guide for the iPad, which directs the teacher to different paths through the material, based on students’ performances. The curriculum is informed by research, verified by rigorous evaluations, and field-tested in classrooms around the country. A study of SEEDS elementary (in 2007) showed that the program resulted in students making greater gains in science vocabulary, reading comprehension and science content as compared to control classrooms (Cohen, 2011).



**Figure 5** Example of SEEDS curriculum products, from left to right: grade 2-3, grade 3-4, grade 4-5.

Over the years, the SEEDS-team has refined a basic process that is well understood in the team. Many of the developers also taught and conducted research at the graduate level and they draw on developer, teacher and researcher mindsets in their work. The team consists of a mixture of people with a science background, people with a literacy background and people specified in developing tests. Different from the general approach of the LHS, which is scaling up programs that proved to be effective, the SEEDS-team involves actors from the start of their development process with the focus to design curriculum materials *for* scale. During their development process they collaborate with different actors to meet needs from practice (and alignment with practice) and to keep their work up to date. These different partnerships help foster the spread depth, shift in ownership and sustainability of the curriculum products.

Previous to the SEEDS materials the development team developed a science and math curriculum called GEMS (<http://lhsgems.org/>). The SEEDS-team uses the network (amongst other means) that was built for GEMS to offer local support and disseminate products for SEEDS products as well. Figure 6 shows this network in the USA.



**Figure 6** Support and dissemination network built for GEMS.

### 3.3. Educational system of the USA

The SEEDS program is developed for the educational system of the USA, specifically elementary and middle school education. Therefore this section gives a short overview of the educational system in the US, relevant for this study. This information is based on information provided by the U.S. Department of Education (<http://www.ed.gov/>, 2012).

The USA has an educational system in which decisions are mostly decentralized to states and school districts. The USA federal government does not have direct authority over education. There is no ministry of education and no national curriculum. While there is no national curriculum (as for example in the UK) in the USA, states and school districts do require that certain standards - attainment targets that students need to acquire- be used to guide school instruction. In addition, to receive federal assistance, states need to develop and improve state standards. Most states impose a basic statewide curricular framework, which local schools may attune to a certain degree.

Elementary schools and (public) middle schools are governed by local school districts and boards. These boards exercise a broad policy oversight of operations, budgets and staff, and may oversee local school curricula within state guidelines. Policies and regulations are in general uniform across all schools within a district but may vary amongst districts. This means that while on state level and school district level autonomy is relatively high, individual schools are administered within the boundaries of these general requirements. So autonomy is limited, but schools got a lot to choose. As well as choosing what to study, schools can also choose how. Whether they choose a premade curriculum, or whether they design their own program specifically for their school, they will have the freedom and flexibility to decide what is best for their pupils, as long as it meets the standards set by

the state or region the school functions in. This means that schools have autonomy over choosing curriculum materials for their students and that these materials play an important role in their education.

Schools are organized into elementary schools, middle schools and high schools. Elementary education ranges from grade 1 to grades 4 to 7, depending on state and school district policy. Middle schools range from grades 5 to 9, with most in the grade 6 to 8 range. Middle schools in the upper grade range (7-9) are sometimes referred to as junior high schools. High schools generally enroll students in grade 9 to 12. In the USA these schools tend to enroll students with widely different interests and capabilities that follow different educational tracks within the same school.

Decisions about what needs to be taught on both national and state level have a great impact on how materials are developed. For the SEEDS-team this means they need to develop materials that need to be able to function in a lot of different contexts; different states and regions that apply different standards. On top of the standards, the USA has a lot of different cultures. This suggests the need of the design of a generic curriculum that is intended for many settings and flexible enough to bend its way to meet the needs of these different contexts. The SEEDS-project is aiming to develop curriculum materials to be used at scale. Different strategies are applied to factor in issues of designing for scale in the development process. During their development process they collaborate with different actors to meet needs from practice, foster alignment with practice and to keep their work up to date. These different partnerships help foster the spread depth, shift in ownership and sustainability of the curriculum products. The SEEDS project fits as a case for this study and the next chapter will describe the methods used to study this case in more depth.

## 4. Methods

*This chapter describes the methods used to conduct this research in order to find answers to the research questions. The purpose is therefore to provide a detailed description of the different actors involved in the large-scale curriculum development process, the roles these actors play and the motives for involvement from both an inside-out and an outside-in perspective. The chapter will start with describing the research design. After this, respondents, instruments used for data collection, procedures and data analysis will be described. An illustrative case study was employed to study the Seeds of Science/Roots of Reading project, operating at the University of California, Berkeley. The units of analysis are actors involved in the SEEDS-project team, like members of the development team and actors externally involved to the project, e.g. publishers (external actors). This way, both an inside-out perspective and an outside-in perspective were achieved. Eleven respondents were selected through a snowball strategy. Data collection was collected through field notes in a reflective journal from participant observation, interviews and documents. The criteria credibility, transferability, dependability, and confirmability were operationalized to maintain quality and authenticity (or rigor) in the study. Directed content analysis was done to analyze the data, in which codes were developed inductively and deductively using the constant comparative method.*

### 4.1. Research design

An illustrative case study research (Yin, 2009) was employed to study the Seeds of Science/Roots of Reading project (SEEDS), operating at the University of California, Berkeley, as described in Chapter 3. The purpose was to portray their inner workings, providing a detailed description of the actors they involve when and with what reason. In this study, the SEEDS case was purposefully selected to enable extracting detailed data about the subjects mentioned in the conceptual framework. The units of analysis were actors involved in the SEEDS-project team, like members of the development team and actors externally involved to the project, e.g. publishers (external actors). This way, both an inside-out perspective and an outside-in perspective were achieved.

In this case study participant observation was used as a data collection technique to enable interaction with the curriculum development team, getting more insight into their development process and interactions with other actors. This way the researcher was able to establish a non-threatening, trusting relationship with the development group. In the study the researcher was a *'participant as observer'* for the SEEDS-project team. This means the project team knows the researcher's identity and the researcher became closely involved with them. To the external involved actors, the researcher had the role of *'observer as participant'*. This means the external actors know the researcher's identity but the researcher did not establish a close relationship with them, remaining a relative "stranger" (cf. Burgess, 1984)

Credibility, transferability, dependability, and confirmability are criteria to maintain quality and authenticity (or rigor), which are inferred from the more common terms 'internal validity, external validity, reliability and objectivity (respectively) (Lincoln & Guba, 1985). In this study these criteria were operationalized by embedding prolonged engagement, persistent observation, triangulation, peer debriefing, member checks, providing a detailed description, creating an audit trail, and producing a reflective journal (cf. Lincoln & Guba, 1985 in Miles & Huberman, 1994; Yin, 2009). Appendix 1 shows an overview of these techniques and how they were applied in this study.

### 4.2. Respondents

The respondents were the key actors in the case; the members of the SEEDS-project team and the external involved actors that were identified by the SEEDS-project members. Selected members of the SEEDS-project team are members with different roles who directly interact with external actors. External involved actors are actors with whom the SEEDS-team interacts, for example: teachers, textbook publishers, examination board, etc. Respondents were selected through a 'snowball strategy' (e.g. Hornby & Symon, 1994). This strategy was used to identify groups or/and individuals that are connected to the SEEDS-project, and who influence(d) the curriculum development process. Data

collection started with the SEEDS-project team members and, based on the results, external involved actors were identified. Table 1 shows the respondents that eventually participated in this study and background information.

**Table 1**  
Overview of the respondents in this study.

<b>Respondent</b>	<b>Function</b>	<b>Working on SEEDS</b>	<b>Actor</b>
Respondent A	<ul style="list-style-type: none"> <li>• <i>Principal Investigator/Director</i> leading the LHS Center for Curriculum Development and Implementation of the GEMS and SEEDS Program.</li> </ul>	9 years	SEEDS
Respondent B	<ul style="list-style-type: none"> <li>• <i>Lead Science Developer</i>, leading curriculum development of the science team.</li> </ul>	4.5 years	SEEDS
Respondent C	<ul style="list-style-type: none"> <li>• <i>Network director</i> (SEEDS and GEMS).</li> <li>• <i>Lead Professional Development</i> (SEEDS and GEMS).</li> </ul>	9 years	SEEDS
Respondent D	<ul style="list-style-type: none"> <li>• <i>Marketing &amp; Operations Director</i>: Managing relationship with the publishers in terms of getting contacts in place, negotiating terms and conditions, etc.</li> </ul>	9 years	SEEDS
Respondent E	<ul style="list-style-type: none"> <li>• <i>Dean of UC Berkeley's Graduate School of Education/co-principal investigator</i> SEEDS.</li> </ul>	9 years	External partner
Respondent F	<ul style="list-style-type: none"> <li>• <i>Product Manager</i> for SEEDS, concerning sales, professional development, marketing and product development.</li> </ul>	3 years	External partner
Respondent G	<ul style="list-style-type: none"> <li>• <i>Associate Director, Lead Professional Development</i> to support SEEDS implementation throughout the state (and GEMS).</li> </ul>	3 years	External partner
Respondent H	<ul style="list-style-type: none"> <li>• <i>Education &amp; Programs Manager</i> for local implementation support.</li> </ul>	4 years	External partner
Respondent I	<ul style="list-style-type: none"> <li>• <i>Education &amp; Programs Assistant</i> for local implementation support.</li> </ul>	4 years	External partner

Additionally, during participating observation, **teachers** and an **academic expert** were informally questioned during field activities. Unfortunately, the publisher the SEEDS-team works most intense with did not want to participate in this study because of policy reasons.

### 4.3. Instrumentation

Data collection has been done through different interviews and a reflective journal, described in this section. Every instrument covers all themes in the research questions.

#### **Inventory Interview scheme (core SEEDS-project member)**

The goal of this semi-structured interview was to clarify the development process the SEEDS-team typically goes through, identify direct involved external actors, identify SEEDS-team members who interact directly with external actors (and why), and get first insights about the inside-out perspective on the relationship with these external actors.

The interview included questions about the curriculum development process the SEEDS-team typically go through, the actors they involve in this process (who, when and with what purpose), their perceptions/experiences of the type of interconnections between the SEEDS-team and the other direct

relevant actor (e.g. what is the role of every actor?)(RASCI). Next to that, documents relevant for document analysis were asked for.

The interview started with the use of a drawing tool with which the interviewee could identify the directly involved actors relevant to the SEEDS-project. Figure 11 in Appendix 3 shows this tool. The tool shows the most common actors in curriculum development (according to literature), but leaves a spot open for other actors that might have been involved in the process. In the center of all these actors, the SEEDS-project team was shown. The inventory interview scheme is shown in Table 10 (Appendix 3). A few example questions are shown below.

- 
- Please take a minute to look at the various groups of participants in the spider's web (and others that might be relevant to this project) and think about the relationships the project team established with different actors from the educational system. Then, please identify:
    - a. The relationships **directly relevant** to this project
    - b. The relationships **indirectly relevant** to this project
    - c. The relationships **not relevant** to this project
  - Let's talk about the nature of the interaction in the relationships that were **directly** relevant to the project. For each group, what **role** did the actor play and what main activities sustained this relationship?
  - Can you please describe each of these activities?
    - a. For each one, I will ask you to indicate the following aspects:  
What was the **purpose/goal** of this activity? (**motive, role**)  
*For example, was the activity used to receive information from partners and reach a common framework, to offer information, to promote ownership, etc.?*
    - b. At which point of the process did this activity take place? (**stage**)
    - e. *Etc.*
- 

#### **In-depth interview scheme (SEEDS-team member)**

This semi-structured interview zoomed into the relation with the external actor(s) the interviewee (SEEDS-team member) interacts with during the development process. This was based on Fullan's (2007) notion on understanding perspectives and the characteristics that shape these perspectives, mentioned in the conceptual framework. The interview was similar to that of the inventory interview. This includes the role of the actor (RASCI), at what project stage the actors got involved, what the perceived outcomes of the relationship were and how the interviewee thinks this actor contributed to the final product or (eventual) development process. Additionally questions were asked about factors that promoted or inhibited the interaction with a certain actor. Table 11 in Appendix 3 shows the interview scheme. A few example questions are shown below.

- 
- Let's talk about the nature of the interaction you are mostly involved with.
  - How did the relationship start? (e.g. whose initiative was it/why did the actor get involved in SEEDS?)
  - Once the relationship established, what **role** did the actor play and what main activities sustained this relationship?
  - Can you please describe each of these activities?
    - a. What was the **purpose/goal** of this activity? (**motive, role**)
    - b. What did this activity look like? (**description**)
    - c. At which point of the process did this activity take place? (**stage**)  
*For example, was the activity undertaken during design, implementation, going to scale?*
    - d. Who was involved? (**actors**)
    - e. *Etc.*
- 

#### **In-depth interview scheme (external actors)**

This semi-structured interview with directly involved external actors focused on understanding the actor's agenda related to the SEEDS-project and the means by which they attempt to achieve those agendas.

Corresponding with the in-depth interview for the SEEDS-team member, issues that were addressed are incentives/motives (what were driving forces for participation in the SEEDS-project/what are the potential benefits etc.); How SEEDS fits in their work/business; their role in the

SEEDS-project (RASCI); and the perceived outcomes of the relationship. Also questions were asked about factors that promoted or inhibited the interaction with the SEEDS-project.

As in the inventory interview, a drawing tool to map actors was used to understand who influences the work of the external actor and what part SEEDS takes in this. This drawing tool was similar to that of the inventory study, except that the center actor now showed the interviewee (the corresponding external actor). Table 12 in Appendix 3 shows the interview scheme. A few example questions are shown below.

- 
- Let's talk about the nature of the interaction you are mostly involved with.  
How did the relationship start? (e.g. who's initiatives was it/why did you get involved in SEEDS?)
  - Once the relationship was established, what **role** did you play in this relationship and what main activities sustained this relationship?
  - Can you please describe each of these activities?
    - a. What did this activity look like? (*description*)
    - b. At which point of the process did this activity take place? (*stage*)

*For example, was the activity undertaken during design, implementation, going to scale?*

*e. Etc.*
- 

### Reflective journal

Throughout a period of three month, participant observation was applied. Based on the interviews the researcher attended discussions/team meetings and meeting with external actors, to understand curriculum development process and see how relationships manifest in practice. Data collected through participant observation were kept as field notes in a reflective journal. In the reflective journal information was recorded about (1) the schedule and logistics of the study, (2) a personal diary for reflection and growing insights, and (3) a log in which methodological decisions were described (cf. Lincoln & Guba, 1985).

### 4.4. Procedures

Figure 4 shows an overview of the data collection process, including the snowball strategy that was used to select the respondents. Before the interviews the respondents were informed about the study and relevant procedures. All interviews were audio recorded and confidential. Intermediate analysis and peer debriefing was done to help making (methodological) decisions and identify 'gaps' to direct further data collection. Member checks were about verifying interview interpretations. Results of the interviews were summarized and presented to the interviewees and feedback and/or clarification was asked.

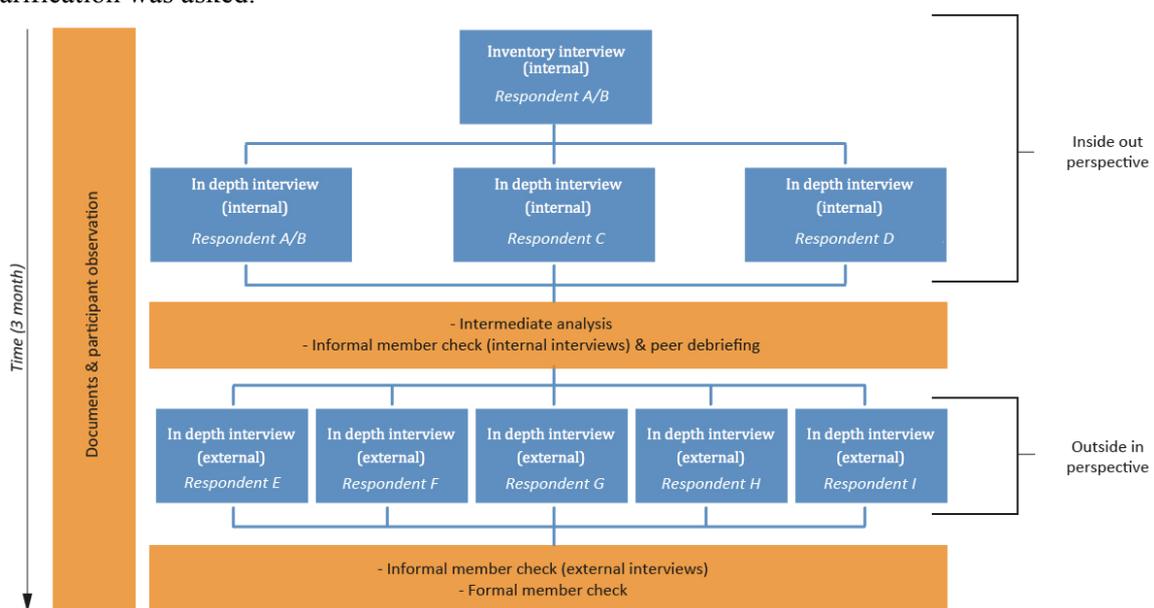


Figure 4 Data collection procedure.

#### 4.5. Data analysis

In this study directed content analysis was done to analyze the data; initial coding started based on the theory described in the conceptual framework and then, during data analysis, the researcher looked for themes that emerged from the data (Patton, 2002). Next to interview data, the documents and the reflective journal were analyzed as well. Documents that were collected are: contracts between the SEEDS-team and the publishers, proposals from SEEDS for funders, documentation on sites and centers, a publication about SEEDS (Cohen, 2011), final products and the SEEDS Facebook page (<https://www.facebook.com/SeedsRoots>).

All interview data was recorded and transcribed, after which the text was broken down in meaningful segments and encoded using Atlas-ti<sup>®</sup>. Themes were induced and clustered into categories corresponding to the research questions and literature themes.

Developing categories inductively from the data was done using the constant comparative method (Glaser & Strauss, 1967). The essence of the constant comparative method is (1) the systematic comparison of each text assigned to a category with each of those already assigned to that category, in order to fully understand the theoretical properties of the category; and (2) integrating categories and their properties through the development. As the coding evolved throughout the process, interpretative memos were kept. Appendix 2 shows codes that were used during analysis. These are both codes identified beforehand and codes that emerged from the data. Two independent researchers in the field of education used the codes to code parts from four interviews to determine inter-coder reliability (Krippendorff's alpha = 0.74, modest degree of reliability) (cf. Krippendorff, 2011; Hayes & Krippendorff, 2007).

After coding, an overview of the results was made, as well as a thick description for every actor substantiated by quotes. This way insight was gained into the ways in which external actors influence the curriculum developing processes and to understand how their role(s) shifts in time, and thereby enabled to determine the degree of involvement and support required from each actor/actor groups at different moments of the curriculum development process. This data analysis process and the other methods described in this chapter, used to study the case in depth, provided results that are described in the following chapter.



## 5. Results

*This chapter starts a description of the development process of SEEDS. After that both results on the identification of the actors and the actors' roles and motives will be presented in order to be able to answer the research questions in the conclusion chapter. Results show that the SEEDS-team goes through the development process of: plan/writing, pilot-testing, polishing, field-testing, polishing, publishing/implementation in which they involve relevant actors needed to go to scale and consider different contexts. Before, during and after the development process the following actors are involved by the SEEDS-team. Involved during development of the product are: publishers, teachers and students, professors/scientists (content experts) and the Graduate School of Education. Actors involved to set conditions for development are: researchers, funding agencies (private and public) and assessment agency. And actors involved to set conditions for (sustainable) implementation are: Teacher education providers, National Science Teacher Association, policy makers and (although not that much) the media. Most roles identified by both the SEEDS-team and the external actors are the 'supportive', 'consulting' and 'responsible' roles. The 'informative' role was only linked to the funders and the publisher was the only one identifying the 'accountable role'. Additionally the perspectives from five external actors involved in the SEEDS-project have been described. Most motives from the SEEDS-team to involve the external actors in the project focus on: establishing links with practice, setting conditions for sustainable implementation (e.g. alignment with different contexts, dissemination), ensuring substantial correctness/relevance and keeping their work up to date. External actors' motives to be involved in the SEEDS-project are mostly focused on supporting their ability to develop curriculum, forming a link between research and practice and supporting local capacity building. Actors related to the SEEDS-team are situated in all three systems of the linkage model. An overview of these results can be found in Table 6, Page 51.*

### 5.1. The SEEDS development process

Over the years, the SEEDS-team has refined a basic process that is well understood in the team. As the background information on SEEDS shows, many of the developers draw on developer, teacher and researcher mindsets in their work and the team consists of people with a science background, people with a literacy background and people specified in developing tests. Interview results and field notes show that their development process goes through the development of three prototypes before a final product is reached. The iterative development process as the SEEDS-team describes as follows: plan/writing, pilot-testing, polishing, field-testing, polishing, publishing/implementation. This is visualized in Figure 7 and described in more detail in Table 2.

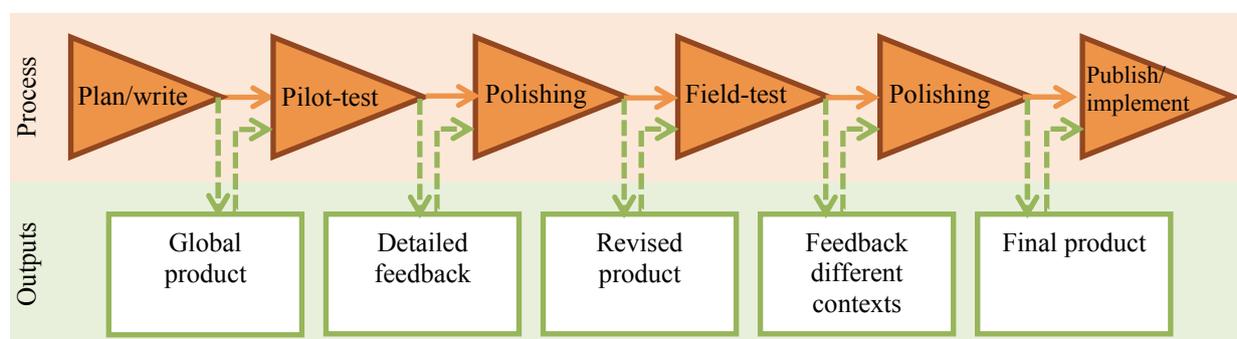


Figure 7 Iterative development process of the SEEDS-team.

**Table 2**

Description per phase.

<b>Phase</b>	<b>Description</b>
Plan/writing	Development of new lesson materials start with a +/- 2 day retreat in which the whole development team comes together on an off site location with the purpose to develop a platform of ideas that could serve as a design framework. The team members prepare for this retreat by conducting relevant literature reviews on content, common misconceptions, learning progressions and pedagogical content knowledge. National and state standards play an important role in this. After that the team breaks up in groups including literacy and science developers to flesh out the different ideas that resulted from the retreat and to start first design drafts on the content of different subjects of the new lesson series. Peer colleagues provide feedback on the drafts and literature is reviewed again. Once the content has been mapped out, a backwards design process ensues. First, the content is deconstructed, and designers distinguish main idea and composite ideas. Second, initial modules are created, based on the content orientation and the deconstruction outputs. Third, a rough outline (global prototype) – more resembling shorthand than a book or guide – is created for each module. The writing process goes on until a global version is ready and the main underlying ideas are worked out in parts of the materials.
Pilot-testing	When a global version is ready it will be piloted in the classroom context and content experts will be asked to review the materials. During pilot-testing people from the SEEDS-team go into the classroom and teach the materials while the teacher is observing and providing direct feedback.
Polishing	Based on the feedback resulting from the pilot-testing phase a group of designers is working on revising and completing a rough written version of the product in order to make it ready for field-tests. Additionally they make sure everything is accounted for (e.g. required materials, practical issues) and plan what they are going to test in the field-tests; what kind of feedback they are going to ask for.
Field-testing	The revised curriculum, which is nearly finished now, will be tested in different classrooms around the country. The purpose is to see how the curriculum works out in different contexts. Teachers can apply for participation in field-tests for which they have to fill in a survey. Results of the survey provide insight into different context variables (e.g. teaching experience, school type (e.g. rural), student population (e.g. English language learners)). Based on these variables a diverse range of teachers around the country is selected. During field-testing these teachers teach the SEEDS curriculum in their class and the SEEDS-team collects feedback from teachers and students, usually electronically.
Publishing/ Implementing	After another ‘polishing’ phase where feedback from the field-tests is incorporated into final versions, the curriculum is final and ready for publishing. From this point on implementation of the published curriculum into practice will start. This is outsourced, but the SEEDS-team stays involved in marketing, sales, professional development activities and work on correlating the units to different state’s science and literacy standards, as well as the National Science Education Standards.

Based on the specific project the SEEDS-team works on they can decide to integrate some sub-stages if needed. In the middle school project, for example, the SEEDS-team decided to do one extra pilot to inform themselves on middle school students and teachers as previous projects only focused on an elementary school population.

*“Last year when we were starting the middle school work we did what is called a pre-pilot. This is like a very first pilot before we got to the point of actually developing a whole unit. Because we were moving from elementary to middle school we wanted to kind of get some more information about the middle school students before we developed things so we did some smaller pilots with teachers. So the*

*project started in January and we got into classrooms by March or April with just a couple of teachers. So, but that is the first time that teachers got involved so early” (designer, SEEDS).*

At the point of data collection, the SEEDS-team has finished final products for SEEDS elementary and are thus in the implementation (into practice) phase. The development of the SEEDS middle school ‘Earth’ units is in the phase of pilot-testing and preparing for field-tests where one year of earth units is ready for grade 6. The development of the new sequence for SEEDS middle school, called Life Sciences, is just starting and thus in the phase of planning and writing.

Of course there was a motive to start developing the SEEDS curriculum program. Before this process started, SEEDS was initiated by needs from practice (needs phase in Figure 1). Changes in the national standards for the elementary curriculum (due to The No Child Left Behind Act of 2001) put more focus on math and literacy instead of science. Since the GEMS curriculum they had been developing and implementing for the last 25 years is a science program, it was not sufficiently well situated within the elementary school curriculum anymore. Most teachers didn’t want to teach science separately since they would be assessed by the performance of their students, related to the standards. The development team reckoned that they needed to provide teachers with materials that could help them meet the standards related to English language arts and literacy. To keep the science into the curriculum, they thought of integrating literacy instruction with science content. First products consisted of the inquiry base of GEMS infused with a reading and writing platform, but most products have been developed from scratch.

*“We decided that there was a need out there that wasn’t being met, that we needed to provide teachers with materials that could help them meet standards related to English language arts and literacy. Things that there was more pressure to teach math and literacy and particularly we were hearing we just don’t have time to teach science unless it also helps us teach literacy. So our first motivation was sort of narrow, and that was, well if science is going to get taught, and become useful for teacher than we have to involve literacy. So that’s when we decided we needed a new program” (management SEEDS).*

*“So basically what we did, the way I like to think about SEEDS is that we took the inquiry base of GEMS and then we infused a reading and writing language platform into it and without compromising the integrity of that inquiry base. I mean that is the logic” (external partner and management SEEDS).*

Summarizing, the curriculum development process used in SEEDS can be characterized as an iterative development process that goes through the stages of: plan/writing, pilot-testing, polishing, field-testing, polishing, publishing/implementation. The process is well known amongst the developers who can tailor it to the nature of the project they are working on. SEEDS got initiated by changing national standards that put more focus on math and literacy. These changes caused more pressure on teachers to teach those subjects instead of science, which was the subject of the SEEDS-teams’ previous program called GEMS.

## **5.2. Actors involved in the SEEDS curriculum development process**

Table 3 shows an overview of the actor groups from the spider’s web that are involved with the SEEDS-team. Included is in what stage of the curriculum development process the actor is involved, in what system of the linkage model the actor resides and the extent to which the actor is involved. An overview of roles and motives for these actors, as well as a thick description, will be provided in sections 5.3 and 5.4.

**Table 3**

Directly involved actors in SEEDS elementary and SEEDS middle school.

<b>Actors</b>	<b>Phase</b>	<b>Linkage model</b>	<b>Involvement rating<sup>a</sup></b>
<b>Textbook writers/publishers</b>			
• Publishers	Throughout the whole development process and implementation (in practice)	Linkage system	+
<b>Teachers and students</b>			
• Teachers	Pilot-testing, field-testing, planning/writing	User system	+
• Students			
<b>Research organizations</b>			
• Professors/scientists (content experts)	Planning/writing, polishing	Resource system	+
• Graduate School of Education	Planning/writing, polishing, Implementation	Resource system	+
• Researchers	Before planning/writing	Resource system	+/-
<b>Professional associations</b>			
• Teacher education providers	Implementation	User system	-
• National science teacher association	Implementation	Linkage system	-
<b>Foundations</b>			
• Funding agencies (private and public)	Depending on the agency, but most actively in the planning/writing phase	Resource system	+/-
<b>Policy makers<sup>b</sup></b>			
• Local <sup>c</sup> : District leaders, program officers, curriculum coordinators, directors of education, directors of museums	Implementation	User system, linkage system	-
<b>Assessment and monitoring boards</b>			
• Assessment agency	Planning/writing	Resource system	+/-
<b>Other</b>			
• Media (Academic and non-academic)	Implementation	Linkage system	-

*Note a:* The ‘involvement rating’ emerged from interview data and field notes, and was categorized as follows: Involved during the development of the product (+). Involved to set conditions for development, but not involved during development of the product itself (+/-). Involved to set conditions for (sustainable) implementation, but not involved during development of the product itself (-).

*Note b:* This relation is not especially established for the SEEDS-project; it was an already existing connection, but one the SEEDS-team uses (amongst other means) to spread the materials and to set conditions for sustainable implementation (e.g. on site support).

*Note c:* local policy makers are policy makers on state or district level, not on national level.

Most intensively involved is the publisher, who is involved throughout the whole development process and during implementation of final products into practice. Also actively involved during the development process are teachers, professors/scientists (content experts) and the Graduate School of Education. Knowledge, experience and input of these actors are used during the development of the product. Also important for the curriculum development process but not involved during the development of the product itself are researchers, funding agencies and an assessment agency that is developing the next standardized tests. The involvement of these actors are important to set conditions for development. Actors important to set conditions for sustainable implementation are (pre) service teacher providers -mostly involved in professional development-, the National Science Teacher Association, local policy makers and the media.

Some of these actors are both directly and indirectly involved with the SEEDS-team. Indirectly involved actors are:

- Teachers and students that use the materials but are not involved in pilot and field-testing. (Often involved through publishers and their own network's sites/centers).
- Policy makers, involved through publishers and their own network's site/centers.
- Principals and school boards, involved through publishers and their own network's site/centers.
- Media, involved through publishers (publishers are using media to spread the product and to provide some support (through social media like Facebook and twitter)).
- Professors, involved through their own network's site/centers (e.g. a network center involves professors to help explain the content in professional development activities).
- Parents, involved through their network's sites/centers (this is based on one example of a museum that developed a home-schooling variant of the SEEDS-team's curriculum materials as a response to the increasing home schooling initiatives by parents)

Summarizing, results show that the SEEDS-team involves salient actors during the development process. The following actors are involved. Involved during development of the product are: publishers, teachers, professors/scientists (content experts) and the Graduate School of Education. Involved to set conditions for development are: researchers, funding agencies (private and public) and assessment agency. To set conditions for (sustainable) implementation are: Teacher education providers, National Science Teacher Association, policy makers and (although not that much) media. Actors related to the SEEDS-team are situated in all three systems in the linkage model.

### **5.3. Roles and motives from the curriculum developers' perspective**

Results about the roles and motives of the actors directly involved in the SEEDS case are described in this section. Since both an inside-out and an outside-in perspective were investigated, this section will start with a description of the roles and motives from the curriculum developers' perspective. The roles and motives from the external actors' perspective will be discussed in the next section

Table 4 presents an overview of the actors and RASCI roles that correspond to these actors according to the SEEDS-team. Additionally it shortly describes the motive for involving a certain actor in a certain role in the SEEDS-project, according to the SEEDS-team. After that, a thick description is provided for every actor that includes (1) how the relationship got initiated, (2) the motive for the relationship (purpose and nature) from the perspective of the SEEDS-team and (3) a detailed description of the actor's role in the development process (from the perspective of the SEEDS-team).

**Table 4**

Actors with corresponding RASCI roles and motives from the curriculum developers' perspective.

<b>Actors</b>	<b>RASCI roles</b>	<b>Motive (from curriculum developers' perspective)</b>
• Teachers and students	Responsible, accountable	Link to practice.
• Teacher education providers (e.g. on-site professional development providers)	Supporting, responsible	Setting conditions for sustainable implementation (e.g. building capacity, tailoring product to specific context, local presence).
• Local policy makers	Supporting, responsible	Link to practice, making supportive on site decisions (about e.g. resources) to support implementation.
• Publishers	Supporting	Link to practice, disseminating product, 'rolling out' product.
• National teacher association	Supporting	Disseminating product, creating awareness/basis of teachers' support (through workshops).
• Media	Supporting	Disseminating product/creating awareness.
• Assessment agency	Consulting	Informing their work for alignment with standardized tests.
• Professors/scientists (academic advisors)	Consulting	Informing their work to improve correctness of content of curriculum.
• Researchers	Consulting	Informing their work with research on specific issues they encounter during development, keeping their work up to date, credibility.
• Graduate school of education		
• Funders	Informing	Setting conditions for development (financial support).

**Publishers**Initiation of the relationship:

The initiation of the relationship with the publisher goes both ways; the SEEDS-team puts out a request for proposals and interested publishers bid, from which the SEEDS-team chooses the publisher that they think fits best.

Motives for the relationship:

Motives for involving the publisher mentioned by the SEEDS-team are to establish a link with practice, expert advice to improve the product, supporting the dissemination of the product, supporting development and implementation, and alignment of their product to different educational contexts. Each of these motives is explained below:

- Link with practice: The publisher facilitates the interaction with practice (e.g. teachers) as the publisher's network is one of the means to spread (and sell) the materials and reach the users (e.g. teachers).
- Advice: The publisher's expertise lies in the area of (graphical) design (layout & usability) and sales & marketing. Additionally the publisher has a close relation to practice and can advise the SEEDS-team on practical issues and demands.
- Spread: The publisher helps disseminating the product across the country using the publisher's network.
- Setting conditions for development and implementation: The publisher provides part of the financial resources to support the development and implementation process and takes over

most part of the implementation, for example by taking over professional development and support activities from the SEEDS-team.

- Rolling out into practice: The publisher helps to align the curriculum products to new educational contexts and classrooms.

#### Role in development process:

The publisher is getting involved in the early stages (planning/writing) of the project and stays involved until the very end (implementation into practice). The relationship with the elementary school publisher and middle school publisher are not entirely of the same nature. The relation with the middle school publisher is a more collaborative relationship (the publisher is involved right from the start and has an impact throughout the whole development process (different drafts go back and forth). The elementary school publisher is also involved from the start but is more focused on sales, marketing, kit development and editorial input, but less on substantive issues.

The team is collaborating with the publisher on designing the curriculum materials and marketing/sales of the eventual product (e.g. through conferences, brochures, Internet). The publisher takes over professional development from the SEEDS-team, after the SEEDS-team trains the publisher's consultants from all over the country.

Involving the middle school publisher in the development process from the start resulted in more fruitful relationship with a stronger mutual understanding and respect towards the products. Both parties invest (not only on money basis but also on a more 'emotional' basis (ownership)) in the work and important organization-related details (e.g. the goals and approaches) are better aligned.

*"I think its more how we fit into their goals. So with the elementary publisher we are just a little piece of their portfolio and they have other projects that are more profitable"* (designer, SEEDS)

The professional development of the publishers' sales representatives, for example. Professional development for publishers' sales representatives in earlier stages helps implementation and dissemination. Through workshops the representatives are taught about underlying ideas and principles of the SEEDS curriculum materials.

*"It became a problem that we haven't felt like the elementary school publisher really understood the integrated approach. Because SEEDS was so new to their salespeople, a lot of them just never really put it to the front because they did not know how to sell it. So you know really fundamental stuff that they struggled with. So we did some training for the sales representatives to get them up to speed about the underlying principles, you know, and I think the fundamental issue is about training and really getting them to know the products."* (coordinator, SEEDS)

*"So with the elementary school publisher we did some training for the sales representatives, and that is happening now, long after we finished the program and when they are trying to sell it, because the need for this was not recognized earlier. With middle school publisher it will happen earlier because I think that they might realize that they need this training. So, I think we would train them about the approach and they train us about the technology. They might want to have it, as they start to market the first commercial version of the curriculum"* (designer, SEEDS)

The intensive collaboration with the middle school publisher influences the final content of the materials. Although the SEEDS-team does officially have the last say on the content, feedback on how they interpreted (for example translating specific content to images) does change and improve the content.

*"We get the final say on content. This is an essential part of our contract. As an academic institution, we need to have control over our academic work. They are not allowed to change the content against our will. But that said, in many cases there is negotiation, and I think they sometimes have great ideas. In the end, however, it is our decision whether or not to take their input"* (management SEEDS).

The less collaborative relationship with the elementary school publisher results in less impact on the content of the materials but does have some impact due to certain publishing-related requirements.

## **Teachers**

### Initiation of the relationship:

Teachers and students are directly and indirectly involved. Teachers and students that are indirect involved with the SEEDS-team are teachers throughout the country that use the commercial materials, bought through the publisher. Direct involved teachers and students are a selection of classrooms with teachers (with a range of different characteristics) that participate in pilot-tests and field-tests. The field-tests-participants have a more distant relationship with the SEEDS-team than the pilot-test-participants.

### Motives for the relationship:

The motives to involve teachers and students during the SEEDS-team's professional development process are to establish a link to practice and foster implementation and quality of the materials by:

- Exchanging knowledge and experience with teachers in the field.
- Asking teachers and students to provide feedback on, and ideas for improving the materials' alignment with practice and contextual/practical issues.
- Fostering teachers' acceptance of the materials and creating a basis for teachers' support.

### Role in development process:

The SEEDS-team has a strong relation with teachers during the curriculum development process. Usually, the first moment teachers and students get involved is during the pilot stage. In case of uncertainties about the needs and nature of the audience a pre-pilot is done even before a whole unit is developed (also see section 5.1). After that, teachers are involved again during field-tests and again during the implementation of the materials. In a way teachers are involved throughout the whole development process since almost all the curriculum developers of the SEEDS-team have a background in teaching. The SEEDS-team tries to keep the knowledge and experience that come with teaching up to date by hiring people with recent teaching experiences, keeping the connection to the practical field fresh.

*“Pretty much all the developers have a background in teaching. That was actually one of our considerations when we did some new hiring's. Getting some people with recent teaching experiences was one of our priorities. Because you know all of us are teachers but for me, I have been out of the classroom for 7 years. So as we do this job we get further away from our classroom experience”* (designer, SEEDS).

During pilot-tests the SEEDS-team uses prototypes of the materials to teach a small group of classes. Teachers observe and provide direct and detailed feedback. During field-tests a big group of field-test teachers from a diverse range of contexts around the country teach the units to their class. Teachers and students provide feedback through surveys, usually electronically. The purpose of the field-tests is to see how the curriculum materials work out in different contexts so it will be easier for teachers to implement successfully. At the point of this study 150 classes and 4331 students were already recruited for field-tests in the middle school project.

*“So one of the big purposes of the field-tests is to see if these materials can work in many different classrooms with different kind of teachers and different kinds of kids. So that is the criteria, diversity. So they do need to apply, for which they fill in questions on a survey. So we ask them things like how long have they been teaching, what kind of a school they teach in, is it urban, sub urban, rural etc. do they have English language learners in their population and then we look at those variables and try to make sure we have a mix. And based on their feedback we polish the units so they are easier for teachers to successfully implement”* (designer, SEEDS).

Additionally the SEEDS-team created teacher advisory groups of about six teachers that are occasionally involved to provide feedback and input on the SEEDS team's designs. Currently the teacher group consists of Californian teachers. They plan is to set up a second group of teachers all around the country.

*"We have a teacher advisory group. So these are teachers that come up here and sit around this table and we ask them questions and get advise and run things by them. We are making a second group of teacher advisors that is going to be across the country because teachers around here are different from other teachers and that is one of the reasons. We are going to use the big screen, doing a kind of webinar, regular meetings with teachers to get their input and their feedback"* (management SEEDS).

After materials are published most of the process of implementation is taken over by the publisher, the SEEDS-team does however stay involved and therefore also come in touch with teachers during workshops activities. Another way the SEEDS-team is involved with teachers and/or students is through research projects (also see the description about the researchers).

*"We have some research studies where teachers have been using our materials but they are just different in terms of the kind of data we collect. In those cases we might be interviewing the teachers or research studies so it is different then piloting or field-testing"* (designer, SEEDS).

### **Professors/scientists (academic advisors)**

#### Initiation of the relationship:

The initiation of the relationship with academic advisors goes one way; the SEEDS-team calls in specific chosen experts, which get paid in return. They come in touch with these experts through other advisors/researchers, informal contacts of members from the SEEDS-team or by reading about the expert's work.

#### Motives for the relationship:

The SEEDS-team involves academic advisors in the project to inform their curriculum materials with the advisor's resource of expertise in two ways: (1) gaining (up to date) insights and inspiration from research to be used in the SEEDS-project's models and prototypes, and (2) gaining substantial feedback on prototypes. Academic advisors are chosen based on what the SEEDS-team needs to learn. Additionally academic advisors are used as a mean to connect to other relevant contacts in the 'research world'.

#### Role in development process:

Although categorized under research organization in the actors' spider's web, the academic advisors involved in by the SEEDS-project are individuals that are called in by the SEEDS-team to inform and help improve the curriculum products. The advice is focused on either reviewing the content or sharing knowledge in a specific research field that the team is missing (e.g. integrating technology in education). The content experts or academic advisors are involved occasionally throughout the whole development process, from deciding on conceptual territory during the planning/writing phase to reviewing prototypes and finished products during polishing phases.

*"But early on we invite scientists around the table as we are trying to decide what the conceptual territory should be for the units. So we get their input early. We just invited them and learned from them and then we started to produce things. And then we would invite them back and show them what we are doing. So subsequently we invite them to give us feedback. We have scientists who review the products we create, so we have a content review that happens"* (management SEEDS).

*"The advisors typically we invite them and they come and visit us once a year and they talk about their work, we talk about our work and they give us advise so that's the main activity and often there will be some email consultation in between"* (designer, SEEDS).

An example is the start of the ‘Life Science’ sequence where scientists were involved before the actual start of the project to determine the conceptual territory. Field notes of a meeting with one of these academic advisors show that the advisor provided the SEEDS-team with scientific models and theories relevant to the project, and concrete ideas about ways to apply the models and theories to the SEEDS-project’s specific work.

## **Researchers**

### Initiation of the relationship:

Usually researchers initiate the collaboration with the SEEDS-team. The SEEDS-team comes in contact with researchers through the relations with academic advisors or other scientists (e.g. the connection with the Graduate School of Education).

### Motives for the relationship:

The SEEDS-team involves researchers in the SEEDS-project to inform their work with research on specific issues they encounter during development of the materials. Additionally researchers are involved by the SEEDS-team to keep the curriculum materials up to date and to gain legitimacy/credibility over their work.

*“Absolutely, I think it is the people that work on it that keep it up to date with research because I think that they have a conviction that they need to make sure that their work is research based and I think that they’re constantly updating knowledge about the latest research. You know and I am always bringing in new ideas and also the people who are involved because the people who are trained in the Graduate School of Education to do research and development they bring that same disposition to the project. It is the connection with the people who receive their graduate in a situation that development theory and research based practices is you know a fundamental value”* (external partner and management, SEEDS).

*“We try to publish the research findings as well. We feel like it is something we are not very preliminary to think about and we should spend more time on, because it is valued so much in certain communities”* (designer, SEEDS).

### Role in development process:

Researchers are consulting the SEEDS-team by involving the SEEDS-team in research projects that use the SEEDS materials and are directed by questions the SEEDS-team have.

*“We had various research projects where researchers have been using our materials that have been driven by the questions we have when we are developing”* (management, SEEDS).

The research projects are not necessarily employed during the development process of a specific product but results are used in the SEEDS-project’s planning/writing phases. For example, at the point of data collection a research project on how curriculum materials can support teachers in accommodating English language learners is being employed. In this research SEEDS materials are used in different conditions in order to make a comparison. Usually the SEEDS-team is to some extent involved in research projects as the team influences the direction of the research and help in collecting data.

## **Graduate School of Education**

### Initiation of the relationship:

The relationship was initiated by the SEEDS-team as the director asked one of the Graduate School of Education’s researchers to be co-director in the SEEDS-project. This particular individual has a background in the field of reading and literacy. Additionally the relationship started as a lot of PhD and master students are involved with the Lawrence Hall of Science and now as researchers in the SEEDS-projects.

*“I got a phone call from the SEEDS director and she invited me up to talk about this project. It made a lot of sense to me and so I became a co pi on the first grant that we submitted to the funder and then I got one of my postdocs and a few graduate students involved”* (external partner and management, SEEDS).

*“Many of the people that work on SEEDS actually come from the Graduate School of Education, so several doctoral students and master students, and I would say that a third of the staff here probably have degrees from the Graduate School of Education so in a sense the Graduate School of Education is kind of a pipeline for SEEDS. And we are promoting for the people to come down and share their activities with the Graduate School of Education; we do that usually once a year. And then I am just trying my best to engage the people from SEEDS and getting students to come to SEEDS and work on the projects”* (external partner and management, SEEDS).

#### Motives for the relationship:

SEEDS involved the Graduate School of Education for the content expertise (reading and literacy and other experts that were brought in by the Graduate school of Education), to establish a link to research (to bring the research-side into the project) and to foster dissemination of the curriculum products.

#### Role in development process:

As the co-director has a background in literacy and reading, from the beginning of the SEEDS-project he has provided a high level of guidance on literacy and reading content. This particular individual is involved throughout the whole process and beyond; next to writing, editing and reviewing prototypes and assessments in argumentation, the co-director assists in writing and editing all proposals (for e.g. funders), and disseminating the SEEDS program (e.g. he speaks to school district officials interested in adopting the programs).

Additionally, as also mentioned in the description of the researchers, the Graduate School of Education involves researchers in the SEEDS-projects to do research on issues and questions the SEEDS-team encounter during development of the program.

*“I bring the literacy perspective to the project. So I work on developing the prototypes, for what we are going to do for the reading and writing side of things. You know planning for the content specifications, reviewing and advising on where we are heading and looking at prototypes and giving advise and sort of sign off on those. I have actually written about 4 or 5 of the books so I do write some of the books. And then I also do a lot of I guess what you might call the public face of it. I do a lot of presentations for teachers and researchers on SEEDS and you know I talk to reading groups about it, I talk to science research groups. So I have done a lot of stuff. Spreading the word about SEEDS”* (external partner and management, SEEDS).

### **Funding agencies**

#### Initiation of the relationship:

The SEEDS-team initiates the relationship with funding agencies. The team submits proposals to (public and private) funders who decide whether or not to give out grants to the SEEDS-projects.

#### Motives for the relationship:

Funding agencies are involved for financial support that is needed to be able to develop curricular materials (The SEEDS-team are a self funded department within the Lawrence hall of science).

#### Role in development process:

Foundations are mostly involved before or in very early stages of the process as they facilitate the SEEDS-team through providing funding. Depending on the funder, but usually on annual basis, the SEEDS-team informs the funder on progress and results by submitting progress reports or presenting a

poster. Most funds come from a federal funding agency but also private foundations are involved. Next to grants for curriculum development initiatives the SEEDS-team has research-based grants.

*“Well we actually have a grant that is more research based where we are trying to investigate the similar fact how curriculum materials can support teachers in accommodating English language learners. So it is more of a research study but our materials are used. So for that study we did classroom observations, we did interviews and we did all kinds of more intensive data collection with these teachers”* (designer, SEEDS).

### **Local policy makers**

*E.g. district leaders, program officers, curriculum coordinators, directors of education, and directors of museums).*

#### Initiation of the relationship:

The relations with local policy makers are not especially established for the SEEDS-project, but were an already existing relationship initiated during the GEMS period. However, the relations with local policy makers are used (amongst others means) to spread the SEEDS materials and to set conditions for sustainable implementation (e.g. on site support). These local policy makers are leaders in powerful positions and member of the GEMS network sites and centers. The network consists of about 70 different sites and centers throughout the USA, including large service areas (e.g. school district and county offices) (40%), universities that are training teachers (30%) (Mostly GEMS, but also SEEDS materials are used as part of the curriculum), and public science centers (e.g. large museums and institutions that have education as part of their program) (30%).

*“These folks are very dedicated leaders they are often in powerful positions within their regions. They’re working at county offices as curriculum and science coordinators or they are directors of education of museums....”* (coordinator, SEEDS).

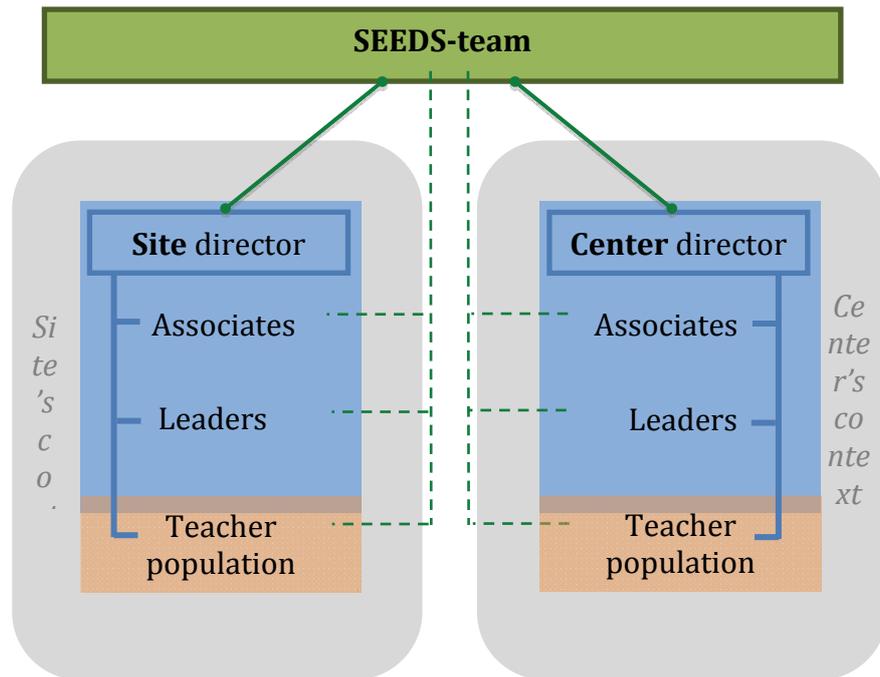
Purchasers of the materials reached out to the SEEDS-team in order to learn how to built capacity in their region and learn how to use the materials to its maximum potential in their contexts.

*“Not all of them, but most of them actually called us to find out and learn how to use the material in a more quality way, ‘can you come to us and help us do that’. They have reached out to us, starting about 20 years ago to partner with us, to help them build capacity in their region to help with the implementation of the material. We haven’t been proactive about this at all. There are so many inquiries and it’s just a matter of funding for people”* (coordinator, SEEDS).

People learned about GEMS through marketing in educational catalogs, which in the SEEDS-project is arranged by the publishers. Additionally, people who attend workshops provide contact information and nowadays the Internet has a strong influence on how people learn about the SEEDS-products. The relationships in the GEMS network go back for a long time (+/- 20 years) and are very strong.

*“So when it became time to start the original field-testing, we went to the network, I mean put it out there, we are looking for this kind of thing and.... because these partnerships are so strong, we love them, they love us, we are like family, its a very collaborative dynamic. And its on our website. Every time we have a field-test opportunity it’s on the site. So anyone can sign up there”* (coordinator, SEEDS).

For a better understanding of the underlying principles of these relationships, the network’s structure is visualized in Figure 8.



**Figure 8** Visualization of the network's structure.

The SEEDS-team has direct contact with a site's director or a center's director. The director coordinates the site or center locally. Additionally the SEEDS-team trains associates, leaders and teachers. Associates are people that received a 3-day workshop from the SEEDS-team in which they get taught about how to provide professional development activities to improve other teacher's practices. Associates are trained to present workshops for leaders and teachers. Associates and leaders share their knowledge amongst educators and train teachers in using the materials. The teacher population is overlapping with the site/center since parts of the teacher population are associates and leaders.

*“So when we launch a center, they have two people from their location who come and become associates and they go through our leadership training. Then we sent a team of two, and they do, and we help them, they recruit anywhere from 20 to 60 local leaders that they want to invest in and we come and we do a co-presented workshop with those two people who we trained. So we have a leadership component we train in how to use the materials, and what we are hoping we are doing is just starting what will become a series of workshops that those two people who we trained will do and they will train other people so the population swells and we get more people doing this” (coordinator, SEEDS)”.*

Motives for the relationship:

The SEEDS-team started and sustained these relationships to maintain a link to practice (schools), support implementation and to be able to influence on-site decisions making. The people at powerful positions are often involved in important decisions that influence the usage of their curriculum program (about e.g. resources). Also, decisions about what needs to be taught on both national and state level have a great impact on how materials are developed. School districts, regional service providers, governmental grants and private foundations, for example, can provide funding for sites and centers.

*“In many cases there are sites that the people that run the sites are very much involved in making decisions about what curriculum get used in the schools” (coordinator, SEEDS)*

*“So the decisions about what should get taught are both at the national level and the state level and so in both cases those decisions have a big impact on what we need to do and how we need to produce materials that can be allowed to be used” (designer, SEEDS).*

*“Yes, and for example also at a school district level, they make a decision that will enables us to work in the district or not or for them to use our materials or not” (management, SEEDS).*

#### Role in development process:

For the SEEDS-team, actors from this network are mostly involved during field-tests and the implementation into practice. Teachers are stimulated to take part in field-tests through the sites and centers. During implementation into practice the sites and centers support the dissemination of the product and support capacity building needed for using the SEEDS-products into practice. Sites and centers function as context specific ‘support points’ that are located in different states and countries. Both are formally affiliated with the GEMS and/or SEEDS-project. Typical activities and tasks of centers and sites are:

- Presenting workshops on a regular basis for teachers, leaders and associates.
- Providing lending libraries for teacher that lend out guides and materials required to teach the curriculum products.
- Distribution of GEMS and/or SEEDS newsletters and brochures.
- Trial testing new materials.

#### *Usage of the GEMS network in the SEEDS-project*

For the elementary school project, SEEDS workshops are promoted through sites/centers and through the publisher. This is still in an early phase and building a ‘SEEDS network’ is in progress. At the point of this study, center and site directors are made aware of the SEEDS curriculum materials. About 16 sites are supporting SEEDS. Directors that adopted SEEDS have received training and are working on setting the new materials into place.

*“...so as we grown seeds of science one of the places that of course we started was when we bring out the word to network directors. So for the new materials we provided them with training in SEEDS of science and they can go back and start work to set the new materials into place” (coordinator, SEEDS)*

*“We make sure that we go to conferences and present there and we call these awareness level workshops, so that we are giving the word out about what we do. The next level up are competency workshops and then the next level up are leaderships kind of workshops. For instances the school district in New Jersey are using the full Elementary program for second, third, fourth, and fifth grade. Four of us will spend time with these teachers from nine Elementary schools in the district who are just going to brand new use the program. So in that case they have a very specific need and that is to use the materials in their schools. And we will also work with some leaders at their site to build the capacity of those leaders and then those leaders will be there supporting those teachers” (management, SEEDS).*

For the middle school project the network is used to recruit schools for SEEDS field-tests and pilot-tests. Recruiting schools for field-tests and pilot-tests also contributes to making people aware of the products, spreading the word and giving people the opportunity to discover the new materials. Eventually the GEMS network and the concept of it will be used to support implementation and dissemination of SEEDS as well although the publishers network plays a more important role in this.

*“What is different about the this publisher relationship is that they also contributed significantly to the cost of developing the materials. So, they have got, you know, in the millions of dollars invested in the product line. And so they want to recoup that and have his be a successful product line. So they are out actively selling and marketing in a way that has more aggressiveness and punch to it. So while the network is a nice entry in some districts, they are not going to go out and say you really need to buy this, let me do what I can to prove to you that this works etc. where as the sales people will do that because that what they make their living on. So the network has proven to be a nice doorway for those sales people as it gets them the introductions to new potential purchasers and to people that are important in making decisions about what curriculum gets used in schools” (coordinator, SEEDS).*

## **Teacher education providers**

### Initiation of the relationship:

There are two kinds of teacher education providers involved in the SEEDS-project. The SEEDS-team is mostly involved with (local) professional development providers for in-service teachers, but the team is also involved with pre-service teachers programs that are using the SEEDS materials as examples. The relationship with the professional development providers are either initiated through the publishers or through the sites/center network. The pre-service teacher programs reached out to the SEEDS-team. Relationships with pre-service teacher programs are often initiated through the sites/center network.

*“I can think of multiple cases but one that I can think of most recently is where two of us went down and worked with the pre-service providers and what they want to know is approaches and methods exemplified in our materials so they can use them with their student teachers” (management SEEDS).*

### Motives for the relationship:

The motive for the SEEDS-team to involve the in-service teacher programs in the project is about setting conditions for sustainable implementation. In-service teacher professional development fosters capacity building and local support (tailoring their product to a specific context, local presence). The pre-service providers are interesting for the SEEDS-team because it provides the team with the opportunity to promote a deeper understanding about underlying principles of the SEEDS materials in the teacher population. Additionally the SEEDS-team hopes to initiate a ‘ripple effect’ as the pre-service teachers can pass on their knowledge and eventually spread the SEEDS’ work when they get hired in schools.

*“They want us to come and help them by either talk to their students directly or train them to teach their students about SEEDS. We are also of course very interested in that. First of all because we believe in the approach and we think that is a good one for anyone to use. Regardless of whether they use our materials or not we just think that the integration of science and literacy is very powerful. And than reason number two is that the more people that know about our program the better of we are, so yeah its certainly important for us but I don’t think we have been the one initiating any of this so far” (designer, SEEDS).*

### Role in development process:

Pre and in service teacher education providers and professional development providers are involved after publishing, supporting the implementation of the product. They support implementation through capacity building in a region, correlating the SEEDS program to the local standards and tailoring the SEEDS program to specific contexts within the region. They function as a local support point for teachers and schools. As these professional development providers are connected through the sites and centers, their role is also described in the policy makers’ description.

*“I mean is it true that the differences can be pretty big between states. First of, we actually don’t make it very obvious what grade level it is for at the front of the books. So what we are doing and what we are finding is that in some cases people are moving the unit to the grade level where it is appropriate for in their state and the sites but also the publishers, that offer professional development, often help in correlating those standards” (coordinator, SEEDS).*

## **Assessment agency**

### Initiation of the relationship:

At the point of this study, the relationship with an assessment agency relationship was about to start. For SEEDS middle school the SEEDS-team involved an assessment agency that is developing the next generation of standardized tests. The relationship got initiated through one of the funders who wanted the SEEDS-team to inform the assessment agency on the SEEDS-project and to get advise on testing from the assessment agency.

*“This assessment agency got some huge amount of money to develop the next standardized test. [Funder] says we want you to be talking to them about what your doing so that we can influence them but they also want us to kind of know what is happening there. So, they think of us as more nimble and able to try some innovative things than these bigger agencies”* (management, SEEDS).

#### Motives for the relationship:

The SEEDS-team’s motive to involve the assessment agency in the project was to make sure the SEEDS curriculum is consistent with the new standardized test and to consult on how to develop tests for the SEEDS-project. Vice versa the SEEDS-team is going to give substantial advise to the assessment agency (and thus influence them) as the SEEDS-team is developing a relatively innovative curriculum.

#### Role in development process:

The assessment agency is involved during the planning/writing phase and will be involved during polishing phases. During these phases they will be consulting the SEEDS-team on how to develop tests for their new units and how to make these tests consistent with the new standardized tests the assessment agency is going to develop.

### **Media**

#### Initiation of the relationship:

The SEEDS-team is not very pro-active in initiating this relationship. There are two kinds of media involved: academic publications and commercial publications (e.g. newspaper). The commercial kind is mostly done through the publishers but occasionally journalists reach out to them for interviews. Researchers working on their project mostly do the academic publications but since most researchers are connected through the Graduate School of Education, members from the SEEDS-team can be co-authors as well.

*“I think that in theory the media could be directly relevant to our work were doing but we haven’t been very active in doing that”* (management, SEEDS).

*“I mean we try to get publicity and we do sometimes but we don’t do that intensively ourselves, but our publisher certainly does. I think there are two dimensions to that. I think there is publishing in journals, like the more research academic type, which we try to do. And then there is more like the marketing kind. Like once in a while we get a newspaper article written about our curriculum in a particular area or region and that is great. But our publisher tries really hard to sell our products so they advertise in journals and stuff like that, so they actually do the marketing”* (designer, SEEDS).

#### Motives for the relationship:

Motives for involving ‘the media’ is to foster dissemination and awareness of their curriculum program and to contribute to research through the research projects.

*“So and then the publisher tweeted the article and put it on Facebook and you know, various things to get the article out”* (coordinator, SEEDS).

*“We also do academic workshops in which we are presenting our findings and what our contributions are to the field of science and literacy education”* (coordinator, SEEDS).

#### Role in development process:

The media do not have a clear role during the development process but are needed afterwards to set conditions for implementation (see motives).

## National science teacher association

### Initiation of the relationship:

The relationship with the national science teacher association is a one-way relationship, which SEEDS initiates by doing workshops and presentations at their conferences.

### Motives for the relationship:

The SEEDS-team established this relationship to foster dissemination and awareness of their curriculum program amongst science teachers and to create a basis of teachers' support through workshops. Many teachers are involved with this association.

*“So another way that happens is that many people got involved with the national science teacher association and they are paying attention to workshops and we always put on workshops” (coordinator, SEEDS).*

### Role in development process:

The association does not have a direct role during the development process but they are needed to set conditions for implementation.

*“We often are doing the workshop as commercial workshops, so the publisher is actually purchasing exhibit store place and a room, and we do our workshops in that room and we are in the conference program. It's a package thing and in this case if you're doing a commercial workshop” (coordinator, SEEDS).*

## 5.4. Roles and motives from the external actor's perspective

Table 5 presents an overview of the external actors including the RASCI role and motive for getting involved in the SEEDS-project. The roles and motives are from the external actors' perspective. After that a more detailed description of the actors' perspective will be provided. These results are only from the specific external actors that were interviewed for this this research.

**Table 5**

Roles in SEEDS perceived by external actors and their motives for involving SEEDS.

<b>Actor</b>	<b>Role</b>	<b>Motive for involving SEEDS</b>
• Publisher (2 <sup>a</sup> )	Supporting, accountable	Setting conditions for development (supporting development so they can sell the product), alignment with practice.
• Researchers/academics <sup>b</sup> (1)	Consulting	Link from research to practice and vice versa, SEEDS is integrating research findings in their work and can contribute to research because of the innovative nature of their work.
• Graduate School of Education (1)	Supporting, consulting	Link from research to practice (making sure that the research they do get in to practice), advising on literacy content, supporting spread of the product.
• Teacher education providers (e.g. on-site professional development providers) (3)	Support, responsible	On site support, flexible curriculum program, link to educational practice (e.g. schools and parents), capacity building for teachers in a region and to support the educational aspect of the museum).
• Teachers <sup>c</sup>	Responsible	Deep learning experience, advocate for better materials, help tailor to own context

*Note a:* unfortunately only one of the publishers was available for an interview. The other publisher was unable to do an interview because of policy reasons but document analysis on their contract with the SEEDS-team resulted in some insights as well.

*Note b:* results from field notes and informal conversation with an academic advisor.

*Note c:* results from field notes and informal conversation with teachers during a workshop.

Below, for every actor a more detailed description of the external actor's perspective is described, focusing on both the perceived role(s) in the SEEDS-project and motive(s) for being involved with the SEEDS-project.

### **The publishers' perspective:**

Both publishers see themselves in a supportive role and in an accountable role. The publisher mentions supporting the SEEDS-projects development in order for them to sell the SEEDS product and to foster alignment of the materials with practice. This corresponds to the motives the SEEDS-team mentioned. The publishers' focus is however more on the ultimate aim to sell and they need curriculum developers to do so. Therefore the publishers support the SEEDS-team in developing a product that is aligned with practice.

*"Typically a lot of the funding that is available is for research and not for curriculum development. There is only a few places that would fund curriculum development so that is why we would like to chip in because we would like them to develop curriculum"* (external partner).

*"We know what is going on in the market place, you know, the schools, we have to be able to meet their needs. So for any relationship with a curriculum program it is important they are able to fit into the market"* (external partner).

Both publishers reckon the SEEDS-team are the experts on the products. This becomes clear as one of the publishers involves the SEEDS-team actively in their work, but also by the following quote:

*"We sort of direct all professional development, we have a policy in general that schools or districts have to purchase a certain amount of money worth of a product to get professional development. So what we typically do for SEEDS is we contact our trained consultants and we also ask the SEEDS-team for any sort of large adoption of SEEDS because they are the experts and you know any of the professional development, it comes through us and then we reach out to the SEEDS-team"* (external partner).

The two publishers use a different model for disseminating the product. One of them uses sales representatives (like described above). The other publisher does not use sales representatives but do 'enterprise sales'. This means that high-level staff (including the CEO) reaches out to high-level people in the educational context to describe to them how the innovation will move the field forward. This way the publisher tries to influence the decisions high-level people in the field make about using the materials. This publisher does however offer context specific support and professional development after selling the product.

### **The teachers' perspective**

During an informal conversation with teachers attending the workshops it became clear that teachers experience the workshop and usage of the SEEDS materials as a deep learning experience. Additionally the teachers mentioned that the SEEDS-team help tailor the SEEDS curriculum to their own context. The teachers explained that attending workshops from the SEEDS-team and using their materials fosters their leadership skills, as they are more confident to advocate for better materials in their school and region. Clearly they feel they're in the responsible role, using the materials in practice.

*"I feel I can go onto an administrator and say, you know these materials are really well designed and well thought out and they I can advocate for better materials in my classrooms rather than just listening to someone give me a sales pitch at some point"* (Teacher).

### **Researchers/academics and the Graduate School of Education's perspective**

Because the graduate school of education also plays part in the researcher's role, these two have been taken together. An informal conversation with one of the academic advisors, who is also a researcher, made clear that she thinks the SEEDS-team forms a link between research and practice. According to advisor the SEEDS-team not only integrates the newest research findings in their work, they also contribute to research because of the innovative nature of the SEEDS products. Consulting and supporting emerge as roles from informal conversations and an interview. Notable is that both the Graduate School of Education and the academic advisor decided to get involved due to their personal interest.

*"Well, I am committing to the idea that research based schools, of which the Graduate School of Education is one, have a moral and ethical responsibility to ensure that the research that people do is taken up by public education. And that means we need to get involved in developing, evaluating and disseminating research. And you know developing a curriculum is one of the most direct routes to do that, so that is exactly why we are involved. Because you know otherwise we just sit around and gather tests so I am very much a believer in research and practice that is the whole idea. I am also a big believer in making sure we highly focus research and that we continue to generate new ideas but then once we have generated those ideas thinking about what it would mean to put them into practice, into curriculum and pedagogical and professional development is the next logical step. And if we don't do that I think we run the risk of remaining irrelevant"* (external partner).

### **Teacher education providers' perspective**

The perspective from the teacher education providers in this study is based on an interview with a professional development provider for SEEDS, located at a university, and an interview with two professional development providers located at a museum (both member of the SEEDS-team's network). The professional development providers situated at the university see themselves in a supportive role, making sure the implementation of SEEDS materials is supported by capacity building in their region.

*"We are kind of like the middleman. We provide professional development throughout the state of Arizona and as a site we do a lot of workshops for teachers. Our folks are able to go out in to the classrooms with these teachers and co teach with them or coach them or whatever kind of support they need. We utilize a lot of materials from the SEEDS folks in multiple ways and with various audiences. Whether they're in service teachers in classrooms getting professional development or pre-service teachers who will some day be in classrooms"* (external partner).

*"I also think that it is a really good, nice way to turn teachers into advocates for something, so you know that when their intimately involved with the development of curriculum materials"* ((local) Lead Professional Development).

Corresponding to the SEEDS-team's motives, the professional development provider feels they form a liaison from the SEEDS-team to teachers and other partners.

*"We have some really strong partnerships and these will often also lead to SEEDS. For example we receive some information from SEEDS that you know we are looking for classrooms to field-test in Arizona, some of our SEEDS materials. And so, we just basically, because we have these relationships with teachers, you know, we just announced it so we had teachers that participated and they talked about that in terms of what an interesting professional learning situation this was for them because they had to complete all kinds of feedback forms and take notes of when and what they were teaching and what the kids were saying and, you know things like that, so the SEEDS folks often have asked us to find some people like that for them, which we were happy to do"* (external partner).

Additionally, results from the professional development providers situated in the museum show that they are constantly looking for new opportunities to fulfill the needs of the people in their area. To gain information about what people need the professional development providers sent out a

survey to teachers and parents. Through these surveys, for example, they found a way to involve parents in the SEEDS materials. As home schooling was becoming popular in the area, the professional development providers saw the opportunity to implement the SEEDS materials for home schooling purposes. From their perspective the SEEDS program is flexible and therefore useful for their region. Additionally the SEEDS program gave them the opportunity to get science back into the classrooms of their region.

*“We do a broad variety of workshops. It is hard to describe because we do so many different ones because it all has to be tailored to the people your working with but to me that is one of the keys in their materials, is that they can be utilized in so many ways with so many different audiences and they make such a good first impression and they are just a wonderful kind of first step for teachers”* (external partner).

*“Science kept getting pushed to the back. By integrating literacy and science together we were able to bring science back into the classroom”* (external partner, quote copied from Cohen (2011)).

For the professional development providers situated in the museum the SEEDS materials fosters the educational aspect of the museum.

*“It was an asset for our museum to be able to offer professional development like a lot of museums we don’t have scientists and lots of research staff so we don’t have a lot of experts to bring in so through their program we are able to provide professional development linked to our museum”* (external partner).

Often these professional development providers are situated in organizations like universities or museums and are initiated or directed by actors in powerful places.

*“A couple of years ago I was the program chair for the phoenix area national science teacher association conference and had the opportunity to invite some speakers and I specifically asked that NSTA invite the SEEDS-team to come and be speakers of that because I was very impressed with all of the work that they have been doing with the SEEDS program and the literacy connections because that is just kind of the road that we are going to have to go if we are going to have science taught as a main core subject in an elementary classroom so you know they came and did a wonderful job at that conference, it was a great featured speaker session. And so, I had a lot of contact I guess in multiple and variety of ways with the SEEDS folks”* (external partner).

Summarizing this section, results show that most motives from the SEEDS-team to involve the direct actors focus on links with practice, setting conditions for sustainable implementation (e.g. alignment with different contexts, dissemination), ensuring substantial correctness/relevance and keeping their work up to date and with research. External actors’ motives to be involved with the SEEDS-team are mostly focused on supporting their ability to develop curriculum (e.g. to be able to sell their product), forming a link between research and practice and supporting local capacity building. Comparing motives shows that although motives are not the same or have a different focus, they complement each other. There were no great differences in the perspectives on the RASCI roles of actors. Most roles identified are the ‘supportive’, ‘consulting’ and ‘responsible’ roles. The ‘informative’ role was only linked to the funders and the publisher was the only one identifying the ‘accountable role’.

## 5.5. Results overview

Table 6 captures the results for this chapter in an overview. All actors have been linked to the SEEDS's development process and different actor roles have been identified as well as motives for involving these actors in their development process. The perspectives from five actors involved with the SEEDS-team have been described. Additionally the actors have been 'placed' in the linkage model and rated to their nature of involvement in the process.

**Table 6**  
Overview of results.

Actor	Rating <sup>a</sup>	Place in linkage model	Role (RASCI) <sup>b</sup>	Phase	Motive (for curriculum developers)	Motive (for external actors)
Publishers	+	Linkage system	S	Throughout the whole development process and implementation (in practice)	Link to practice, disseminating product, 'rolling out' product.	Setting conditions for development (supporting development so they can sell the product), alignment with practice
Teachers (and students)	+	User system	R, A	Pilot-testing, field-testing, planning/writing	Link to practice.	Deep learning experience, advocate for better materials, help tailor to own context
Professors/scientists (content experts)	+	Resource system	C	Planning/writing, polishing	Informing their work to improve correctness of content of curriculum	Link from research to practice and vice versa, SEEDS is integrating research findings in their work and can contribute to research because of the innovative nature of their work.
Researchers	+/-	Resource system	C	Before planning/writing	Informing their work with research on specific issues they encounter during development, keeping their work up to date.	Link from research to practice and vice versa, SEEDS is integrating research findings in their work and can contribute to research because of the innovative nature of their work.
Graduate School of Education	+	Resource system	C, S	Planning/writing, polishing, implementation	Informing their work with literacy expertise and with research on specific issues they encounter during development, keeping their work up to date.	Link from research to practice (making sure that the research they do get in to practice), advising on literacy content, supporting spread of the product
Funding agencies (private and public)	+/-	Resource system	I	Depending on the agency, but most	Setting conditions for development (financial support).	No data

actively in or before the planning/writing phase

Teacher education providers	-	User system	S, R	Implementation	Setting conditions for sustainable implementation (e.g. building capacity, tailoring product to specific context, local presence)	On site support, flexible curriculum program, link to educational practice (e.g. schools and parents), capacity building for teachers in a region and to support the educational aspect of the museum).
Assessment agency	+/-	Resource system	C	Planning/writing, polishing	Informing their work for alignment with standardized tests.	No data
Local policy makers ( <i>district leaders, program officers, curriculum coordinators, directors of education, directors of museums</i> ).	-	User system, linkage system	S, R	Implementation	Link to practice, making supportive on site decisions (about e.g. resources) to support implementation.	No data
Media (Academic and non-academic)	-	Linkage system	S	Implementation	Disseminating product/creating awareness.	No data
National science teacher association	-	Linkage system	S	Implementation	Disseminating product, creating awareness/basis of teachers' support (through workshops).	No data

*Note a:* The 'involvement rating' emerged from interview data and field notes, and was categorized as follows: Very involved during development of the product (+). Involved to set conditions for development, but not involved during development of the product itself (+/-). Occasionally involved, to set conditions for (sustainable) implementation, but not during development of the product itself (-).

*Note b:* Responsible (R), Accountable (A), Supportive (S), Consulting (C) and Informative (I).

As the overview shows, the results that emerged in this study are focused on the curriculum development process, the identification of the actors and the actors' roles and motives. Different actors are identified in the SEEDS-team's curriculum development process, involved in different roles and with different motives. The intensive involvement of these actors from the start of the curriculum development process suggests the mindset behind the SEEDS-team's curriculum design and the ways decisions are made in the process are different from a small-scale approach. For example, the collaboration with actors that can attend to implementation. All these results are taken together and discussed in the next chapter, followed by concluding remarks and recommendations.



## 6. Conclusion and discussion

*In this chapter, the research questions are answered and conclusions are drawn. SEEDS' development process for large-scale curriculum design infuses strategies into well-known models for curriculum development that enables 'rolling out' their curriculum product on a large scale. These strategies are mainly focused on the involvement of specific actors before, during and after the development of the curriculum program. A team with multidisciplinary backgrounds enables to develop curriculum based on mindsets of research, teaching and development. These different mindsets help to choose and understand relevant actors in the development process. Actors the SEEDS-team involves in their curriculum development process are publishers, teachers and students, research organizations, funding agencies and assessment boards, professional associations, policy makers and media. The actors identified in the SEEDS case correspond to the actors identified in other literature as highly influential. The publisher is, according to the SEEDS-team, the most important means by which they reach actors in the field. Comparing the motives and roles from the curriculum developers' perspective and the perspective of the external actors shows that although motives are not the same or have a different focus, they complement each other. Most roles identified from both perspectives are the 'supportive', 'consulting' and 'responsible' roles. Based on the data gathered in this study, the actors with these roles and motives are situated in the linkage model, which shows the different influences of the connections. The four dimensions important in large-scale curriculum development ('depth', sustainability, 'shift in ownership' and 'spread') emerge in this study as well and are linked to more explicit examples in the SEEDS case. Finally recommendations for further research are provided as well as recommendations for designing for scale.*

### 6.1. Summary of results

The main research question of this study was: *From the perspective of the curriculum developer, what actors are particularly salient in large-scale curriculum development across different stages of the curriculum development process, and how do they perceive their own roles as well as those of others?*

The answer to this question was found through answering the sub questions:

1. How can the curriculum development process of an organization concerned with designing for scale be characterized?
2. What actors are particularly salient in the different stages of a large-scale curriculum development process?
3. How do curriculum developers perceive their own roles and those of external actors in the different stages of the curriculum development process?
4. How do external actors perceive their own roles and those of the curriculum developer in the different stages of the curriculum development process?

In these questions, 'perception of roles' includes: ideas about the task the different actors do and their motives for engagement.

#### 6.1.1. The large-scale curriculum development process

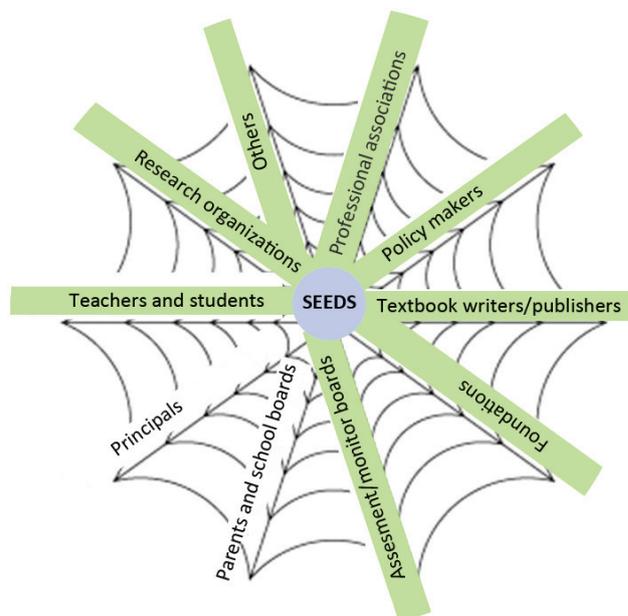
The first research question is about the characterization of a large-scale curriculum development process. The curriculum development process used in SEEDS can be characterized as an iterative development process that goes through the stages of: plan/writing, pilot-testing, polishing, field-testing, polishing, publishing/implementation. Additionally the SEEDS-team infuses strategies into the development process that enables them to 'roll out' the curriculum product on a large scale. These strategies are mainly focused on the involvement of specific actors before, during and after the development of the curriculum program.

#### 6.1.2. Salient actors in the large-scale curriculum development process

The second research question is about the identification of the actors important in the large-scale curriculum development process. First of all it should be noted that the SEEDS-team itself

consists of people with multidisciplinary backgrounds which not only enables them to develop curriculum based on research, teaching and development mindsets, but also helps them in choosing and understanding relevant actors in their process. Results show that the actors the SEEDS-team involves can be distinguished in actors involved during the development process, actors involved to set conditions for development and actors involved to set conditions for (sustainable) implementation. Actors the SEEDS-team involves during the development of the SEEDS program are: publishers, teachers and students, professors/scientists (experts) and the Graduate School of Education. Actors involve to set conditions for development are: researchers, funding agencies (private and public) and an assessment agency. Actors involve to set conditions for (sustainable) implementation are: Teacher education providers, national science teacher association, policy makers and (although not that actively) media. Figure 9 shows these actors in the actors spiders' web (based on van den Akker, 2012) highlighted in green.

Indirect involved actors are: teachers and students that use the materials but are not involved in pilot and field-testing, other policy makers, principals and school boards, other media related actors, other professors and parents. Most of these indirect involved actors are mediated through the publisher or through SEEDS' own network. This network was originally built for GEMS but is now used to disseminate and support the SEEDS program as well. Although the network has proven to be a doorway for the publisher to reach teachers, students, policy makers and other actors in the user system, the publisher is, according to the SEEDS-team, the most important means by which actors in the field can be reached.



**Figure 9** Actors' spider's web of the SEEDS case.

### 6.1.3. Curriculum developer role perceptions

The third research question is about the roles of these actors in the curriculum development process and motives for involvement of the actors from the perspective of the curriculum developer (in this case the SEEDS-team). Roles were identified based on the RASCI model (Baker, 2009; Hightower, 2008), which distinguishes between the following roles: responsible, accountable, supportive, consulting and informative. Results show that most roles identified from by the curriculum developers are the 'supportive', 'consulting' and 'responsible' roles. Motives for involving these actors focus on links with practice, setting conditions for sustainable implementation (e.g. alignment with different contexts, dissemination, capacity building), ensuring substantial correctness/relevance and keeping their work up to date. Table 7 summarizes these roles and motives for the actors highlighted in Figure 9.

**Table 7**

Summary of perceived roles and motives of actors.

<b>Actors</b>	<b>RASCI roles</b>	<b>Motive (from curriculum developers' perspective)</b>
• Teachers and students	Responsible, accountable	Link to practice.
• Publishers	Supporting	Link to practice, disseminating product, 'rolling out' product.
• Research organization	Consulting	Improve substantial correctness of content. Informing their work with research, keeping their work up to date, and credibility.
• Professional associations	Supporting, responsible	Setting conditions for sustainable implementation (e.g. building capacity, tailoring product to specific context, local presence, dissemination, creating awareness/basis of teachers' support)
• Local policy makers	Supporting, responsible	Link to practice, making supportive on site decisions (about e.g. resources) to support implementation.
• Assessment/monitoring boards	Consulting	Informing their work for alignment with standardized tests.
• Funders	Informing	Setting conditions for development (financial support).
• Others (media)	Supporting	Disseminating product/creating awareness.

#### 6.1.4. External actor role perceptions

The fourth research question is about the perception on roles in the curriculum development process and about motives for involvement from the perspective of the directly involved (external) actors. Results show that, similar to the curriculum developers' perspective, most identified are the supporting, responsible and consulting roles. Motives to be involved in the SEEDS-project are mostly focused on supporting the SEEDS-team to develop a commercially viable curriculum (publisher), forming a link between research and practice (researchers) and supporting local capacity building (teacher education providers). Notable is that most interviewed actors suggested that their personal interest in the SEEDS program was (amongst others) an important motive to be involved with the SEEDS-team. Mostly these relationships got initiated as a result of the actor's particular interest in either the SEEDS-project goals and/or the innovative character of SEEDS. This suggests that relationships with some actors are previous contacts and interactions amongst individuals.

**Table 8**

Roles in SEEDS perceived by external actors and their motives for involving SEEDS.

<b>Actor</b>	<b>Role</b>	<b>Motive for involving SEEDS</b>
• Publisher (2)	Supporting, accountable	Setting conditions for development (supporting development so they can sell the product), alignment with practice.
• Researchers/academics (1)	Consulting	Link from research to practice and vice versa, SEEDS is integrating research findings in their work and can contribute to research because of the innovative nature of their work.
• Graduate School of Education (1)	Supporting, consulting	Link from research to practice (making sure that the research they do get in to practice), advising on literacy content, supporting spread of the product.
• Teacher education providers (e.g. on-site professional development providers) (3)	Supporting, responsible	On site support, flexible curriculum program, link to educational practice (e.g. schools and parents), capacity building for teachers in a region and to support the educational aspect of the museum).
• Teachers	Responsible	Deep learning experience, advocate for better materials, help tailor to own context

## 6.2. Discussion

### 6.2.1. The large-scale curriculum development process

As the results show, the development process itself does not have to be very different from development processes on a small scale. The SEEDS-team uses a development process similar to elements in other well-known models for curriculum development (e.g. Gustafson & Branch, 2002). The planning/writing phase is where analysis takes place and first design principles are determined. Following are the design and development of the product, characterized by a four-stage iterative process (pilot test, polishing, field test, polishing). Finally the implementation/publishing stage is where the final product is implemented into practice and evaluation takes place.

Different however, from a small-scale process, is the mindset behind the curriculum development and the way decisions are made in each phase. Consequently, to make sure the curriculum can be used at a large-scale, aligned to the context in which it needs to function, the SEEDS-team involves salient actors throughout the whole process, from planning to publication and dissemination. Results showed that the SEEDS-team considers the “bigger picture” they work in as curriculum developers, like the stages of educational change, initiation, adoption, implementation and institutionalization (Fullan 2007; Marsh 2009). For example, the cooperation with actors that can attend to implementation and the efforts to promote adoption of the product and create a basis of teachers’ support by both the SEEDS-team and other involved actors, like the publisher. Another example is the development of the SEEDS program that was initiated by the needs of teachers who needed to put more focus on math and literacy. This is consistent with for example Lee and Krajeik (2012) who emphasize that successful curriculum innovations for scale requires more than just high quality curriculum or effective teacher professional development. These authors suggest developers need to consider multiple factors that lie outside the curriculum innovation, but influence the implementation and impact of the curriculum innovation. Furthermore, over the years, the SEEDS-team has refined a basic process that is well understood in the team, which enables them to put most of their energy into developing and testing the materials, and not into developing and refining the development process at the same time, which is often the case with innovative design projects (Corrigan, Loper & Barber, 2010).

### 6.2.2. Salient actors in other projects and literature

The actors identified in the SEEDS case correspond to the actors identified in other literature (Marsh, 2009; Cuban, 1992; Van den Akker & Letschert, 2004) as highly influential. Actors that have a connection to large scale curriculum development according to literature but not directly linked in the SEEDS network are: principals, parents and school boards. During the development process principals, parents and school boards related to teachers involved in field-testing may get in touch with the SEEDS-team as they have to approve the usage of the materials in their schools, but are not directly involved in the development process. At the same time principals are reached through local policy makers, publishers, professional associations and media as well, but this is more after the development of the process when materials are implemented into practice.

In a study from Pareja, Corbalan Perez, McKenney, Nieveen, & van den Akker (2012), directors from four other large-scale curriculum development projects in different countries (Scotland, USA and UK) were interviewed. In these projects funders, teachers, research organizations and policy makers were involved, as is the case in SEEDS. One mentioned an advisory board (similar to content experts), which is involved twice a year to go over plans, and none mentioned media. Different from SEEDS is that in only one of these projects a publisher was involved, but only after the curriculum materials were already designed. In the SEEDS-project the involvement of the publisher from during the whole curriculum development process is crucial for the success in scale. It should be noted these projects are research-oriented instead of development-oriented as SEEDS is. This implies that in SEEDS research is always conducive to the development process.

### 6.2.3. Roles and motives of actors

Comparing the motives and roles from the curriculum developers' perspective and the perspective of the external actors shows that although motives are not the same or have a different focus, they complement each other. Notable is that almost none of the respondents mentioned conflicts, even though specifically asked for. One conflict in goals between the SEEDS-team and the publisher was mentioned where the publisher's goals were more focused on sales while the SEEDS-team valued quality of their product. According to many researches conflicts in for example goals are a common obstacle and should be acknowledged in partnerships (McKenney & Reeves, 2012; Coburn & Stein, 2010).

Similar motives, from the perspective of the curriculum developers, emerged in Pareja et al. (2012). Motives for involving external actors that emerged from this study were dissemination, local presence, legitimacy and to help to demonstrate a shared commitment towards a particular direction of change. These motives do correspond to motives mentioned in this study but are mostly focused on what should happen after design. Such as the motive for the involvement of the publisher for commercial reasons only, while in the SEEDS case motives were also focused on rigorous design (e.g. alignment with different context and needs in practice). Also Lee and Krajcik (2012) mention that development for scale occurs within the confines of, amongst other things, the expectations and motives of actors and suggest that there should be compromises between the intentions of curriculum developers, the intentions of external actors and the constraints of practice.

There were no differences in the perspectives on the RASCI roles of actors. Most roles identified are the 'supportive', 'consulting' and 'responsible' roles. The informative role was only linked to the funders and the publisher only identified the 'accountable role'. Although members of the SEEDS-team did not specifically mention the 'accountable role' for teachers, the way in which they involve teachers and reach out to them does implicitly refer to this role. The SEEDS-team highly value the feedback and input of teachers during the development process (pilot-test, field-test and teacher advisory group) and work on building a basis of teachers' support and acceptance for their product. This suggests they do feel teachers need to approve their work before it to be effective and points to the 'accountable role' next to the 'responsible role'. The importance of teachers' consent corresponds to a lot of other studies that suggest teachers are key in implementing curriculum products into practice, adapting programs to fit in their context and values (e.g. McLaughlin, 1987; Healey & DeStefano, 1997; Elmore, 1996).

Although in the SEEDS-project teachers are involved during the large-scale development process, small-scale curriculum development can offer a more intensive development role for teachers. Instead of just giving feedback and using the curricular products, several studies show teams of teachers in the role of developers (teacher design teams) in small-scale curriculum projects, actually designing curricular products (e.g. Voogt, Westbroek, Handelzalts, Walraven, McKenney, Pieters & de Vries, 2011). Teacher design teams are often more focused on site-specific curricula while large-scale curriculum development suggests a more generic curriculum. The SEEDS-team often hires people with a teaching background to make sure that teacher experiences are incorporated in the design process.

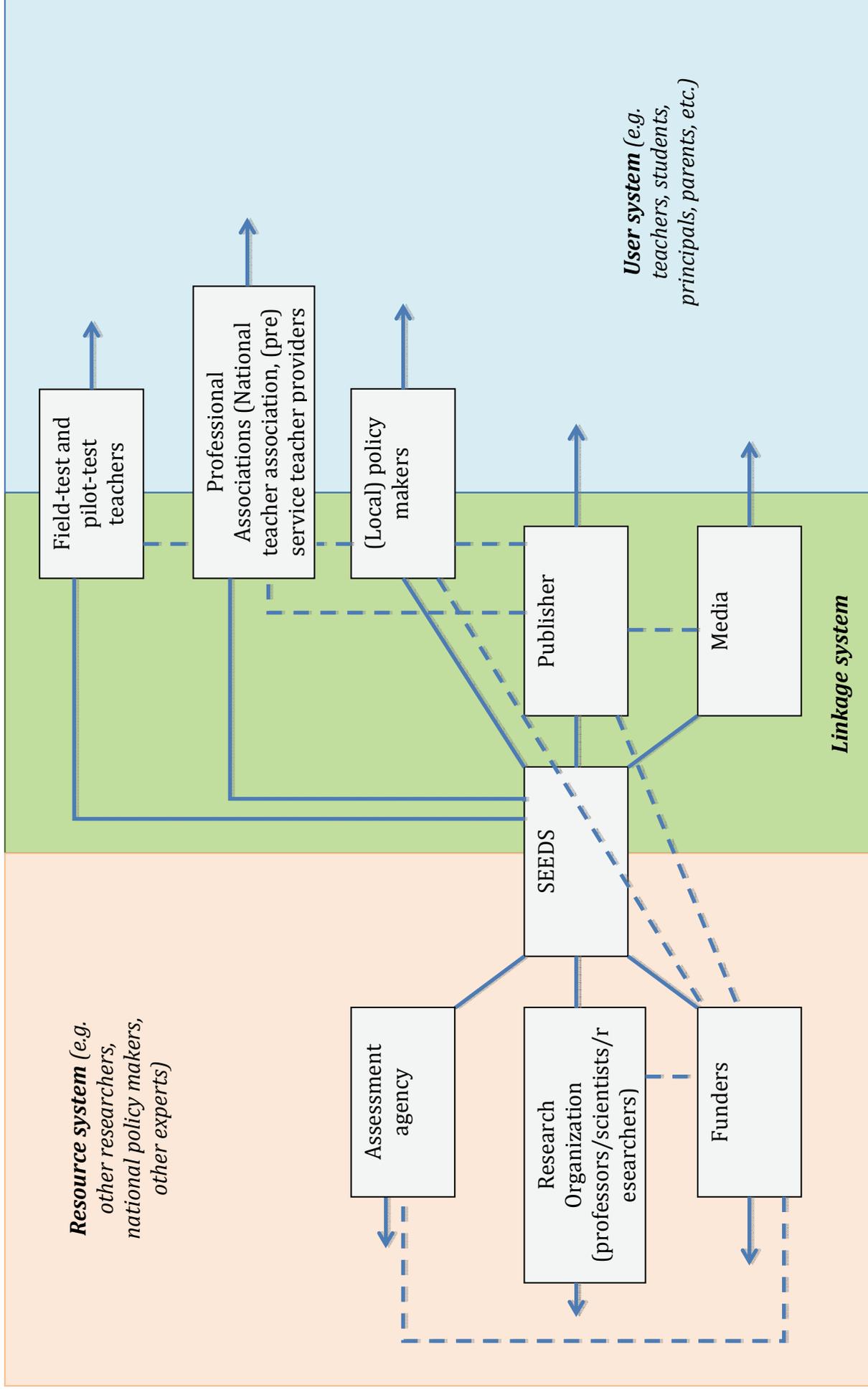
### 6.2.4. Linking actors in this case

Roles are often influenced by how people perceive their roles in this system (and also by how others expect their roles to be played). A way to look at how actors in curriculum development are situated in a system is the linkage model suggested by Havelock (1971) and Bartholomew et al. (2006) in McKenney and Reeves (2012). The model shows that the 'resource system' interacts with the 'user system', through a, often temporary, 'linkage system' that aids curriculum development by facilitating the exchange of information and ideas.

Placing the different actors in the linkage system, visualized in Figure 10, situates their motives and shows the different influences of the connections. It should be noted that the connections and placements in this figure are based on the data gathered in this study. The figure shows in what part of the linkage model the different actors are situated (according to the participants in this study), the direct connections the SEEDS-team made with other actors (solid lines) and the connection each actor forms with other actors (dotted lines).

Teachers and students directly involved with the SEEDS-team are partly in the linkage system and partly in the user system because teachers and students are not only using the SEEDS materials in the broader educational context, but also act in the exchange of ideas and information from the user system to the SEEDS-team and vice versa. This is also true for the national teacher association and (pre) service teacher providers. The SEEDS-team is both in the resource system and in the linkage system, because for actors in the resource system, the SEEDS-team is their link to practice. For example, the motive for being involved in SEEDS from the researchers' and scientist advisor's perspective is to establish a link from their own research work to practice. This suggests that from their perspective the SEEDS-team resides in the linkage system, playing a supportive role in facilitating the transfer of research information/ideas to the user system. From the SEEDS-team's perspective, however they are in the resource system, needing the help of other actors in the linkage system, like the publisher, to be able to reach the user system.

The number of connections touching different actors provides an indication of the importance of the actor. For example the publisher has a lot of connections with other actors, indicating his crucial role in mediating the interest of different actors. Another example is the policy makers, who make decisions about the contexts the SEEDS program needs to function in. It is through sustaining connections with these important actors that the SEEDS materials gets disseminated and supported. It also shows the importance of the funders for actors in all three systems. No research and implementation activities could have been done without money from the funders. It shows the power funders actually have in the processes. The funder is the one who decides to grant money to research (which in turn informs SEEDS), to development of the SEEDS materials itself and to implementation of the SEEDS curriculum in practice.



**Figure 10** Placement of actors in the linkage system to reveal connections based on motives (information based on the data gathered in this study). Solid lines correspond the direct connections the SEEDS-team made with other actors and the dashed lines show the connections each actor forms with other actors direct involved with the SEEDS-team.

### 6.2.5. Reflection on the methods

To maintain quality and rigor, credibility, transferability, dependability and confirmability were applied through different techniques in this study. Due to the relative short period of time in which this study was conducted, far more data referring to the inside-out perspective than data referring to the outside-in perspective was collected. There was enough time to get to know the culture, to test for misinterpretation and to build trust with the SEEDS-team, but insufficient time to reach all the involved external actors and to build trust with some of them. For example, due to the SEEDS middle school publisher's policy, they were unable to participate in this research. The perception of the publisher on the collaboration with the SEEDS-team would have been very interesting for the purpose of this study. A longer data collection period would probably have facilitated the building of trust. However, to deal with this problem most of the data was complemented with relevant documentation (e.g. publisher's contracts), which turned out to be a good solution for these issues. Although the time period was limited, the purpose of exploring designing for scale through the interactions between actors in the SEEDS-project resulted in a detailed description of the actors' involvement and their motives and contributed to understanding of designing for scale.

Finally it should be noted that all respondents participated voluntarily in this research. This might have given a biased image of reality. People that are reached easily are often the ones that are most positive about the subject of research (Swanborn, 2007. For example the teachers that participated in the SEEDS workshops had a very positive and motivated attitude towards SEEDS, and also an external actor said: "*Enclosing I want to say that I think that all of the SEEDS folks are phenomenal and they do wonderful work. They are some of our favorite folks. If it comes from them, its wonderful*". ). By collecting data from the inside out perspective and the outside in perspective an image closer to reality could be developed. Because of the fact that only one case was investigated, the results particularly apply to the context of this study. An example is the involvement of policy makers that fostered local decision-making processes worked out this way also because of the US educational system. By extensively describing the project and the context we tried to contribute to the ecological validity of the study. The study of Pareja et al. (2012) gave first insights in others large-scale curriculum development projects but more in-depth research is needed to better understand the underlying mechanisms of designing for scale.

Furthermore a reflection on the limitations of participant observation is appropriate. By nature, participant observation studies are impossible to exactly replicate and thus reliability is limited. The audit trail and reflective journal are used to minimize reliability issues. In this case an 'overt observation' was applied as the researcher has been open about the reason for her presence and is given permission by the group to conduct her research. This approach avoided problems of ethics, enabled observations in the natural setting and limited the chance on potential hostility towards the researcher. A problem with this kind of observation could have been the observer effect, where the behavior of the participants may alter due to the presence of the researcher. Collecting data from different sources minimized the chance of the observer effect. Data was collected by conducting interviews with different people within the organization and different actors external to the organization, and similar topics were compared. Next to the interviews, data was also collected through field notes, attending meetings etc. with external collaborators, and documents. If the researcher detected mismatches, an explanation was asked for.

Because of the openness it was easier for the researcher to separate the roles of participant and observer. The researcher did attend meetings and helped out with small tasks but never got so immersed in the behavior of the group that she became a participant and forgot to be an observer. The daily notes in the reflective journal helped in this as well. Overt observation makes demands on the researcher, not only in terms of observing and recording behavior accurately, but also in terms of interpreting data. Formal and informal member checks minimized the chance of misinterpretations and missing significant data. Additionally the inter-rater reliability check with two other researchers coding the data helped. Finally reactions of the respondents at the end of the observation period showed they did not feel nervous "*in the beginning we were a little nervous when we heard someone was going to observe us, but then it was just you*".

## 6.3. Conclusions and recommendations

### 6.3.1. Conclusions

To conclude, the SEEDS curriculum development team involves actors from different parts of the system to inform their work and set conditions for (sustainable) implementation before, during and their curriculum development process. The motives of actors involved with the SEEDS-team complemented those of SEEDS and vice versa. Most roles identified from both perspectives are the ‘supportive’, ‘consulting’ and ‘responsible’ roles.

Coburn (2003) distinguishes four dimensions important in large-scale curriculum development (‘depth’, sustainability, ‘shift in ownership’ and ‘spread’) (see also Chapter 2). Taking a look at the way these dimensions emerged in the SEEDS case is useful. Depth is reached as professional development activities are an integral part of the product and focus on altering knowledge, skills, attitudes and beliefs of teachers, superintendents, curriculum coordinators and others in the user system). The results of this study have shown that these professional development activities makes teachers feel like advocates of the materials and the involvement of the teachers throughout the whole development process (advisory group, pilots test, field-tests) contributes to a shift in ownership. By building relationships with actors (e.g. the publisher, professional development providers and policy makers) that offer local support (e.g. tailoring their materials to local context and needs), sustainability is promoted. The important dimension ‘spread’ is reached through several actors and activities. Dissemination of the product is fostered by the relationship with the publisher, but also policy makers in their network and actors on the research side are active in disseminating the materials. Additionally the SEEDS-team makes sure to be ‘visible’ in the field, for example, by going to conferences and publishing about their materials through the media.

The SEEDS-team’s strategies for involving salient actors from the start of the curriculum development process foster these dimensions of scale and therefore SEEDS can be considered a best practice case of large-scale curriculum development. Armed with the lessons learned in this case and this study several recommendations are described in the next section.

### 6.3.2. Recommendations

Based on the results of this study, a few design guidelines important for curriculum developers that aim to design for scale emerge from this study. As theoretical development for large scale curriculum development is lacking and many projects that go to scale fail on one or more of the characteristics of scale (sustainability, depth, shift in ownership and spread), guidelines for directing large-scale curriculum development projects are needed. These recommendations are based on the data of this study and specifically focus on the process of large-scale design.

- **Mapping the system.** To design for scale it is important to identify the key actors in the system in which the curriculum development process will take place. As in the SEEDS case the involvement of the policy makers fostered local decision-making processes worked because of the structure of the educational system that is specific to the USA. In other contexts other actors might be important and should be identified before curriculum development.
- **Involvement of important actors in the curriculum development process,** rather than only involving these actors once curriculum products are already designed. The creation of a basis of key actors’ support from the start is of particular importance. Verhagen (2000) states that curriculum development models need to consider implementation from the start. This study has shown that an important aspect of implementation is the involvement of key actors, like the publisher involvement in SEEDS throughout the development process.
- **Piloting and testing in different contexts.** As in relatively small-scale curriculum development projects, field-tests are important in the development process. On large scale, however, these field-tests should be appropriate for different contexts, which means larger-field-tests are necessary and the involvement of users of the eventual product should already be ‘scaled up’ during the curriculum development process. This means that before publishing, teachers and students from a diverse range of contexts use the materials and give feedback.

- **Responding to the system.** As changes in the system are inevitable, readily reacting to the problems, needs and suggestions of actors is important. The SEEDS-team, for example, reacted to the needs of teachers due to the changing standards in the system.
- **Rolling out strategy.** Design flexible materials from which parts can function in a range of contexts and for different uses and provide (or partner up to provide) capacity building. In the case of SEEDS the publisher mapped the curriculum materials on different state standards, which helped to focus the SEEDS-team on the core parts.
- **Multidisciplinary design teams.** A design team with mindsets from different parts of the system (e.g. research, development, teaching) not only fosters the development of the product but also helps in identifying, connecting with and understanding relevant actors.
- **Visible presence.** Active participation in the field oriented towards the dissemination of the project's ideas and underlying principles (e.g. conferences) initiate and develop relationships with important actors, put ideas on agendas, and/or establish consensus over a particular direction for change (corresponding to Pareja et al. 2012).

Understanding the perspectives and motives of different actors is essential to understanding what facilitates and hinders curriculum implementation and change (Fullan, 2007). Results in this study suggest this is not only true for curriculum implementation but also for curriculum design. Involving key actors and investing in relationships with them is important in shaping the process of large-scale curriculum development. This study expanded on salient relationships and identified roles and motives from both the perspective of the curriculum developer and the external actors. Given the scant prior research and limited theoretical developments in this area, this study has contributed to a better understanding of the nature and purpose of the interactions between actors in a large-scale curriculum development process.

Needed are studies that identify potential strategies for initiating and maintaining these relationships. As mentioned above, follow-up studies should also focus on the translation of the results of this study to other contexts. Good practices, like the SEEDS-case, are needed for getting more insight into the essential mechanisms of large-scale curriculum development. Additionally, it would be interesting to not only investigate direct relations of the curriculum development team, but also the relations of the external actors, visualizing the complete network of the 'world of curriculum development', valuing impacts and influences of different actors on for example Coburn's (2003) different dimensions of scale. After all, the success of large-scale curriculum development is a network effort.

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## 8. Appendices

### 8.1. Appendix 1: Trustworthiness criteria and applied techniques

**Table 9**  
Applied techniques to maintain quality and rigor in this study.

Trustworthiness criteria	Techniques	Applied in this study
Credibility	Prolonged engagement. <i>The investment of sufficient time to get to know the culture, testing for misinformation and building trust.</i>	The researcher will be engaged as a participant observer for three months. In addition both an inside-out and an outside-in perspective will be achieved which provides a more sophisticated reconstruction of the interactions with other actors important in the project than if only an inside-out perspective was achieved.
	Persistent observation. <i>Use of techniques to focus on the most relevant issue in detail, providing depth.</i>	Every interview will be recorded and a reflective journal will be kept. This way the data can be consulted as much as is needed to gain in-depth insights.
	Triangulation. <i>Using multiple sources and methods for data collection, achieving evidence for the same phenomenon.</i>	Multiple methods: Interview, document analysis, participant observation. Multiple sources: members of the SEEDS-project team with different roles and who interacted with external involved actors.
	Peer debriefing. <i>Review results and interpretations by a peer who has understanding of the study.</i>	Researcher will discuss findings and the process of inquiry informally during the study with Design for Scale project members. In addition, during data collection a case study database will be developed to organize, store and document the data collected. The case study database will be online accessible for the other project members and is organized by case study documents, interviews, observations, extra field notes, etc.
	Member checks. <i>Testing findings and interpretations with the corresponding participants.</i>	Informal (during data collection) and formal (after data collection) member checks will be conducted. Informal member checks will be done on the interview's results with the corresponding participants. The formal member check will be done on the draft case study report with the SEEDS-project team.
Transferability	In detailed, rich (or thick) description. <i>Obtaining a greater depth, richness, detail and understanding of a phenomenon.</i>	A context rich in-depth description of the case will be documented.
Dependability &	Audit trail <i>(same as Yin's (2009) case study's)</i>	According to Lincoln and Guba (1985), a research audit trail comprises six categories of information:

Confirmability <i>protocol</i> ).	<ol style="list-style-type: none"> <li>1. Raw data, for example, written field notes and audio- and/or video recordings.</li> <li>2. Data reduction and analysis products, for example, summaries, segmentation procedures.</li> <li>3. Data reconstruction and synthesis products, for example, clustering of themes into categories, interpretations.</li> <li>4. Process notes, for example, methodological notes and trustworthiness notes.</li> <li>5. Information about intentions and disposition, for example, the research proposal and personal notes.</li> <li>6. Instrument development information, for example semi structured interview questions.</li> </ol>
Reflective journal. <i>Diary used during the study in which information about personal insights and methodological discussions are recorded.</i>	The researcher will keep a journal in which (1) the daily schedule and logistics of the study; (2) a personal diary that provides the opportunity for setting thoughts straight for reflection and for speculation about growing insights; and (3) a methodological log in which methodological decisions are recorded. In addition field notes will be processed in this journal as well (Lincoln & Guba, 1985).

## 8.2. Appendix 2: Data analyses – codes overview

### Involved actors

References to the involvement of actors in the curriculum development process (analysis, design, implementation, evaluation)

Research organization (e.g. university, researcher, scientist)	ACT-RO
Teachers/students	ACT-TS
Principals	ACT-PR
Parents and/or school boards	ACT-PSB
Assessment/monitoring boards/agencies	ACT-ASS
Foundations (funders)	ACT-FUND
Textbook writers/publishers	ACT-PUB
Policy makers (e.g. district leaders, directors of education, curriculum coordinators)	ACT-PM
Professional associations (e.g. teacher education institutes)	ACT-PA
Media	ACT-MD
Direct involvement of actor	ACT-DIRECT
Indirect involvement of actor	ACT-INDIRECT
Other (if emerges from the data)	ACT-....

### Motives for involvement of actors

References to the motives for development of relationships with actors from the educational system.

**Content advice.** *Relationships with specialists in a specific content domain (e.g., science educators, statisticians, academics, etc.).* MOT-CA

**Keeping up to date.** *Relationship that helps to keep the innovation up to* MOT-UP

date with research.

<b>Links with practice.</b> <i>Relationships with actor aimed at facilitating interactions with schools, teachers and students. Links with schools may include the following activities: (a) recruiting schools; (b) providing professional development; and/or (c) providing on-site support.</i>	MOT-LWS
<b>Spread.</b> <i>Relationships with actors aimed towards facilitating the involvement of more schools/teachers/students by (a) disseminating the project across the region, or (b) taking over (part of) professional development and support activities.</i>	MOT-SP
<b>School involvement.</b> <i>Relationships with schools and teachers established for research and/or evaluation purposes. School involvement may include activities such as the provision of systematic feedback (through surveys, interviews, etc.) on issues related to the curriculum innovation and/or its implementation in order to improve the product.</i>	MOT-FS
<b>Link to policy makers.</b> <i>Relationships with actors that make decisions over school curricula etc. that can effect issues related to the curriculum innovation and/or its implementation</i>	MOT-PM
<b>Legitimacy/credibility.</b> <i>Relationships with actors that contribute certain status, reputation and/or trustworthiness to the project or to create a basis of teachers' support.</i>	MOT-LC
<b>Local Presence</b> <i>Relationships with actors that belong to the region where the project is being implemented, and hence may serve as a visible point of contact and reference for schools and teachers.</i>	MOT-LP
<b>Rolling out.</b> <i>Relationship with actors aimed at facilitating 'rolling out' of curriculum innovation in regions, tailoring the curriculum innovation to different contexts and meet different needs.</i>	MOT-ROUT
<b>Setting conditions for sustainable implementation.</b> <i>Relationships with actor aimed at facilitating the implementation and continuation of the project beyond pilot studies.</i>	MOT-CONDI
<b>Setting conditions for curriculum development.</b> <i>Relationships with actor aimed at facilitating the development work of the project. (e.g. money, knowledge about marketing based on experience dealing with schools, knowledge about needs from schools)</i>	MOT-CONDD
<b>Own initiative</b> <i>Individuals within partner organizations who (voluntarily/naturally) adopt the role of coordinators or project champions as a result of (a) their personal interest in or commitment to the project, and/or (b) their prior relationships with members from the project team.</i>	MOT-PRSL

### **Roles**

References to the roles of involved actors (RASCI roles: responsible, accountable, supportive, consulting, informative)

<b>Responsible.</b> <i>Those who contribute to/make sure that the curriculum innovation gets implemented and sustained over time (e.g. teachers).</i>	ROL-R
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**Accountable.** *Those who must approve before the work is to be effective.* ROL-A

**Supportive.** *Those who provide resources or play a supporting role during the implementation of a curriculum innovation (e.g. textbook publishers).* ROL-S

**Consulting.** *Those who provide information and/or expertise necessary to complete the project (e.g. academics).* ROL-C

**Informing.** *Those who need to be notified of results or progress, often only on completion of the task or deliverable, but need not necessarily be consulted.* ROL-I

### **Scale characteristics**

References to characteristics of scale.

**Spread** *of norms, beliefs and principles corresponding to the innovative curriculum.* SCALE-SP

**Shift in ownership** *from the innovative curriculum, controlled by a support agency, to a curriculum product with authority held by schools and teachers.* SCALE-SO

**Sustainability** *to sustain the innovative curriculum in a multilevel system characterized by multiple and shifting priorities as distributions and adoption of innovative curricula are only significant if its use can be sustained.* SCALE-SU

**Depth** *of the change, beyond surface structures or procedures, focusing on altering the knowledge, skills, attitudes and beliefs of teachers.* SCALE-DP

### **Linkage model**

References to how the actor is situated in the linkage model.

**Resource system.** *Researchers, designers, experts, etc.* LM-R

**Linkage system.** *People facilitating the exchange of information and ideas.* LM-L

**User system.** *Participants and the broader educational context).* LM-U

### **Process**

References to the involvement of actors in phases of the development process (SEEDS' specific process names are explained in 5.1).

<b>Analysis</b>	PROC-A
<b>Design</b>	PROC-D
<b>Initiation</b>	PROC-INI
<b>Implementation (for purpose of design)</b>	PROC-IM
<b>Implementation (into practice)</b>	PROC-I
<b>Evaluation</b>	PROC-E
<b>Planning/writing</b> (SEEDS' specific)	PROC-SDS-PW
<b>Pilot-testing</b> (SEEDS' specific)	PROC-SDS-PT
<b>Polishing</b> (SEEDS' specific)	PROC-SDS-POL
<b>Field-testing</b> (SEEDS' specific)	PROC-SDS-FT
<b>Publishing/implementation</b> (SEEDS' specific)	PROC-SDS-PUB
<b>Involvement of actor in process</b> (to generate a list)	PROC-(ACTOR CODE)

### 8.3. Appendix 3: Instruments

#### 8.3.1. Spider's web interview tool

The heart of the spider's web will present the concerning actor (SEEDS, external actors).

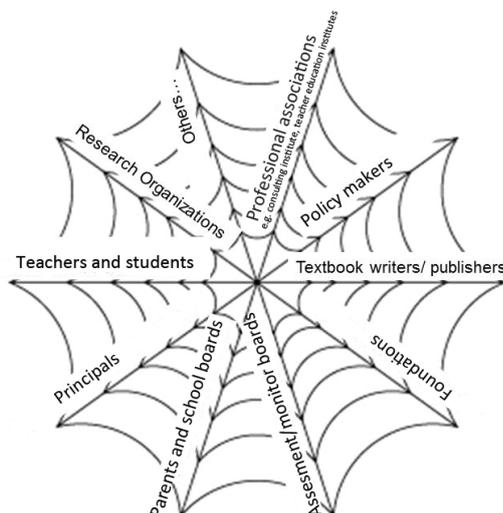


Figure 11 Spider's web interview tool.

#### 8.3.2. Inventory interview scheme

Table 10

Inventory interview scheme.

(Next page)

1	Welcome, thanks, ok to record this, confidentiality. Goal of interview: The purpose of the interview is to gain a better understanding of the system that links curriculum developers and practitioners and, more specifically, the relationships that reside within this system and the various ways in which interaction is shaped.
2	First I would like to get an idea of the process you typically go through while designing products as in the SEEDS-project. Could you describe the process? What is the force (strong things) behind this process?
3	Please take a minute to look at the various groups of participants in the spider's web (and others that might be relevant to this project) and think about the relationships the project team established with different actors from the educational system. Then, please identify:
3a	The relationships <b>directly relevant</b> to this project
3b	The relationships <b>indirectly relevant</b> to this project
3c	The relationships <b>not relevant</b> to this project
4	Let's talk about the nature of the interaction in the relationships that were <b>directly</b> relevant to the project. For each group, what <b>role</b> did the actor play and what main activities sustained this relationship? <i>(write the activities associated with each relationship in the spider web)</i>
5	We are very interested in how you conducted these activities. I would like to ask you about all of them, but we will have to choose the ones you think were the most (and the least) powerful in this project. Can you please describe each of these activities? For each one, I will ask you to indicate the following aspects: What was the <b>purpose/goal</b> of this activity? ( <b>motive, role</b> )

	<p><i>For example, was the activity used to receive information from partners and reach a common framework, to offer information, to promote ownership, etc.?</i></p> <p><i>Whose initiative was?</i></p> <p><i>Was this activity planned or unplanned?</i></p> <p>What did this activity look like? (<b>description</b>)</p> <p>At which point of the process did this activity take place? (<b>stage</b>)</p> <p><i>For example, was the activity undertaken during design, implementation, etc.?</i></p> <p>Who was involved? (<b>actors</b>)</p> <p><i>How contact took place?, how often?</i></p> <p>Why was this activity important? (<b>motive, role</b>)</p> <p>What considerations did you have in selecting/designing/using this activity? (<b>motive</b>)</p> <p>How did the activity work out in practice? What are the lessons learned? (<b>outcomes</b>)</p> <p>Why was the activity not successful? (only for the least successful ones)</p>
6	Repeat step 4 as many times as necessary to address <b>at least one activity for each relationship</b> .
7	Who within the project team interacted most intensively with actors directly relevant to the project? Would it be possible to do a more in-depth interview about these actors/actor relationships with them as well?
8	Thanks, ask whether they would like to add some other relevant information, and request any additional project documentation for more in-depth view of above

### 8.3.3. In-depth interview scheme

**Table 11**

In-depth interview scheme (SEEDS-project team members).

1	<p>Welcome, thanks, ok to record this, confidentiality.</p> <p>Goal of the study:</p> <p>The purpose of the study is to gain a better understanding of the system that links curriculum developers and practitioners and, more specifically, the relationships that reside within this system and the various ways in which interaction is shaped.</p> <p>Goal of interview:</p> <p>The gain better understanding of the specific relationship you established with [ACTOR X] to foster the SEEDS-project.</p>
2	<p>During a former interview, various groups in this system spider web (show) that are relevant to the SEEDS-project and with whom the project team established different relationships were identified.</p> <p>I understood that you are involved most intensively with [ACTOR X], is that correct?</p>
3	Let's talk about the nature of the interaction you are mostly involved with.
3a	How did the relationship start? (e.g. who's initiatives was it/why did the actor get involved in SEEDS?)
3b	Once the relationship established, what <b>role</b> did the actor play and what main activities sustained this relationship?
4	<p>We are very interested in how you conducted these activities. I would like to ask you about all of them, but we will have to choose the ones you think were the most (and the least) powerful in this project. Can you please describe each of these activities?</p> <p>For each one, I will ask you to indicate the following aspects:</p> <p>What was the <b>purpose/goal</b> of this activity? (<b>motive, role</b>)</p> <p><i>For example, was the activity used to receive information from partners and reach a common framework, to offer information, to promote ownership, etc.?</i></p> <p><i>Was this activity planned or unplanned?</i></p> <p>What did this activity look like? (<b>description</b>)</p> <p>At which point of the process did this activity take place? (<b>stage</b>)</p>

	<p><i>For example, was the activity undertaken during design, implementation, going to scale?</i></p> <p>Who was involved? (<b>actors</b>)</p> <p><i>How contact took place?, how often?</i></p> <p>Why was this activity important? (<b>motive, role</b>)</p> <p>What considerations did you have in selecting/designing/using this activity? (<b>motive</b>)</p> <p>How did the activity work out in practice? What are the lessons learned? (<b>outcomes</b>)</p> <p>Why was the activity not successful? (only for the least successful ones)</p>
5	Repeat step 4 as many times as necessary to address all activities mentioned in question 3.
6	Thanks, ask whether they would like to add some other relevant information, and request any additional project documentation for more in-depth view of above.

### 8.3.4. In-depth interview external actors scheme

**Table 12**

In-depth interview scheme (external actors).

1	<p>Welcome, thanks, ok to record this, confidentiality.</p> <p>Goal of the study and this interview:</p> <p>The purpose of the study is to gain a better understanding of the system that links curriculum developers and practitioners and, more specifically, the relationships that reside within this system and the various ways in which interaction is shaped.</p>
2	<p>During a former interview, various groups in this system spider web (show) that are relevant to the SEEDS-project and with whom the project team established different relationships were identified.</p> <p>I understood that you are one of the groups with whom the SEEDS-project interacted during their development process. Is that correct?</p>
3	Let's talk about the nature of the interaction you are mostly involved with.
3a	How did the relationship start? (e.g. who's initiatives was it/why did you get involved in SEEDS?)
3b	Once the relationship was established, what <b>role</b> did you play in this relationship and what main activities sustained this relationship?
4	<p>We are very interested in how you conducted these activities. I would like to ask you about all of them, but we will have to choose the ones you think were the most (and the least) powerful in this project. Can you please describe each of these activities?</p> <p>For each one, I will ask you to indicate the following aspects:</p> <p>What was the <b>purpose/goal</b> of this activity? (<b>motive, role</b>)</p> <p><i>For example, was the activity used to receive information from partners and reach a common framework, to offer information, to promote ownership, etc.?</i></p> <p><i>Was this activity planned or unplanned?</i></p> <p>What did this activity look like? (<b>description</b>)</p> <p>At which point of the process did this activity take place? (<b>stage</b>)</p> <p><i>For example, was the activity undertaken during design, implementation, going to scale?</i></p> <p>Who was involved? (<b>actors</b>)</p> <p><i>How contact took place?, how often?</i></p> <p>Why was this activity important? (<b>motive, role</b>)</p> <p>What considerations did you have in selecting/designing/using this activity? (<b>motive</b>)</p> <p>How did the activity work out in practice? What are the lessons learned? (<b>outcomes</b>)</p> <p>Why was the activity not successful? (only for the least successful ones)</p>
5	Repeat step 4 as many times as necessary to address all activities mentioned in question 3.
6	Thanks, ask whether they would like to add some other relevant information.



