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The focus of schools on twenty-first–century competencies and students' experience of these competencies

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The importance of teaching twenty-first–century competencies has increasingly been emphasised. Little is known, however, about how schools actually approach teaching such competencies. We investigated (1) how innovative and innovating secondary schools in the Netherlands implement a focus on self-regulation, collaboration and creativity in their curriculum and (2) how and to what extent schools' curricular focus was reflected in students' self-reported mastery of these competencies. To answer the first sub-question we used the data of 16 school portraits. The second question was addressed with a quasi-experimental study. About 551 students from 51 tenth grade classes (age 15–16) of 12 schools completed questionnaires measuring their self-reported competencies regarding self-regulation, collaboration and creativity, and the extent to which they experienced a curricular focus on self-regulation, collaboration and creativity in their schools. The article describes how innovative and innovating schools aim at developing their students' self-regulation, collaboration and creativity through curriculum content, pedagogy and school organisation. It appears that the stronger a schools' curricular focus on self-regulation, collaboration and creativity, the more students indicate they master these competencies, and the more they improve in self-regulation and collaboration skills between the ninth and tenth grade.

Keywords: twenty-first–century competencies; secondary education; self-regulation; collaboration; creativity

Introduction

In the last two decades, the importance of educational goals like creativity, critical thinking, self-regulation and collaboration has increasingly been emphasised in educational policies and research (Voogt & Parreja Roblin, 2012; European Commission, 2018; OECD, 2018). Although these goals are not new, they are often called twenty-first–century skills or competencies. The increased focus on twenty-first–century

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skills is not uncontested. Debate exists on the economic orientation of the argument that students should be prepared for the twenty-first century (Biesta, 2013; Hilt *et al.*, 2019) and on the nature of these skills at stake—do generic skills actually exist? (Ericsson & Pool, 2016; Hattie & Donoghue, 2016). Nevertheless, governments, scholars and educators are increasingly taking up the challenge to imagine the implications for the curriculum of changes in society, such as globalisation, the impact of technology on the labour market, the increased use of social media, and a decrease of civic engagement (e.g. European Commission, 2018). It is argued that traditional curricula do not adequately play into these developments and that schools should pay more attention to so-called twenty-first–century skills or competencies (Ananiadou & Claro, 2009; Voogt & Pareja Roblin, 2012). This has resulted in a growing body of research addressing the conceptualisation and implementation of twenty-first–century skills (Dede, 2010; Voogt & Pareja Roblin, 2012; Griffin & Care, 2015; van de Oudewetering & Voogt 2018). However, little is known about the extent to which schools actually pay attention to twenty-first–century skills and what their practices look like. Neither do we know whether schools that do focus on twenty-first–century skills are successful in developing students' competencies in the areas addressed.

In the period 2015-2018 we carried out a research project in The Netherlands with the aim to investigate how schools focus on twenty-first–century skills and aim at their students' mastery of these skills. We collaborated with schools for secondary education that explicitly focused on the development of twenty-first–century competencies in their curriculum and pedagogy. This collaboration allowed us to study how these schools approached the teaching of twenty-first–century competencies. We also investigated whether their teaching was successful, that is, to what extent the schools' focus on twenty-first–century competencies was reflected in their students' (self-reported) mastery of such competencies.

The concept of twenty-first–century skills

Changes in today's society demand that students not only learn subject-specific knowledge and skills, but also competencies such as collaboration, self-regulation, critical thinking and learning to learn. It is argued that students need to develop these competencies to enable lifelong learning and flexible adaption to rapid changes in the labour market and society (Ananiadou & Claro, 2009; OECD, 2018). The concept of twenty-first–century skills or competencies[1] summarises this idea. The competencies in question are no inventions of the twenty-first century. The novelty is that the urgency to teach them at school has only recently been acknowledged so widely. Since it was first introduced, the concept of twenty-first–century skills has been broadly discussed from both national policy and curriculum perspectives (Voogt & Pareja Roblin, 2012; Hilt *et al.*, 2019). A substantial part of the literature on twenty-first–century skills consists of attempts to develop models or frameworks that conceptualise and categorise the competencies that are at stake. Each framework uses its own terminology and categorisation, but certain competencies are repeatedly mentioned, even if they are named differently (Chalkiadaki, 2018). These competencies concern: creativity, critical thinking, problem-solving skills, communication, collaboration, digital

competencies, meta-cognition, self-regulation (also referred to as self-direction) and responsible citizenship (Lemke *et al.*, 2003; Dede, 2010; ; Voogt & Roblin, 2012; Van der Molen *et al.*, 2016; Partnership for twenty-first–century skills, 2019).

Twenty-first–century skills in the secondary school curriculum

The importance of these competencies is reflected in a shared agreement on the need for curricular changes worldwide, that aim to keep the curriculum up to date (OECD, 2018).

But despite this agreement, twenty-first–century competencies do not seem to be systematically integrated in Dutch national and school curricula nor in classroom activities. Although an increasing number of countries around the world have started to address twenty-first–century competencies in their national curricula (Ananiadou & Claro, 2009; Choo *et al.*, 2017), national studies show that twenty-first–century competencies are barely systematically integrated in school curricula and classroom activities (e.g. Thijs *et al.*, 2014). This may be due to the complexity of the curriculum innovation; twenty-first–century competencies need attention at different age levels and throughout the curriculum (Voogt & Pareja Roblin, 2012), and different ways of addressing them are possible, for example in domains or subjects and in interdisciplinary, thematic teaching methods (Skills-platform OCW, 2016). Voogt and Pareja Roblin (2012) distinguish three different approaches for their implementation in the curriculum: adding new subjects or new content within existing subjects, integration as cross-curricular competencies or transforming the curriculum.

It has been argued that an integrative approach of twenty-first–century competencies requires major changes in curriculum, instruction and assessment as well as in professional development of teachers. Such an approach implies students constructing knowledge by working on complex problems, involving authentic learning content and learning environments, collaborative learning, and a teacher role focused on supporting students' learning instead of transferring knowledge (Voogt & Pareja Roblin, 2012). Integration of twenty-first–century competencies in traditional curricula may, therefore, require teachers to develop new competencies, for example cross-curricular competencies and digital literacy competencies. Teachers will also have to master diverse teaching strategies and to develop and use more formative ways of assessment (Voogt & Pareja Roblin, 2012).

In a recent study van de Oudewetering and Voogt (2018) explored teachers' perceptions of everyday practices that may foster twenty-first–century competencies, in order to come up with practicable and sustainable curricular guidelines for twenty-first–century education. The results suggested six coherent dimensions of classroom activities that, according to the teachers, foster the following competencies: activities aimed at digital literacy, innovative thinking, critical thinking and communication, (digital) citizenship, self-regulated learning and (computer-supported) collaborative learning. The authors conclude that the substantial interrelationships among the six dimensions demonstrates that teachers did not perceive twenty-first–century competencies to be fostered by disconnected classroom activities, but that they already have a more integrative conception of the curriculum innovation.

The increased focus on twenty-first–century skills is not uncontested. Since the concept was introduced, criticism has been voiced. Philosophical-political critiques point out that the argument for paying attention to these skills in schools, is based on a utilitarian approach of education, that takes a global competitive economy as an unquestioned frame of reference (Biesta, 2013) and draws on and promotes neo-liberal discourses of education (Hilt *et al.*, 2019). From a curriculum theoretical perspective it has been called into question whether 'generic' competencies actually exist. Critics have argued that twenty-first–century competencies are promoted as being 'generic' whereas they actually depend on substantive knowledge of a particular area, and cannot be developed separated from domain-specific knowledge (Ericsson & Pool, 2016; Hattie & Donoghue 2016). In this article we do not take sides in this debate. On the one hand, we do not consider problem-solving, creativity and critical thinking generic skills; they only get meaning when exerted in a specific domain and related to domain-specific knowledge. On the other hand we do think that competencies like self-regulation, being able to collaborate and creativity are qualities that can be learned and taught. This is what we saw in the schools that we collaborated with and that we report on in this article.

Research questions

Although several approaches towards teaching twenty-first–century competencies have been described, little is known about how schools practically shape the implementation of such competencies in the curriculum. Our research, therefore, addressed the ways in which schools focus on twenty-first–century competencies. We also investigated whether and how their efforts are reflected in their students' (self-reported) mastery of these competencies. We focused on three competencies that were considered important in the schools in our research and that measurement instruments were available for: self-regulation, collaboration and creativity. *Self-regulation*, defined as the ability to direct one's learning and the willingness to take responsibility for one's learning, was seen as an important competence for students during their school careers, as well as later in their professional life. Planning, taking initiative, organising and persevering, were considered aspects of self-regulation. C*ollaboration* was also seen by the schools as a lifelong important competence. Through collaboration students can learn to be able to cope with strengths and weaknesses of themselves and others, as it requires sharing tasks, listening to each other and respecting other opinions. *Creativity* was defined in a broad way in the schools, not only referring to the ability to create, but also to imagination, creative thinking and problem-solving (Volman *et al*. 2018).

In this article we first describe the curricular decisions and corresponding changes that the schools had implemented in order to develop students' self-regulation, collaboration and creativity. Then we investigate the relationship between the extent of the schools' focus on these competencies and their students' self-reported mastery of self-regulation, collaboration and creativity. To our knowledge there is no research that has studied this relationship before. We expect, that curricular focus on these three competencies will have an impact on students' mastery of these competencies

and we expect that the more a school pays attention to these competencies the more students will master them. In this article we explore these assumptions. We differentiate between the six *innovative* schools in our research and the four *innovating* schools. The *innovative* schools either had a longer tradition of innovation or were recently founded with an innovative educational concept; these schools all explicitly mentioned goals like self-regulation, collaboration and imagination as important aspects of their approach. The *innovating* schools were more traditional schools that were just beginning to pay attention to such educational goals.

The research question of this study is: How and to what extent is a curricular focus in secondary schools on self-regulation, collaboration and creativity reflected in students' self-reported mastery of these competencies? Sub-questions are:

1. How do innovative and innovating secondary schools implement a focus on self-regulation, collaboration and creativity in their curriculum?
2. Is the extent of schools' focus on self-regulation, collaboration and creativity related to students' mastery of these competencies?

To answer the first research question a qualitative study was conducted. Research question 2 was answered with a quantitative quasi-experimental study.

Method

Qualitative study

To answer the first sub-question we used the data of 'school portraits' of 16 schools. Ten of these schools were part of a school-university collaboration that aimed to study how schools implement twenty-first–century competencies in their curriculum. Six of these schools had a longer tradition of pursuing educational goals like self-regulation, creativity, critical thinking and collaboration or were recently founded schools with innovative educational concepts that mention such goals as an important aspect of their approach. They considered themselves and were considered by the other schools as 'forerunners' in this respect. Four schools were just beginning to pay attention to such educational goals. They participated in the study as they hoped to learn from the other schools. In the first phase of the study teacher–researchers from the participating schools wrote portraits of their schools, in which they described which twenty-first–century competencies were important according to the school's mission and how they worked on these competencies in their curriculum and through their pedagogy. These portraits were based on interviews with school leaders and teachers conducted by the teacher–researchers and analysis of school documents. Researchers supported the teacher–researchers in drawing up the portraits by providing an interview guideline, a coding scheme for analysing the interviews and a format for reporting the results in a 'portrait', and supervising the analysis. Schools were facilitated with about ten days to have teacher–researchers participate in this phase of the study.

In addition to these ten portraits, researchers wrote school portraits of six other schools, based on interviews with school leaders held by the researchers and school

documents, in order to get a more thorough picture of how schools approach the teaching of twenty-first–century skills. These schools were selected because they were known as innovative schools that were forerunners in paying attention to twenty-first–century competencies. As these schools were not part of the collaboration and there was no facilitation for teacher–researchers, the portraits of these schools were written by the researchers. All 16 school portraits can be found on the project website (https://toekomstgerichtonderwijs.kohnstamminstituut.nl/).

The school portraits were systematically analysed using matrix-display techniques (Miles & Huberman, 1994). First, one of the authors coded all school portraits using a coding scheme that distinguished aspects of the curriculum that might be relevant for teaching twenty-first–century competencies: curriculum content, pedagogy, assessment and school organisation (including use of the environment). Second, the data were summarised in the form of a matrix with the curriculum aspects along one axis and the schools along the other axis. Third, this matrix was used to find patterns within and across the schools in their curricular approach of self-regulation, collaboration and creativity. This resulted in more specific codes (e.g. for pedagogy: guidance, structure) that were used in a second round of analysis. We also looked for clear examples and counterexamples. The results of this round were summarised in descriptions of the approaches of the innovative and innovating schools. The descriptions were checked by the researchers who had been the supporting researchers of the schools or had written an additional school portrait.

Quantitative study: Design and sample

To answer the second research question a quasi-experimental study was conducted. Respondents were 551 students from 51 tenth grade classes (students age 15-16) of 12 secondary schools. These included nine of the schools with which we collaborated in the research project (data of one of the schools were unfortunately lost), and three schools that were added to the sample. These schools were interested in the attention paid to twenty-first–century competencies in our study but were not (yet) actively engaged in implementing such competencies in their curriculum. Thus we could extend the range of intensity of the schools' curricular focus on twenty-first–century skills. This resulted in a sample of schools that varied in the extent to which a focus on twenty-first–century competencies was anchored in their curricula; some had been working on competencies (under different denominators) for a long time, others just started doing so, and some (the three added schools) were just interested. We used students experience of their school's focus on self-regulation, collaboration and creativity as a proxy for extent of curricular focus on these three twenty-first–century competencies. The students completed two questionnaires, one measuring experienced focus of their school on self-regulation, collaboration and creativity and the other measuring how competent students felt in self-regulation, collaboration and creativity. We also collected data on the students' experience of their school's focus on critical thinking, personal development and societal engagement, but as we did not find adequate measures to collect data on the corresponding competencies (not even self-reported), we decided to focus on self-regulation, collaboration and creativity.

Both questionnaires (one on the school's focus on and one on self-reported mastery of these competencies) were completed when the students were in tenth grade (age 15–16; December 2017 and April 2018). The questionnaire regarding mastery of the three competencies was also filled in when the students were in ninth grade (age 14–15; between September 2016 and February 2017) so that we could test whether the (self-reported) competencies of the students increased between the ninth and tenth grade. Information on background characteristics were provided by the schools and by the students themselves.

Quantitative study: Variables and instruments

Measuring self-regulation, creativity and collaboration. The three competencies *self-regulation, creativity and collaboration* were measured with the iSELF (Theunissen & Stubbé, 2014; Stubbé *et al.*, 2015). This is a web-based tool for self-evaluation and consists of a card-sort game. Students score competence statement cards on a 7-point scale (1 'Not applicable at all'—7 'Totally applicable') to indicate the extent to which they suit them (they score the statements by pricking post-it leaves on one of the seven scale options on a digital noticeboard).

Self-regulation was measured with two subscales: *learner control* and *strategy use*. Regarding creativity, we decided to focus on the 'imagination' aspect of creativity in this part of the study, as this had been mentioned as a particularly important focus by some of the schools that actively participated in our research project. It was measured with the subscale *imagination skills* and collaboration was measured with the scale *collaboration skills*. The subscale 'learner control' consists of six items and measures how well students think they manage and monitor their own learning process (example item: 'I choose in which way I want to learn'). The subscale 'strategy use' consists of four items and measures how well students think they are able to take control over educational decisions (example item: 'I closely monitor my planning'). The scale 'collaboration skills' consists of nine items and measures how well students think they collaborate with others in learning (example item: 'I learn from the mistakes that others make'). The subscale 'imagination skills' consists of seven items and measures how well students think they use their imagination for solving problems, finding solutions and creating new thoughts and connections (example item: 'I try out several ways of doing something'). The (sub)scales had Cronbach's alpha values of 0.73 (learner control), 0.83 (strategy use), 0.79 (collaboration skills) and 0.85 (imagination skills) in the first measurement. These values were quite similar in the second measurement (respectively, 0.73, 0.82, 0.78 and 0.87).

Curricular focus on twenty-first–century competencies. In collaboration with teachers in the schools participating in the study, a questionnaire was developed to measure whether students experience that the curriculum at their schools focuses on twenty-first–century competencies. The students were asked to judge to what degree their school actively contributes to the development of several twenty-first–century competencies. The questionnaire consisted of six scales and a total of 55 statements. The students indicated on a 5-point scale to what extent per statement he/she

agreed with the statement. Because the questionnaire was not specifically developed to measure only self-regulation, collaboration and imagination, we selected the items that theoretically fitted these constructs and three scales were derived: self-regulation, collaboration and imagination. Subscales similar to the ones in the competencies questionnaire were found within the self-regulation scale: (focus on) learner control and (focus on) strategy use. *Learner control* was measured with five items and consisted of items such as 'at this school you learn to plan your work'. *Strategy use* was measured with four items and consisted of items such as 'at this school you learn to use strategies for learning'. (Focus on) *collaboration* was measured with five items and consisted of items such as 'at this school you learn to accept different opinions when working together with others'. (Focus on) *imagination* was measured with four items and consisted of items such as 'at this school you learn to use your imagination skills'. The scales had Cronbach's alpha values of 0.78 (learner control), 0.76 (strategy use), 0.79 (collaboration) and 0.77 (imagination).

Students' background characteristics. We used control variables to assess whether the relationship between curricular focus and mastery of the three competencies is not a reflection of other influences. Individual factors could influence students' twenty-first–century competencies, for example there is some evidence that girls show more self-regulation skills than boys (Bidjerano, 2005). We controlled for gender, ethnic background, parental education level, educational level of the student and whether the student repeated a grade or went to a lower educational level between the ninth and tenth grade. Parental education level was measured in the students' questionnaire with separate questions regarding the educational levels of the mother and the father and was divided into three categories: maximal senior secondary vocational education, higher education and unknown. Parental education level was based on the highest level of education within the family. Educational level of the student was divided into three categories: lower pre-vocational secondary education, higher pre-vocational secondary education and senior general secondary education or pre-university secondary education. Information on whether the student retained a grade or changed in educational level between the ninth and tenth grade was given by the school administration.

Quantitative study: Data analysis

The research questions regarding the relationship between the extent of schools' curricular focus on the three competencies and students' mastery of these competencies were tested with regression analyses taking into account non-independence of observations due to nested data (students within classes within schools). Because self-regulation is measured with two subscales, learner control and strategy use, we used multivariate analyses when investigating the relation between attention for self-regulation and self-regulation competencies to reduce the risk of type 1 errors (finding a non-existing relationship) and type 2 error (failing to find an existing relationship) (de Maeyer *et al.*, 2010). Control variables were included in the analysis to examine

whether curricular focus of schools was related to perceived competencies after we controlled for students' background characteristics.

To determine the impact of a predictor, the effect sizes were calculated by the regression coefficient of the specific variable, divided by the square root of the variance of the empty model (without independent variables). An effect size of 0.2 is considered small, an effect size of 0.5 is medium and an effect size of 0.8 is considered a large effect (Cohen, 1988).

Results

Ways of paying attention to self-regulation, collaboration and creativity

In this section we answer the first research question by describing how innovative and innovating schools aim to develop their students' twenty-first–century competencies, in particular self-regulation, collaboration and creativity.

For the *innovative* schools the three competencies were central in the mission of the school (among other twenty-first–century competencies). They worked on developing these competencies through all aspects of the curriculum: curriculum content, pedagogy, assessment and school organisation, including the use of the environment. Traditional cognitive goals were also aimed at in non-traditional ways, for example through project-based and inquiry-based learning. Typical in all innovative schools was a learner-centred approach; the schools aimed at aligning the curriculum with the interests and talents of individual students. However, all innovative schools mentioned that their focus on twenty-first–century skills diminished in the higher grades, they are supposed to prepare the students for the national exams. The *innovating* schools were taking steps towards the implementation of some of the twenty-first competencies in their curriculum as they felt the need to approach students in a different way and prepare them for a changing society. They focused on specific competencies (e.g. self-regulation) and saw these as goals that were additional to the traditional cognitive goals. Their approach was to adapt particular aspects of the curriculum, for example offering new content. Below we describe in more detail, how schools in our project worked towards the three twenty-first–century goals that are central in our study, self-regulation, collaboration and creativity.

Self-regulation. All schools in our research saw self-regulation as an important competence, both necessary for learning at school and for functioning outside the school, now and in the future. Self-directed or self-regulated learning was also seen as a way of making students the owners of their learning processes. Self-regulation was encouraged through the pedagogies that teachers employed, giving students responsibility for their own learning processes and stimulating students' ownership of their own learning process. In the innovative schools, students often worked self-directedly in large classrooms (often called learning squares), while several teachers were available for offering guidance and individual coaching, giving tailor-made feedback. Team teaching was quite common. Students were offered a lot of choice. In the innovating schools this mainly entailed that students could work

at their own level and pace and were sometimes allowed to choose how to work towards learning goals, examinations or presentations. In the innovative schools students could also choose how and when they wanted to work on the subject matter, and with whom they wanted to collaborate. In a few cases students could decide about the content of their learning as well, in other schools this was the case in projects or inquiry-based parts of the curriculum.

Structure was offered in several ways. Study guides were used that explained the structure of a theme and indicated when assignments had to be handed in. Coaches or mentors were crucial in the process of self-regulation too, as their support allowed students to develop self-regulation skills in a guided context. In all schools, students were encouraged to reflect on their goals, planning, and achievements in order to develop self-regulation skills. One of the innovative schools, for example introduced making an autobiography in order to stimulate students to reflect on their development. Not only teachers but also fellow students played a role in this, for example in reflective group discussions.

Some schools used a questionnaire for monitoring the development of students' self-regulation skills, others used rubrics or assessment sheets on which students or teachers scored students' level of self-regulation, or students reported on it as part of a portfolio. In several schools the issue was also addressed in so-called 'development conversations' with students.

A positive and safe classroom climate was seen as a precondition for students to be willing to reflect on their and each other's development. Therefore, the innovative schools were organised in small-scale units, in which groups of students collaborated with a team of teachers, and worked in their own area of the building, preferably for several years in a row. This enabled students and teachers to really know each other. Art and theatre were used in several schools as ways to get to know each other and to realise a friendly and open atmosphere.

Collaboration. Collaboration was common practice at the innovative schools in our study. It was both used as a teaching strategy and seen as one of the twenty-first–century competencies the schools wished to develop. Several innovative schools characterised their pedagogical approach as 'collaboration in a learning community'; students collaborated in longer lasting projects. Schools used several ways of organising collaboration. One of the schools, for example grouped students in 'circles of mates', small groups of students working together and reflecting on each other's activities and contributions. In the innovating schools, students collaborated in the context of specific tasks. Student groups were composed based on ability levels or relevant personal qualities, or students were allowed to choose themselves with whom they wanted to collaborate. In most schools students were also allowed to help each other, while working on assignments, for example when working self-directedly in the 'learning-squares'. This kind of collaboration was mostly unregulated.

Several schools offered students explicit support in developing collaboration competencies, for example by training students' social competencies, practicing giving and receiving feedback, and by explaining what collaboration is about. 'Students

have to learn that collaboration is about agreements, and that it is not necessary to be friends', as a teacher of one of the schools put it. Assessment of (the development of) students' collaboration skills was done in a similar way as described above for self-regulation: rubrics, (self-)assessment sheets and portfolios were used. Just as for self-regulation, the school and classroom climate was considered important to encourage and support collaboration. Students must respect each other and treat each other as equals, in order to collaborate and further develop their collaboration competencies.

Creativity. Developing students' creativity was a less common educational goal and was only found in some of the innovative schools. These schools interpreted creativity in a broad way. It was seen to include skills like being able to create, being imaginative, creative thinking and problem-solving. Some of these schools used curricular content in the area of arts and culture in order to stimulate creativity or creative thinking. Two innovative schools had developed teaching strategies and assignments that were aimed to stimulate creative thinking. One of these schools presented students with a phenomenon by means of a story or image, which they then studied and discussed with peers en teachers in order to discover a theory or pattern. Another school stimulated creative thinking by assignments that offer different solutions, and that stimulate students to ask questions and make choices. The teachers' role was to ask open questions, and respond to reactions of the students. Students were encouraged to find out for themselves how they could approach the assignment. Schools reported few methods they used for assessing students' (development of) creativity or creative thinking. Presentations by students were a common practice in the innovative schools, and sometimes creativity was an aspect used in the assessment.

Students' self-reported mastery of self-regulation, collaboration and creativity

In this section we answer the second research question that focuses on whether the extent of schools' focus on self-regulation, collaboration and creativity, particularly imagination, is related to students' mastery of these competencies.

Descriptive statistics. The descriptive statistics of the control variables are shown in Table 1. Girls and boys were equally represented in the sample. Most students who participated in this study had parents who were born in a Western country (83%) and more than two third of the students' parents completed higher education (69%). Almost three out of four students in our sample were attending senior general or pre-university secondary education (72%).

Table 2 shows the mean scores and standard deviations of the students' scores on the three competencies in the ninth and tenth grade (age 14–15 and 15–16). Only the students' scores on learner control seem to increase between the ninth and tenth grade. Students' scores on the other competencies seem to decline between the ninth and tenth grade. With paired sample *t*-tests we tested whether students' scores increased or decreased significantly between the ninth and tenth grade. We found that

Table 1. Descriptive statistics for background characteristics of the students

		N	%
Gender	Boy	270	50
	Girl	275	50
Western	Unknown	16	3
	Western	460	83
	Non-Western	75	14
Parental education level	Unknown	32	6
	Low	140	25
	High	379	69
Education level of the student	Lower pre-vocational secondary education (vmbo-b/k)	6	1
	Pre-vocational secondary education (vmbo-t)	150	27
	Senior general or pre-university secondary education (havo/vwo)	395	72
Delayed	Unknown	25	5
	Not delayed	466	85
	Lower education level or grade retention	60	11

Table 2. Mean scores and standard deviations for students' self-reported twenty-first–century competencies

	Ninth grade			Tenth grade		
	M	s.d.	***N***	***M***	s.d.	***N***
Learner control	5.12	0.95	458	5.19	0.91	511
Strategy use	4.50	1.49	458	4.45	1.44	511
Collaboration skills[a]	4.86	0.91	458	4.79	0.90	511
Imagination skills	4.90	1.08	475	4.80	1.06	536

Note. Scales ranged from 1 'not applicable at all' to 7 'totally applicable'.
[a]Because the iSELF measures self-reported mastery, we decided to use the term collaboration skills here. When we address 'focus' we use the term 'collaboration'.

only students' scores on imagination skills significantly decreased between the ninth and tenth grade ($t(462) = 2.05$, $p = 0.04$).

Table 3 represents the mean scores and standard deviations of students' experience of the focus of their school on learner control, strategy use, collaboration and imagination in the tenth grade (age 15–16). On average the students scored high on experienced focus of their school on these competencies.

The relationship between schools' curricular focus on the three competencies and students' mastery of these competencies. We examined the relationship between the schools' focus on and students' perceived mastery of the three competencies in the tenth grade. The results, after controlling for gender, ethnic background, parental education level, educational level of students and grade repetition or change, are shown in Table 4. It appears that the stronger a schools' curricular focus on these

Table 3. Mean scores and standard deviations for schools' focus on twenty-first–century competencies

	Tenth grade		
	M	s.d.	***N***
Focus on learner control	3.74	0.63	508
Focus on strategy use	3.61	0.73	507
Focus on collaboration	3.66	0.69	514
Focus on imagination	3.59	0.71	516

Note. Scales ranged from 1 'totally disagree' to 5 'totally agree'.

Table 4. Standardized coefficients and effect sizes (ES) for Learner control and Strategy (N = 466), Collaboration (N = 473) and Imagination (N = 497)

	b	SE	***p*-value**	ES
	Learner control			
Focus on learner control	0.23	0.06	<0.01	0.25
	Strategy use			
Focus on strategy use	0.34	0.04	<0.01	0.38
	Collaboration			
Focus on collaboration	0.28	0.04	<0.01	0.30
	Imagination			
Focus on imagination	0.11	0.05	0.03	0.11

Note. Control variables: gender, ethnic background, parental education level, educational level of the student and delayed.

Table 5. Standardized coefficients and effect sizes (ES) for Learner control and Strategy (N = 387), Collaboration (N = 393) and Imagination (N = 433) in the tenth grade after controlling for the score in the ninth grade (measurement 1)

	b	SE	*p*-value	ES
	Learner control controlled for measurement 1			
Focus on learner control	0.18	0.06	<0.01	0.20
	Strategy use controlled for measurement 1			
Focus on strategy use	0.23	0.04	<0.01	0.27
	Collaboration controlled for measurement 1			
Focus on collaboration	0.15	0.04	<0.01	0.18
	Imagination controlled for measurement 1			
Focus on imagination	0.02	0.04	0.67	0.02

Note. Control variables: gender, ethnic background, parental education level, educational level of the student and delayed.

competencies, the more students indicate they master these competencies. This is the case in all four areas of the investigated twenty-first–century competencies: learner control, use of learning strategies, collaboration and imagination.

We also examined the relationship between schools' focus on and students' perceived mastery of the three competencies in the tenth grade (age 15–16) after

controlling for students' perceived mastery of these competencies in the ninth grade (age 14–15). Table 5 presents the results after controlling for gender, ethnic background, parental education level, educational level of the student and whether the student was delayed in his/her educational carrier between the ninth and tenth grade.

The results show that the more schools focus on learner control, use of learning strategies and collaboration in the tenth grade (age 15–16), according to the students, the more students improve in these competencies between the ninth and tenth grade. For the school's focus on imagination we did not find a significant relationship with improvement of the students' imagination skills.

Conclusion and discussion

This study examined (1) how schools implement a focus on twenty-first–century competencies and (2) whether the extent of schools' curricular focus on three specific competencies is related to students' mastery of these competencies (self-regulation, collaboration and creativity).

First, we described how innovative and innovating schools integrate self-regulation, collaboration and creativity in the curriculum. There was quite some variation in the way and extent of working towards these competencies. In the innovative schools they were part of the school's mission and curriculum content, pedagogy and school organisation were all geared towards developing students' competencies in these areas. In the innovating schools paying attention to these competencies was an emerging effort, which was seen as an addition to the regular curriculum. For *self-regulation* the approaches varied from students working at their own level and pace with the help of a study guide to students making their own choices concerning learning goals to pursue and curriculum content to study, with teachers providing tailor-made feedback. In the innovative schools students were stimulated to take responsibility and ownership of their learning process. In all schools reflection was seen as an important way of stimulating students' self-regulation. *Collaboration* was both a goal and common practice in the innovative schools, and students were used to collaborating in longer lasting projects. In the innovating schools collaboration was restricted to specific tasks. Several schools offered explicit support in developing collaboration competencies. Developing students' *creativity*, in the sense of being able to create, being imaginative and thinking creatively, was less common and only found in the innovative schools. Some schools used specific content in the area of arts and culture for stimulating creativity and creative thinking.

In the second part of the article (research question 2) we found that the focus of schools on self-regulation, collaboration and imagination was positively related to tenth-grade students' (age 15–16) perceived mastery of these competencies. This finding supports our expectation that curricular focus on competencies will have an impact on students' mastery of these competencies and that more focus means more mastery. Moreover, we found that after controlling for students' mastery of the competencies in the ninth grade (age 14–15), the focus of schools on self-regulation and collaboration was still positively related to students' mastery of these competencies, which indicates that students also *develop* more twenty-first–century competencies

when schools focus on these competencies. For schools' focus on imagination we did find a positive relationship with students' mastery of this competence but not after controlling for students' mastery of this competence in the ninth grade. Thus, students do not seem to develop more imagination skills between the ninth and tenth grade in schools that focus more on these competencies. This finding can actually be explained by an overall drop in students' perceived mastery of imagination skills between grade ninth and tenth.

First, our study shows that, although twenty-first–century competencies may not yet be systematically integrated in national and school curricula (Ananiadou & Claro, 2009; Thijs, Fisser & van der Hoeven, 2014), schools are beginning to pay attention to these competencies into their curricula and classroom activities, and do so in different ways. This means that examples are becoming available, that other schools can learn from and get inspired by, choosing what best fits their particular situation. These examples also show that paying attention to twenty-first–century competencies does not need to imply denying the importance of knowledge (Hirsch, 2016). These competencies are addressed through different aspects of the curriculum, including curriculum content. The willingness of a variety of schools to participate in our study proves there is an interest in paying attention to twenty-first–century schools in a broader range of schools. It should also be noted, however, that for some of the schools in our study, for example the Waldorf school paying attention to these competencies has been part of the educational concept of the school for almost a-century already.

One of the reasons that is given for the slow implementation of twenty-first–century competencies is the complexity of the curriculum innovation it requires (Voogt & Pareja Roblin, 2012). The school portraits on which we drew in the first part of our study indeed confirmed that a broad range of aspects of the curriculum was involved: goals, curriculum content, pedagogy and assessment. The innovating schools, however, show that it is possible to take small steps in innovations aimed at teaching twenty-first–century competencies. Also we saw that, as the literature suggests, these competencies were paid attention to throughout the curriculum and across all age levels. However, this did not seem to be based on explicit ideas about how these competencies develop.

Across the schools we found all three approaches for implementation of twenty-first–century competencies that Voogt and Pareja Roblin (2012) distinguished: adding new subjects or new content within existing subjects, integration as cross-curricular competencies or transforming the curriculum. The innovating schools in our research seem to tend towards adding new subjects or content, whereas the innovative schools seem have adopted either an integrative, cross-curricular approach towards twenty-first–century competencies or have transformed the curriculum in more fundamental ways.

Second, our study shows that focussing on twenty-first–century competencies in the curriculum makes a difference. It is encouraging that schools that pay more attention to these competencies realise more mastery of these competencies in their students. Although we cannot directly link the results of the qualitative and the quantitative study, the drop in students' perceived mastery of imagination skills between

grade nine and ten might be explained in line with this finding. It may be harder for teachers to sustain and to keep stimulating the imagination skills of students in the higher grades as they are expected to prepare students for the national exams that do not yet cover this twenty-first–century skill.

Finally, we mention some limitations of this study. First, for describing *how* schools work on twenty-first–century competence we drew on school portraits, made by teacher–researchers from these schools, with help of a researcher. These school portraits were rich descriptions of curricular aims and practices, and were based on interviews, observations and school documents. However, we did not use the primary data. The school portraits were already interpretations.

Second, we found that students' mastery of twenty-first–century competencies was higher in schools that pay more attention to these competencies, but our data do not allow to establish whether particular ways of focussing on twenty-first–century competencies are more effective than others. As we did not dispose of school portraits of all schools in the quantitative study, we were not able to relate the student data to information about the schools' approach as reported in the school portraits. Future research might try to relate characteristics of the approach of a school to its students' competencies. Third, we were not able to test differences between innovative and innovating schools in their students' mastery of twenty-first–century competencies, as the number of school in these two groups were too small.

A final limitation is the fact that we measured schools' focus on twenty-first–century competencies by asking students whether they experience such a focus at their school. If language and aims associated with promoting a twenty-first–century approach are visible and audible in the discourses of a school, they may be echoed in students' responses. Also students' mastery of twenty-first–century competencies was reported by the students themselves; we asked students to what extent they felt able to use twenty-first–century skills. Whereas tests are available for measuring students achievements on traditional goals, instruments for measuring twenty-first–century competencies are scarce and tests are not available or do not represent the competencies in a proper way (Voogt & Pareja Roblin 2012; Ledoux *et al.*, 2013). Both measures thus concern student perceptions: perceived focus and perceived mastery.

Despite these limitations, this study does provide an impression of how innovative and innovating schools implement a focus on twenty-first–century competencies into their curriculum and of the extent to which schools manage to realise such competencies. It shows that schools that focus on twenty-first–century competencies do indeed effectively realise twenty-first–century competencies in the sense that mastery of the competencies in the specific areas schools focused on was perceived as higher by the students. Therefore, this finding provides support for the thought that schools are able to implement twenty-first–century competencies in educational practice.

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Geolocation information

The data for this study were collected in The Netherlands.

Data availability statement

The data set associated with the paper is available by contacting the authors. Complete school portraits can be found on the project website: https://toekomstgerichtonderwijs.kohnstamminstituut.nl

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NOTE

[1] In some studies the term twenty-first–century 'skills' is used, in others the term twenty-first–century 'competencies'. The latter refers to an integrated set of skills, knowledge and attitudes. In the context of our study we prefer the term 'competencies', but we use 'skills' when this term is used in the cited literature. We also sometimes use the term 'skills' when referring to specific skills like collaboration or self-regulation.

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