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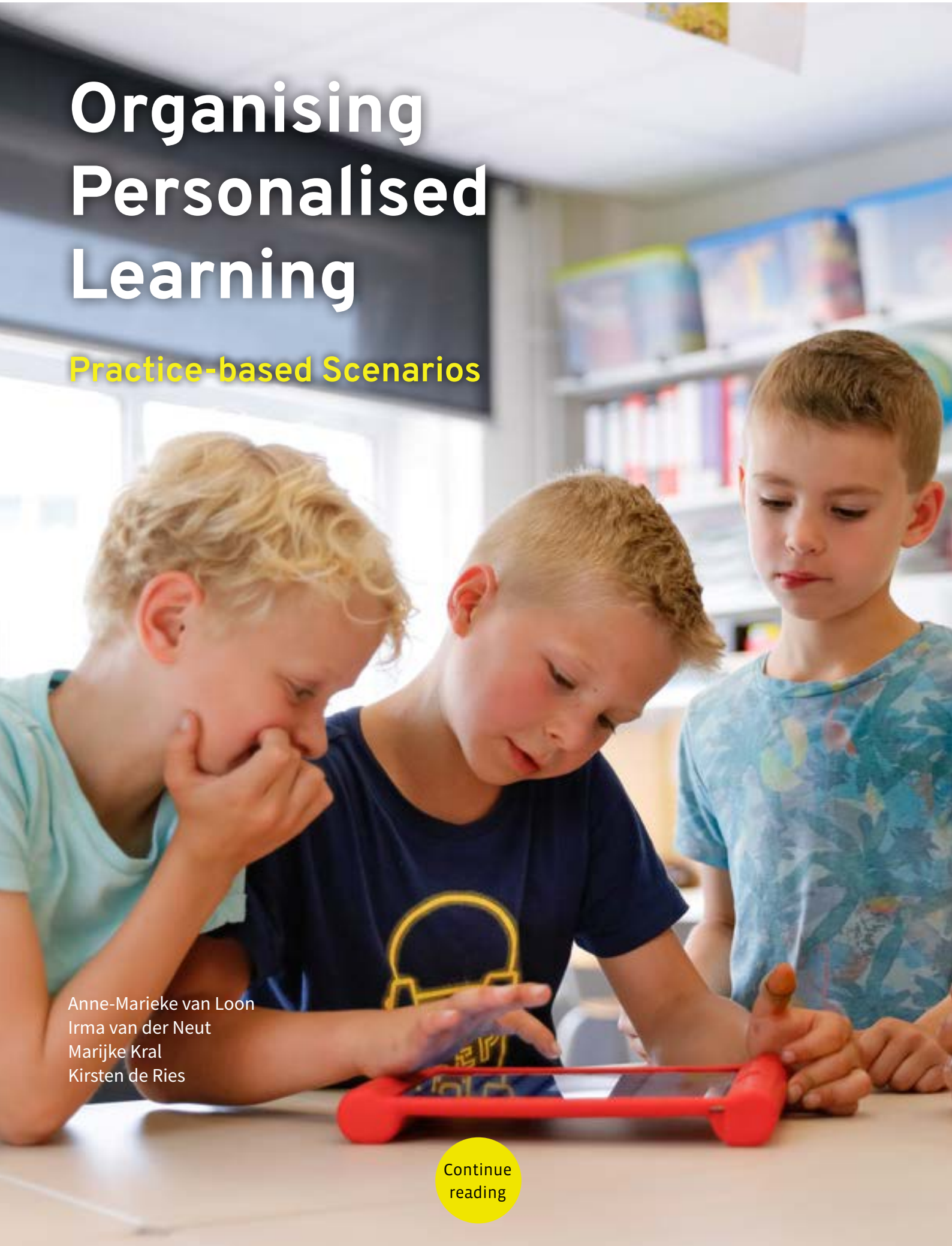
CENTRE OF EXPERTISE

Organising Personalised Learning

Practice-based Scenarios



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1 Introduction

This publication describes the aspects of the school organisation that change or require change when learning becomes more personalised; in other words, when education caters more to the students' individual educational needs and students have more control over their own learning process.

Organising personalised learning: Practice-based scenarios follows up on the publication *Dimensies van gepersonaliseerd leren: De eerste bouwsteen voor het organiseren van gepersonaliseerd leren*[1] (Van Loon, Van der Neut, De Ries, & Kral, 2016). It discusses the concept of 'personalisation of learning' and the choices that underpin this approach. These choices are made in two dimensions. The first dimension relates to how much freedom students are given to self-regulate their own learning processes, varying from no self-regulation to full self-regulation. The second dimension relates to the extent to which the student's individual interests take priority. This varies from catering exclusively to the collective interests and goals to catering exclusively to the student's individual learning goals and needs. The position on each of the dimensions affects how personalisation of learning is shaped in schools. Different positions lead to different variations in the personalisation of learning.

When personalisation of learning is organised using information and communications technology (ICT), all kinds of actors and factors play various roles. Actors include teachers, students, parents, the ICT coordinator, the remedial teacher, the school leader and external parties. Factors include the learning environment, learning resources, ICT applications, examinations, group formations and building design. Depending on the particular variation of personalisation of learning, actors will have different roles, and factors will be organised differently. How the actors and factors relate to and influence each other will also differ. Every form of personalisation of learning requires a distinctive organisational method. To describe the connection and relationship between actors and factors, we use the Actor Network Theory (ANT) (Latour, 2005, 2011).

Are you interested in what personalisation of learning entails and what choices lie at the heart of this concept? Please refer to Chapter 2. Would you like more information about the most important actors and factors involved in organising the personalisation of learning? Go to Chapter 3. Do you want to know how schools organise the personalisation of learning in practice? Read the three scenarios in Chapter 4 and the reflections in Chapter 5.

1 *Dimensions of personalised learning – the first step towards organising personalised learning.*

2 Personalisation of learning: what is that?

2.1 Doing justice to differences between students

Many terms are used to describe doing justice to the differences between students. Differentiated learning, customised learning and personalised learning are terms that are used interchangeably. However, there is a significant difference between differentiation and individualisation, on the one hand, and personalisation of learning on the other.

Differentiation aims to maximise the potential of all students by designing proactive learning experiences in response to the students' individual needs (Santangelo & Tomlinson, 2012, p. 310). The demands and the level of the learning activities match the needs, interests and capacities of the individual student (Prain et al., 2015). From a pedagogical perspective, differentiated learning considers why, what, how, when and how quickly students learn (Moje, 2007). In differentiation or individualisation, the students are seen as objects of learning, with the teacher adapting the education to the students' learning needs (Bray & McClaskey, 2013).

Personalised learning, in contrast, makes the students active participants in their own learning processes. They are much more the subject here, steering the learning so that it matches their own interests, talents and ambitions (Bray & McClaskey, 2013). According to Hargreaves (2006), the student and teacher, each with their own role, are jointly responsible for the learning process. The learning environment facilitates student-driven learning. 'Personalised learning is the coordination of methodology, pedagogy, curriculum and the learning environment, for students and by students in order to meet their different learning needs and ambitions' (Hargreaves, 2006). Students are co-owners of their own learning processes and the education matches their needs, capacities and interests (Bartle, 2015). Education takes shape based on the involvement and independence of the students, with a variety of learning goals and/or learning routes. Students have the space to direct the learning, to connect it to their own interests and talents and to take responsibility for their own learning. Students have autonomy.

2.2 Not an individual affair

Learning is personalised when it matches students' individual needs and when they have control over their own learning processes. This does not mean that learning is an individual affair. Learning takes place in interactions with fellow students, teachers, parents and the learning environment. Learning requires participation in collaborative activities (Moje, 2007). 'Personalized learning is more than individualized coaching, in that students participate in collective, structured activity with scaffolded support from their teachers, including modelling, guidance in goal-setting, and timely feedback' (Campbell, Robinson, Neelands, Hewston, & Mazzoli, 2007). Many argue that education should also serve the collective interests. The Dutch Education Council (2015) believes that basic education should do justice to individual differences between students, while adhering to regulations concerning final examinations. As such, it can guarantee the basic character of education. The Dutch Education Council (2017) argues that when societal and individual interests clash, societal interest should take precedence. Biesta (2012) argues that good education should focus on three target domains: qualification, socialisation and subjectification.

2.3 Importance of personalisation of learning

Schools face increasing heterogeneity in students' educational needs, partly as a result of developments in the 'passend onderwijs' framework (Dutch Ministry of Education scheme for inclusive education). Teachers wonder how they can do justice to the differences between students so that every student can develop optimally. Setting up learning routes that are more attuned to students' individual development needs is one of the important development themes in the teaching profession today.

Personalisation of learning could help to increase the effectiveness of education (Volman & Stikkelman, 2016). The underlying idea is that when education is based on students' individual needs (capacities and interests), it leads to better performance (Pane, Steiner, Baird & Hamilton, 2015). By giving students autonomy in their learning processes, they

are more motivated to learn (Van Loon, 2013). Increased motivation results in better learning performances (Ryan & Deci, 2000). More learner-centred education could be used to achieve other broader educational goals. As a result, students get a variety of learning options to match their personalities and interests. This allows them to develop their creativity and to work more on their personal development (Volman & Stikkelman, 2016). A systematic evaluation of the effects of personalised learning is, however, lacking (Van Eck, Heemskerk, & Pater, 2015). It is therefore difficult to make any general statements about the effects of personalised education.

2.4 Personalisation of learning according to different dimensions

Personalisation of learning can take on many forms. It depends on how much the school allows students to control their own learning processes and how much attention it pays to individual interests. The ultimate form of personalisation of learning is personalised learning (see the quadrant at the top right of Figure 1).

The choices a school makes when personalising the learning process affect primary processes and the school's organisation. The way in which learning is personalised depends on two dimensions, namely:

1 External regulation versus self-regulation; and
2 Collective interest versus individual interest.

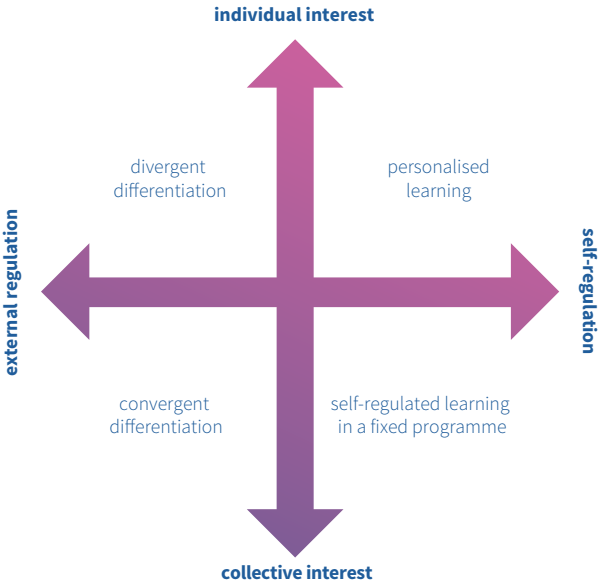

Figure 1. Dimension descriptions for personalisation of learning (Van Loon, Van der Neut, De Ries, & Kral, 2016).

2.4.1 Dimension: external regulation/ self-regulation

The first dimension is the student's self-regulation of learning. In other words, the student influences and takes responsibility for the learning process, i.e., what, when, where, how, why, with whom and how quickly he or she learns. On one side of the dimension, the control is completely in the hands of the teacher or other external actant, for example, an ICT program or course book. This actor tells students where, how, when and with whom they are to learn and how much time it should take. The learner is more of a receptor and neither an active player nor developer of his or her learning process (OECD, 2013, 2016). On the other side of the dimension, students have full control of their own learning processes. All kinds of mixed forms are possible between these two extremes, whereby students are to a greater or lesser extent co-owners of their own learning processes. Choosing one of these dimensions can affect the roles of the teacher and student, the use of ICT and the educational organisation, such as learning resources, group formation, time and place of learning, and tasks.

Not all students are capable of regulating the educational process or of making the right choices about the learning process (Reeve, Nix, & Hamm, 2003). Good metacognitive and self-regulating skills are needed for personalised learning to have a positive effect on learning achievements (Devolder, van Braak, & Tondeur, 2012; Pintrich, 2004; Zimmerman, 2001). Students need support in developing their capacities for self-regulation and self-regulated learning (Marquenie, Opsteen, Ten Brummelhuis, & Van der Waals, 2014).

2.4.2 Dimension: collective interest versus individual interest

The Organisation for Economic Co-operation and Development (OECD, 2013) argues that the extent of personalisation of learning changes as the balance between individualisation and collectivisation shifts. The greater the emphasis on the collective interest, the more the educational offering becomes collectivised and standardised. We no longer speak of personalisation when students get the same education (one-size-fits-all). The more educational decisions are made on a collective level, the less space there is for individual choices. When the emphasis is on the individual interest and when education is geared to individual goals and learning needs, we can speak of individualisation and differentiation. Here, students can follow strongly personalised learning tracks or design their own learning track (one-size-fits-one).

The risk of an extreme form of individualisation and pursuit of individual interests is that it can jeopardise social objectives. This could involve, for example, knowledge and skills needed to function in social communities and values that lie at the heart of our democratic, constitutional state (Dutch Education Council, 2017). When gearing education towards personalised learning, the school must not lose sight of societal interests and the socialisation of its students.

2.4.3 The four quadrants

Schools that choose external regulation (left side of the quadrant) can cater to students' needs in two ways, namely by convergent or divergent differentiation. In convergent differentiation, the teacher focuses on minimum goals that all students have to achieve (Coubergs, Struyven, Gheyssens, & Engels, 2013). Students stay together as long as possible. In divergent differentiation, the focus is on individual students who receive differing levels of guidance (Coubergs et al., 2013). Students follow their own learning routes with appropriate goals and instructions. Therefore, the levels and the educational offerings are very diverse.

Schools that decide to give students a lot of control (right side of the quadrant) can cater to the students' needs in two ways. They can allow self-regulated learning. Students need to achieve the same minimum goals but regulate how, when, where and with whom they learn. The programme is thus fixed, but they can make choices within the programme. Personalised learning takes place when the individual needs of students are considered and when students regulate their own learning processes. Students not only decide how, when, where and with whom they learn, but they also influence their own learning goals.

3 Organising the personalisation of learning

To adequately organise personalised learning, the design of primary processes and the school organisation must be well aligned. Earlier research has confirmed the importance of this alignment. The way schools shape personalisation of learning affects aspects such as curriculum, pedagogical approach, examinations, professional development of the team, development of the school culture and infrastructure (Bates, 2014). According to Hargreaves (2006), changes must take place at different levels within the school organisation for personalisation of learning to be successful in practice. Petri and Zuylen (2011) point out the necessity for coherence in the learning and educational vision in both primary processes and in the school organisation. The assumption is that learning, teaching and the organisation have to be in line with each other. Continuing from this assumption, a change in the learning and educational vision requires changes in student and teacher behaviour, matching ICT use, and changes in the school organisation. Conversely, a certain school organisation is needed to bring about changes in teachers' behaviour. Schools that manage to achieve strong learning results in their students understand the art of providing coherent education, in other words, coherency in the curriculum, teachers' behaviour and the organisation (Waslander, 2007).

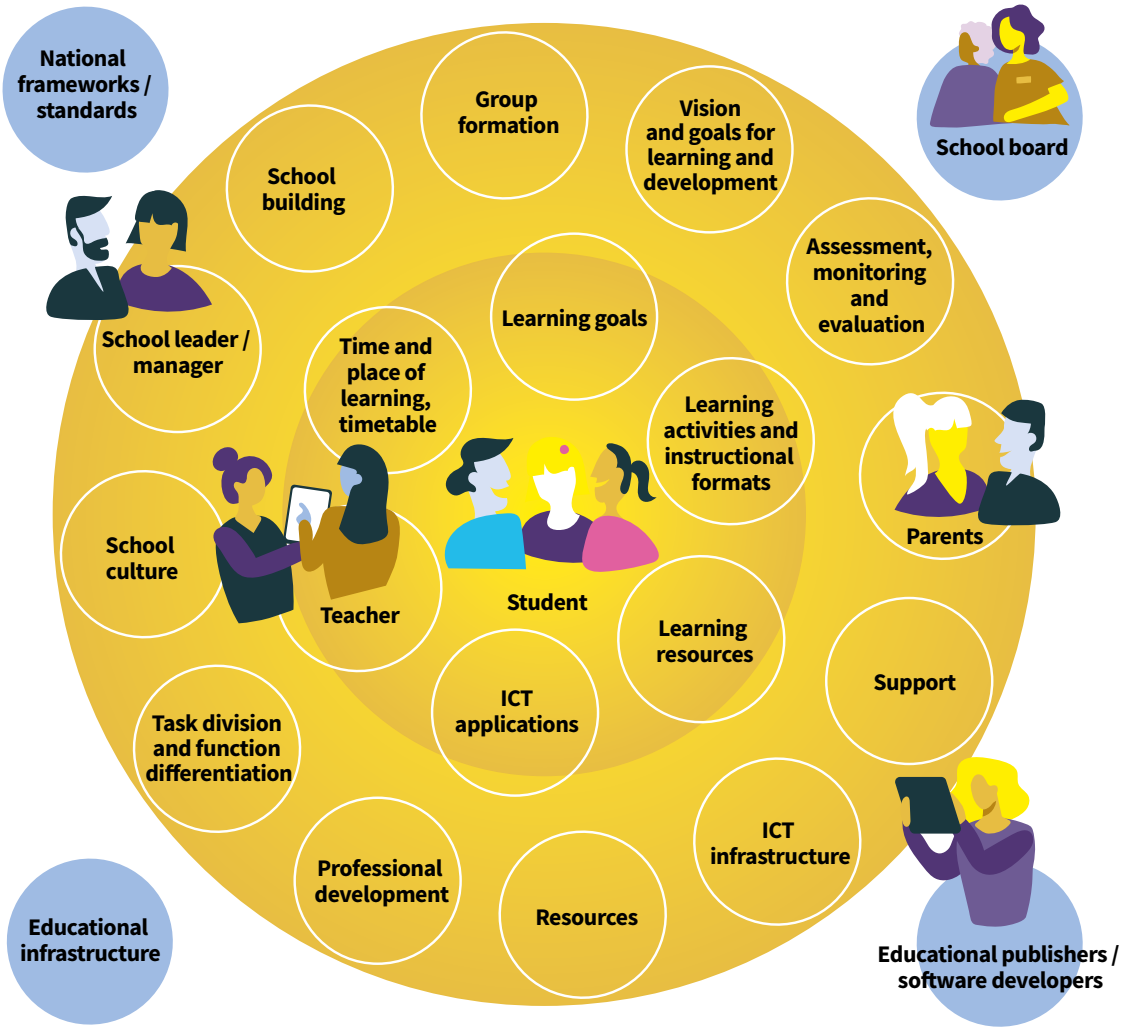

Figure 2. The actors and factors that play roles in organising the personalisation of learning

3.1 Interrelated network of actors and factors

The design of primary processes and school organisation can be considered as an interrelated network of all kinds of actors and factors. Each has its own characteristics and behaviours and they all mutually influence each other. Research based on existing conceptual models of school innovation and ICT integration (e.g., Hew & Brush, 2007; Kozma, 2003; Lim, 2002; Tearle, 2003; Vanderlinde & Van Braak, 2010) has defined the most important actors and factors involved in organising the personalisation of learning with ICT. These are given in Figure 2.

To describe the relationship between actors and factors, we use the Actor Network Theory (ANT) (Latour, 2005, 2011). This theory refers to the interrelated network of actors and factors as an actant network (Latour, 2005, 2011) in which an actant can be an actor or a factor. Each actant has multiple characteristics and connections and can undertake various actions. The characteristics of teachers, for example, include opinions, knowledge and skills. These opinions, knowledge and skills influence teachers' behaviour, i.e., the actions they carry out (Van der Neut, Teurlings, & Vink, 2015). The teacher also has numerous connections with other actants, for example, with learning goals, learning resources, ICT applications, students, school leader/manager, parents, etc.

Through their actions, actants can influence the characteristics and behaviours of other actants in the network. Teachers can perform various actions to influence the actants with whom or to which they are connected, for example, instructing students or selecting learning resources. The teacher, in turn, is influenced by other actants. The actors – 'teacher', 'student', 'parent', etc. – do not really exist. Each individual student, teacher, parent, etc., is a separate actor, with his or her own opinions, knowledge and skills, and relationships with other actors. This means they can behave differently in the same actant network. Thus, while some students are capable of regulating their own learning processes, others need a lot more support for this. While some parents can easily fulfil their role in guiding and supporting their children, other parents do not have sufficient motivation, time or competencies to do so. While some teachers are capable of understanding and catering to the individual needs of their students, other teachers need training and support to achieve this.

Chapter 4 describes the scenarios of three schools that have taken steps towards the personalisation of learning. Each is at a different stage, which can be seen in their actant networks.

4 Scenarios on the path to personalisation of learning with ICT

Six innovative schools (primary and secondary) were visited. They have all taken steps towards the personalisation of learning with ICT. The schools vary in the extent to which students regulate the learning process (external regulation – self-regulation), the extent to which they cater to the differences between students (collective interest – individual interest) and their use of ICT in these respects.

The school leader and one team member were interviewed at each school. They indicated the crucial actors and factors that, in their opinion, play roles in the personalisation of learning at their school. Based on this, they made a concept map in which they indicated how the actors and factors relate to each other. They were continually asked to give concrete examples to illustrate these actors and factors. Each school rated itself on the dimensions of 'extent of collective interest – individual interest' and 'external regulation – self-regulation'. They were also asked to give concrete examples from their school.

This chapter describes how three of the six visited schools organise the personalisation of learning. They were selected because they made different choices in the dimensions and are positioned in different quadrants of the model.

The scenarios are described first and foremost in terms of the school's position on the dimensions of 'external regulation – self-regulation' and 'collective interest – individual interest'. This is followed by a description of their most typical actors and factors, characteristics, connections and behaviours. The final result is a schematic diagram of the actant network of each scenario. An arrow between two actants in the diagram denotes a connection between these actants. The direction of the arrow indicates which actant carries out the action. Figure 3 shows a connection between teacher and learning goal and between student and learning goal. Both the teacher and the student carry out an action in the direction of the learning goal, i.e., they decide the learning goal. The teacher and the student also have a connection; they carry out actions back and forth. This may mean the teacher and student together decide on the learning goal.

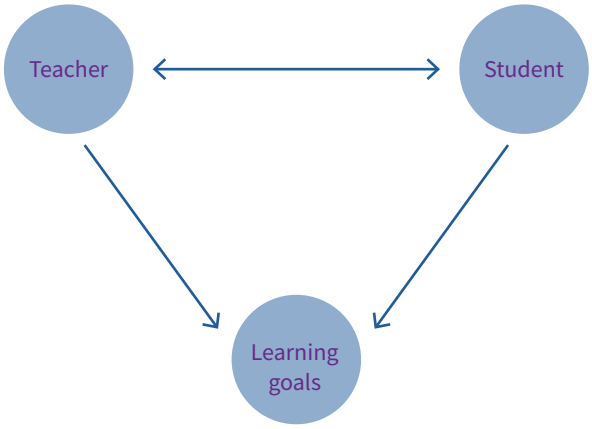

Figure 3: Example of connections between actants and actions.

The description of each scenario includes at least the student, the teacher and the ICT applications. We do not aim to exhaustively describe each scenario.

4.1 Towards personalisation of learning in just one subject area. School moving towards more self-regulation (primary education)

Position on the dimensions

Depending on the subject, the school is positioned differently on the dimensions. The teacher is in control of the core subjects (including spelling, reading, writing, mathematics, motor skills, and language). The school wants to meet the exit qualifications (collective interest) that form the basis for the learning goals. The teachers determine these learning goals and the educational offering. For students who do not meet the collective outcome or fall far below it, the teachers formulate individual development-based outcomes (individual interest).

'Working with core concepts is an approach for World Orientation that leaves a lot of room for students and teachers, but nonetheless provides a targeted approach to gaining understanding. The core concepts consist of eight interrelated clusters of understanding outcomes. These outcomes together cover the core outcomes for World Orientation2 as well as other outcomes focused on understanding. Based on these outcomes, teachers can design the learning environment with all kinds of challenging instructional formats, activities and learning resources. Working with core concepts involves the integration of communicative skills and creative subjects. Mathematics skills are applied as well.'
Source: www.kpcgroep.nl

Regarding the subject of World Orientation, the school works with the core concepts method, whereby students have a lot of self-regulation. The school also strives to reach collective learning goals (collective interest), but there is plenty of room for students' own learning needs (individual interest) because they learn through self-discovery.

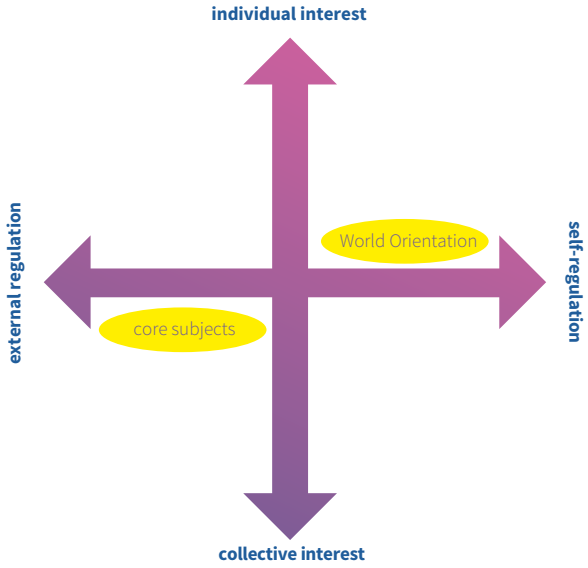

Figure 4. Illustration of scenario 1 on the two dimensions.

2 *World Orientation is a collective subject covering geography, history, nature and technology.*

Organising the personalisation of learning

A key aspect of the school's *vision* is that every *child* is in control of his or her own development. The *teachers* support the children intensively and direct them when needed. We see this vision in practice in the subject of World Orientation, but not (yet) in the core subjects. For World Orientation, the school uses the core concepts method: *students* formulate their own *learning questions* and learn through self-discovery (*learning goals*). This applies only to the subject World Orientation. The *teacher* supports individual students in formulating *learning questions* by discussing the topics with them, getting them to create a word web or having them work in groups using cooperative *instructional formats*. 'What do you already know, what do you want to investigate and what do you want to know when the theme is finished?' The students choose *learning activities* that suit their individual *learning goals*. The *students* raise questions to the *teacher*, ask for support and give the *teacher* feedback. The *teacher* checks what the *student* knows at the end of the theme and again a month later (through *assessment, monitoring and evaluation*). For the core subjects (including spelling, reading, writing, mathematics, motor skills, and language), the teachers mainly use *course books*. The teacher creates a weekly task for each student based on previous educational offerings and results (*assessment, monitoring and evaluation*). The *teacher* fills in the specially developed Course Planner (*ICT application*). This is done once a week (*time*). The *teacher* also explains the weekly task to the *students* and supports them in their planning for it. In addition, the teacher has to be able to determine the zone of proximal development, follow and monitor the learning track, provide instruction, respond to students' needs, carry out reflection and feedback discussions with students and discuss the progress with students. Some *teachers* show an inability to respond adequately. It is essential that teachers interpret the learning results at an individual level and determine individual learning programmes based on the results. In practice, they do not manage this. Teachers do not sufficiently follow students' development (*monitoring, assessment, evaluation*). They also need to gain more understanding of the quality of the education and check where they can improve the education (*monitoring, assessment and evaluation*).

There are two types of teachers: the regular teacher who guides a form group and also has a specialism (e.g., Math-

ematics) and the specialist teacher who teaches only a particular subject (Physical Education, Music or Art). The regular teacher teaches a group of students together with a teaching assistant (*support*). The teaching assistant supports the teacher and works under the teacher's direction. The teacher always has the final responsibility (*task and function differentiation*). *Parents* shape the educational partnership together with the teacher. They follow the behaviour and development of their child (e.g., by helping at school for a few hours each year, attending parent-teacher interviews three times a year and regularly talking to the teacher about their child) (*assessment, monitoring and evaluation*). *Parents* also take responsibility for the organisation and performance of secondary activities and they help with the reading hour at school. The school is open 15 minutes before school starts so that parents can have a quick word with the *school leader* or *teacher* if needed (*timetable*). The *school leader* aims for an organisational structure in which the *teachers* are at the top of the organisation/organogram and are self-managing (*vision*). Currently, the *management team* does a lot of the managing: ensuring agreements are met, ensuring everyone subscribes to and acts according to the vision, and discussing how to improve the approach with *teachers* and *teaching assistants*. The *school leader* determines and decides the staffing target (*task and function differentiation, resources*). The current staffing at the school does not meet the target because of a high level of *support staff* (ICT coordinator, teaching assistants, management team). At the moment, this is necessary because certain areas need to be further developed. In the long term, the *principal* wants less *support staff* and a self-managing organisation (*vision*).

The school works with units: lower school (years 1, 2, 3), middle school (years 3, 4, 5) and upper school (years 6, 7, 8) (*group formation*). Each unit has a number of mixed form groups and a large, inviting room, where these form groups work (*school building*). Each form group has its own zone within this room.

The school day (8:30 am to 2:00 pm) is divided into three work blocks of approximately 75 minutes (*time and place of learning*). In the morning, during the first two work blocks, the *students* work mainly on core skills: reading, mathematics and language. They also work on the 12 competencies of the school (*time and place of learning*). These are: having understanding, showing responsibility, cooperating, using your talents, reflecting, communicating, being open-minded, having self-confidence, being empathetic, being curious and solution-oriented and taking initiative (*learning goals, vision*). The afternoon, the third work block, is for World Orientation. At the start of the day and between the work blocks, *students* sit in a circle with their form group to talk, reflect, eat and drink. Each day, there is also a reading hour (*timetable*). The circle is the students' 'home base'. Each student belongs to a fixed form group. This gives students a sense of security (*group formation*).

In the past, *students* could choose from three *workshops* per work block (*time and place of learning*), but too much time was wasted walking from one place to another. Now, the students sit in one spot during the work block (*time and place of learning*), where they receive instruction and immediately start working. They also have a small space where they can work on the weekly task (*learning goals, learning activities*).

The weekly task is set by the *teacher*, but it includes a few assignments that are more flexible.
The *school leader* wants to gradually abandon *course books* and ideally use them as learning tracks but also use a variety of other learning resources (*vision, learning resource*). This should deliver more differentiation in the learning tracks. These would not be individual but clustered into different developmental needs of *students* (*vision*). However, the *teachers* are not ready for this yet, according to the school leader.

Teachers need to be able to identify the *students'* learning needs based on their learning achievements (*assessment, monitoring and evaluation*), and they have to be prepared to work on their own development (*professional development*). The *school leader* believes that *teachers* have to continue developing so that they can cater to students' needs in the best way possible and can discuss any manner of question that students might raise. This concerns both general development and the development of one's own specialism and profession (*professional development*). The *school leader* believes that education should be theoretically underpinned. He stimulates this by sharing articles with *teachers* and allowing them to gain their master's degrees (*professional development*). Three of the twelve *teachers* currently have a master's degree. Next year, more will follow. The *school leader* uses the training budget in such

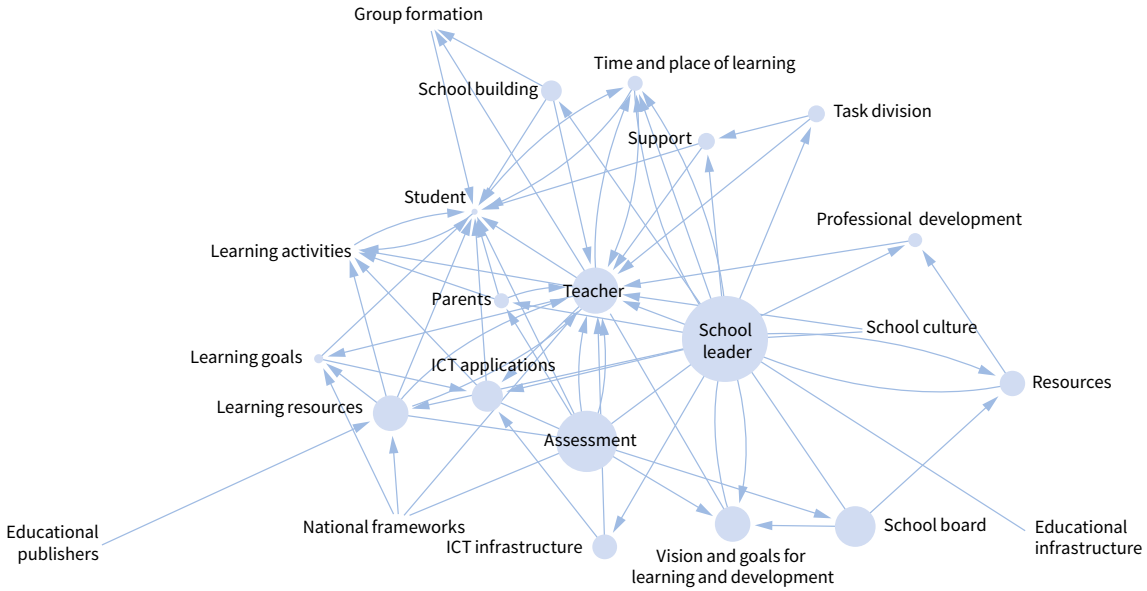

Figure 5: Illustration of actants network scenario 1.

a way that it serves the school's development (*resources, vision, professional development*). The *school leader* now chooses to invest the available *resources* mainly in *professional development* in order to meet the conditions for more differentiation in learning tracks. This is about teachers being able to gauge a student's zone of proximal development, having an overview of the learning tracks and knowing what to use, when to use it and how (*learning resource, learning activities*). This approach is partly enforced by the *board*, which has threatened to close the school if students' learning results do not improve.

The school uses *ICT* to a limited degree. The *ICT infrastructure* consists of a smartboard in each unit, a laptop per teacher, a few mobile devices and tablets. When *students* present the answers to their learning questions in World Orientation, they can use *ICT applications*. There is a digitally adaptive learning track for reading that monitors the *students'* learning results and gives them suitable assignments (*ICT application, assessment, monitoring and evaluation*). The *school leader* would also like to have a planning tool for *students* to plan the weekly task as well as adaptive software for other subjects (*ICT application*). To use a planning tool, all *students* need to have a tablet, which is not the case now (*ICT application, ICT infrastructure*). *ICT* does not yet have the position the school would like. Investments in ICT have lagged behind because of the choice to first invest in professional development. ICT has been 'sidelined' (*resources*).

Typical aspects of scenario 1

What typifies this scenario is the lack of arrows departing from the student. Other actants direct their actions towards the student. These include the teacher, learning goals, learning activities, learning resources, ICT applications, assessment, monitoring and evaluation, group formation, and time and place of learning. The student's behaviour is largely determined by the other actants (external regulation). The two arrows departing from the student point towards time and place of learning and towards learning activities and instructional formats. After all, the student does have some control over planning. A few arrows depart from parents. Parents often discuss their child's development with the teacher and take responsibility for the organisation and execution of secondary activities.

In this scenario, a lot of arrows depart from the teacher and the school leader. The teacher chooses the learning resource, gathers the information about the student's learning results, discusses the student's development with the w parents, and uses this information to make decisions on the student's learning programme. The teacher largely determines the time and place of learning and guides the student in the learning process. The school leader has a strong leading role. He largely determines the vision for learning and development, the division of resources, the task and function differentiation, ICT infrastructure and

available ICT applications, and the focus for professional development. Through continuous dialogue with teachers, the school leader tries to influence their actions and to stimulate them to take more control of, for example, their own professional development.

4.2 School searching for more individual interest and shared control (primary education)

Position on the dimensions

The school is positioned halfway on the dimension of external regulation – self-regulation. Students have partial control of what they learn, how they learn and when they learn. Teachers, students and parents together decide on the student's learning goals. The teacher provides a suitable offering of activities and digital learning resources for the students, who partly have to follow the offering and partly choose themselves.

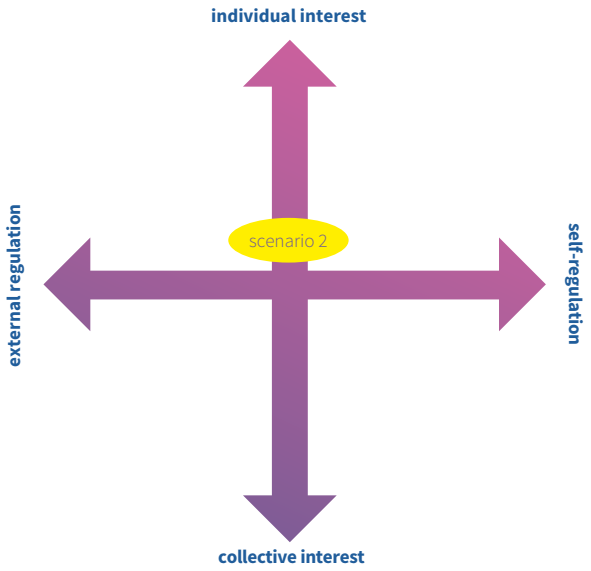

Figure 6. Scenario 2 on the two dimensions.

On the dimension of collective interest – individual interest, the school is positioned a little over halfway. The school is moving in the direction of individual interest, i.e., towards individual learning goals for students. When setting the activities and learning resources, the teacher considers the student's level and interests. The aim is to offer education that caters to the students' needs.

Organising the personalisation of learning

Students decide on their learning goals for a period in consultation with the *teacher* and their *parents* during a coaching session. These sessions take place five times a year and are based on analyses generated by the *teacher* from digital programs (*assessment, monitoring and evaluation, ICT applications*). The students are *grouped* into 'family groups' of approximately 25 students. These groups include students from different years within a unit (lower, middle or upper school). There are also instruction groups at different levels across the years. Each family *teacher* is a specialist in a certain subject, e.g., Maths specialist (*task and function differentiation*). That *teacher instructs* all the *students* of the unit in that area of expertise. He or she works closely with the specialist from the other unit. The subject of instruction for each *teacher* is mainly based on what they like and are good at. This method of *forming groups* means that all the *teachers* know all the *students*. *Teachers* from one unit and the *remedial teacher* regularly discuss all the students (*assessment, monitoring and evaluation*). Based on the input of the other *teachers* and the *remedial teacher*, the family *teacher* sets the educational offering for each *student* (*learning resources, learning activities, instructional formats*).

The family *teacher* decides what *instruction* the *student* receives; the *student* chooses which *workshops* to follow and when to work in the quiet zone (*learning activities, time and place of learning*). One day a week, the *students* can decide for themselves which *instruction* to follow. When the school started with this concept, students could decide for themselves whether to follow the instruction. It turned out that the students who needed it most were not following any instruction. The school then limited the self-regulation on this point. The *student* can independently plan by using a planning program (*ICT application*). The *teachers* enter the timetable (*time and place of learning*) with the com-

plete educational offerings for that week and activate the relevant parts for the *student*. The available instruction and workshops (Language, Maths, World Orientation, Art, Technology Games and Reading) vary per student, depending on the student's level and interests. The programme ties in with the key theme for that period.

The *students* all have their own tablet (*ICT infrastructure*), allowing them to independently work at their own level on (adaptive) digital language and maths programs and other supplementary programs selected for them by the teachers (*ICT applications*). All digital programs are linked to the electronic learning environment (*ICT application*). Thanks to adaptive programs, teachers can offer customised learning so that students can work at different levels.

Trust is extremely important in the teacher-to-teacher and teacher-to-student relationships (*school culture*). *Teachers* no longer teach every subject and have to trust their colleagues to teach the other subjects well. *Teachers* have to trust *students* and give them control over their own learning. The school expects *parents* to follow their child's progress: they can see the schedule and use this to discuss the day with their *child*. Up to year 4, the *parents* have to plan together with their *child*. Whether they actually do this and how they do it differs per parent. *Teachers* often remind *parents* of their role. This method of learning requires students to be highly independent. *Students* differ in their level of independence. It is also demanding for *teachers* because they have to set up a study programme; know the learning tracks and be able to look beyond the year boundaries; create weekly tasks; select suitable digital *learning resources*; gain an understanding of the students' needs (*assessment, monitoring and evaluation*); let go of students and guide and support them to self-regulate their own learning processes; cooperate with each other and hold each other accountable (*school culture*); and cooperate with and coach *parents*. The *school leader* supports *teachers* by steering the entire process based on the *vision for learning and development*. This is supplemented mainly by dialogue: there is room for joint discussions about specific topics, and the school leader has numerous discussions with teachers about their role in the learning process (*school culture*). The school leader has also set the rule that teachers are present from 8:00 am to 4:30 pm (*timetable*).

Typical aspects of scenario 2

In this scenario, as in scenario 1, the arrows are mainly directed at the student. However, there are more arrows departing from the student. The students determine the learning goals in consultation with the teacher and their parents. Within certain parameters, they also choose which workshops to follow and when. Therefore, within certain boundaries, they have control of the learning goals, the group formation, the learning activities and the time of learning.

The teacher plays an important role in this scenario, as shown by the many arrows departing from the teacher in the direction of the other actants. As in scenario 1, the teacher selects the learning resource but also a broad range of ICT applications, learning activities and instructional formats to more effectively cater to the students' needs. The teacher also gathers information about the student's learning results and uses it to make decisions about the student's learning programme in consultation with the student and his or her parents. In contrast to scenario 1, we see arrows departing not only from the school leader but also from the teacher. They move towards task and function differentiation, support, vision and goals for learning and development, and professional development. The teachers choose their specialist subject and a range of suitable ICT applications. Teachers also have more control over their own professional development, especially with regard to their specialism.

Scenario 2 is typified by increasing connections between teachers. Each teacher is the family teacher of a group of students and is also a specialist in a certain subject. Different subject specialists together teach the same group of students. They are expected to collaborate, coordinate their work and discuss the students' learning results. Teachers with the same or comparable specialism also work together to further develop their subject.

Parents decide the child's learning goals together with their child and the teacher. They also support their child with planning and discuss it with their child.

The school leader in scenario 2, as in scenario 1, plays a very leading role. He has connections with the vision for learning and development, the division of resources, the

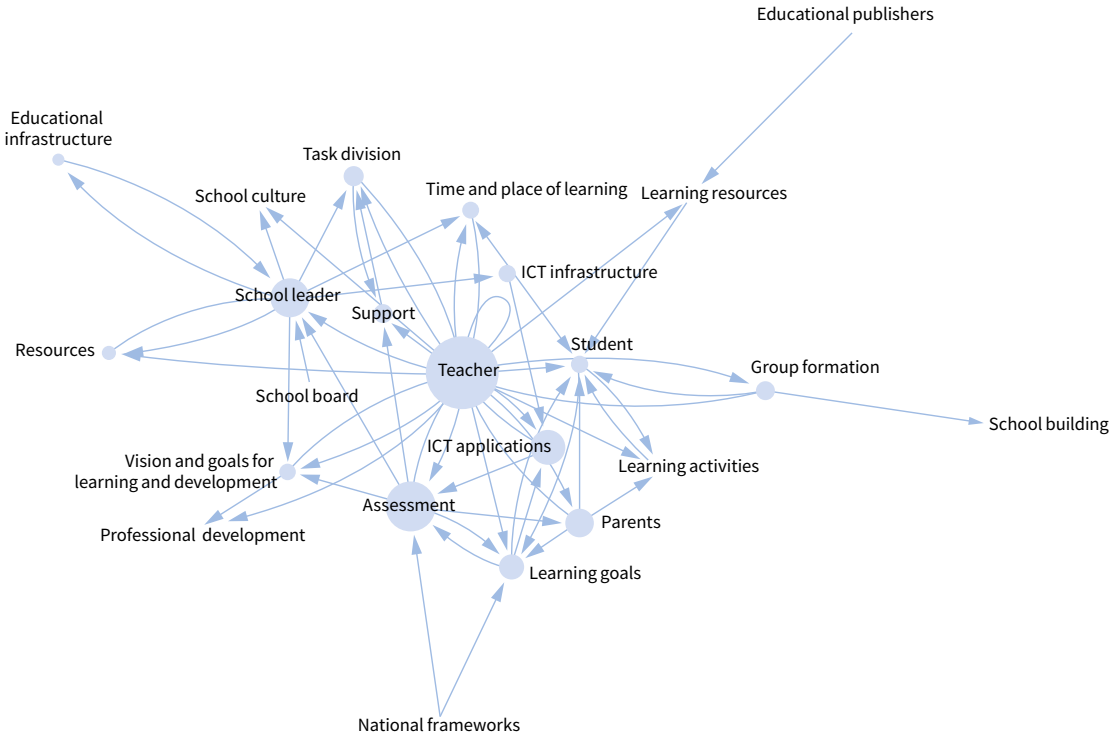

Figure 7. Illustration of actants network scenario 2.

task and function differentiation and the ICT infrastructure. The school leader largely determines what shape these will take (arrows from the school leader towards these actants). We also see continual dialogue between the school leader and the teachers in this scenario (arrows back and forth). This includes clarifying the vision for learning and development, coordinating, pointing out behaviours, supporting and coaching teachers. Both the school leader and the teachers together look at how they can put the vision for learning and development into practice.

4.3 Students with a high level of control: individual interest is leading

Position on the dimensions

In principle, each student decides what they learn, how they learn, when they learn and/or with whom they learn. It seems that not all students are capable of this. Students are thus divided into three groups which differ in the degree to which they control the learning process. Students in group A work on short and closed assignments and tasks with a limited duration. Students in group B work on longer assignments and more extensive tasks. They also decide where, when and in what order they learn. In group C, students decide what and how they learn.

The teacher plays an inspiring, activating, structuring and supporting role. The teacher gears the guidance to the student's own level of self-regulation. The school is positioned more towards self-regulation on the external regulation – self-regulation dimension. On the collective interest – individual interest dimension, the school is positioned highly on individual interest.

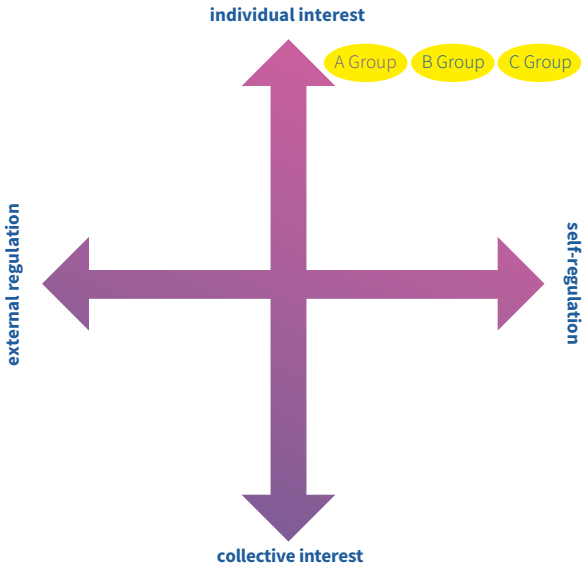

Figure 8. Illustration of scenario 3 on the two dimensions.

Organising the personalisation of learning

The starting point for this school's *vision for learning and development* is that all *students* can follow their own learning routes, the idea being that all children are unique and have their own natural ways of learning. A team of *teachers* designed the *educational concept*. They were relieved of their duties for one day a week over the period of a year for this purpose (*resources*). They looked for inspiring examples from outside education and they worked with partners from outside the school (*professional development, educational infrastructure*) and outside education. *The board* trusts the *management team* to achieve this educational concept and provides the necessary *resources* because they agree with the underlying vision of learning: highly personalised learning that is truly customised for each child. They started with a heterogeneous group of students (pre-vocational secondary education [VMBO], senior general secondary education [HAVO], and pre-university education [VWO]) in their junior years (*group formation*).

The starting point is that *students* themselves decide what they learn, how they learn, when they learn and with whom they learn (*learning goals, learning resources, learning activities, time and place of learning, group formation*). *Students* work on projects. They set up their project according to a method: (1) formulate a learning question, (2) design the research, (3) conduct the research, (4) present, and (5) reflect (*learning goal, learning activity, assessment/monitoring/evaluation*). This method can be found in a workbook (*learning resource*). *Students* who need more guidance and feedback get a workbook (*learning resource*) in which the steps are set out in more detail.
To plan their project and their learning process, *students* use digital scrum boards in the electronic learning environment (*ICT applications*). All *students* have their own device (*ICT infrastructure*). If necessary, students can borrow a tablet from the school. *Students* have different *learning resources* (course books, reference books) and a digital package with 25 modern languages (Rosetta Stone) that automatically monitors their progress (*ICT applications, learning activity, monitoring and assessment*). Students can choose from a selection of *learning activities* (workshops, lectures, assignments) given by teachers, parents or experts (*educational infrastructure*). But *students* can also design their own *learning activities*. To practice speaking skills, one *student* gave himself the assignment of ordering in German at MacDonald's. *Students* work on the assignments both at school and elsewhere, both during and after school (*time and place of learning*).

Originally, there were no lessons, timetables, subjects, course books, tests or any division into educational levels (*time and place of learning, learning resources, assessment/monitoring/evaluation, group formation*). This lack of structure led to some *students* doing nothing. The transition from the clear structure of primary school to a world of unlimited possibilities proved too much for many of the *students*. The system was therefore adjusted to provide more structure.

First, by clearly defining the role of the *coach* (*task and function differentiation*). In that role, the *teachers* inspire, activate and support the *student*. They also offer the *students* structure and boundaries. *Teachers* no longer just teach their subject but function mainly as *coach* and *mentor.* This places a great demand on their pedagogical skills. The entire *team* is responsible for the *students*' wellbeing, and the *students* themselves choose at any given time which *coach* they feel most comfortable with. To guide the learning process and monitor the progress and planning, each *student* has a fixed *coach*. The student meets with this coach for 15 minutes each week (*monitoring*). The *student* decides the *destination* and the *coach* decides the route in consultation with the student.

Second, *students* are divided into three groups (A, B and C) to offer them more structure (*group formation*). The groups are formed based on the *coaches*' understanding of the *students'* level of independence and guidance needs. The division is derived from the levels of Inquiry Based Learning, with the accompanying *teacher* roles.

Third, *teachers* provide a weekly timetable (*time and place of learning*) so that *students* carry out certain activities at set times of the day, for example, a joint start of the day, foreign languages, maths, Dutch, time for project work, break, daily scrum and meeting with *coaches*. Certain parts of the *timetable* (including maths and Dutch) were proposed by the *students* themselves.

The *parents* have consciously chosen this *educational concept* and also play a role in it. A joint session for parents is organised four times a year. These sessions signify the end of a project period. The structure is usually comprised of

reflection on the past period, successes, points for improvement/development, questions and discussion, *student* presentations and conclusion. *Parents* have the email address and phone number of their child's fixed *coach*. *Parents* also participate in the education at school for two half-days per week. *Parents* are asked to actively contribute to the education by offering a workshop on a topic they are knowledgeable about (*instructional formats, learning activities*). At the end of each school year, the *fixed coach* meets with the *parents* and the *student*. This final meeting is about the *student's* social and cognitive development and, where relevant, about the results achieved in the self-study programmes for maths, Dutch and foreign languages (*assessment, monitoring and evaluation*).

Teachers work closely together. They start each day with a meeting where they divide the tasks based on qualities and expertise (*task and function differentiation*). They also meet each month to evaluate how things are going: What did we want to achieve? What did we actually achieve? What went well and not so well? What are we going to adjust? How shall we do this? (*assessment, monitoring and evaluation*). Finally, the *teachers* reflect on the educational concept several times a year. *Management* sometimes joins in. Based on the reflection, they reassess and further develop the concept (*assessment, monitoring and evaluation*). *Teachers* follow training courses to further their *professional development,* and they participate in innovative, external initiatives. Two teachers are looking into the possibilities of Viewbrics together with a university. These are formative tests using rubrics that contain video options.

Students do not get grades. However, their development has to be visible and in accordance with an agreement between the school and the Education Inspectorate. To visualise the *students'* learning routes, the school uses a custom-made *digital learning environment,* developed in consultation with *software developers*. *Students* enter their project choices in this system (*ICT application*). Then, they make a word web, a mind web and a list of learning questions. The list of learning questions then leads to learning tasks. There are three columns for each learning task: in progress, done and to do. Each time *students* work on their learning task, they also enter their progress (*assessment, monitoring and evaluation*). The results of the learning tasks are also entered into the system (*ICT application; assessment, monitoring and evaluation*). After completing the learning tasks, the *students* deliver the product and enter it in the system. Finally, the results of the evaluation are entered in the system. The *students* are assessed on how well they are able to self-regulate and on their knowledge and skills. The idea is to use Covey's seven habits of highly effective people (2004) here: be proactive, begin with the end in mind, put first things first, think win-win, seek to understand and then be understood, synergise and sharpen the saw. Marzano's taxonomy (2007) is also used: direct your motivation, set up your learning process in a goal-oriented manner, acquire knowledge/skills, gain understanding, broaden your knowledge, gain in-depth knowledge and apply in combination (*assessment, monitoring and evaluation*).

The school has abandoned the exit qualifications (*national frameworks and standards*) for juniors but cannot do this for the seniors because of final exams. The school (*school leader* and *teachers*) are faced with the challenge of how to prepare students for the final exams in a way that ties in with the educational concept.

Characteristic aspects of scenario 3

In contrast to scenarios 1 and 2, the students in scenario 3 have few incoming arrows. Instead, they have numerous outgoing arrows, i.e., actions they undertake in the direction of numerous actants. Students determine their own learning goals, choose their own learning resources, learning activities and instructional formats, choose their own time and place of learning, decide how and when they use ICT, monitor their own learning processes and choose what they learn. Students can choose at any time which teacher, parent or expert will support them in carrying out their learning activities. The teacher supports the students in this process and offers them structure when needed. We also see the student making other connections in scenario 3, for example, with the parents of other students and with the educational infrastructure (experts). These are the parents and experts who give a workshop or whom students approach for support in achieving their learning goals. These connections cannot be found in the other scenarios.

The teachers in scenario 3 select the learning resources, learning activities and instructional formats, as in scenario 2. However, students and parents do so as well. Ultimately, it is the students who determine which learning activities they undertake. Therefore, this scenario not only

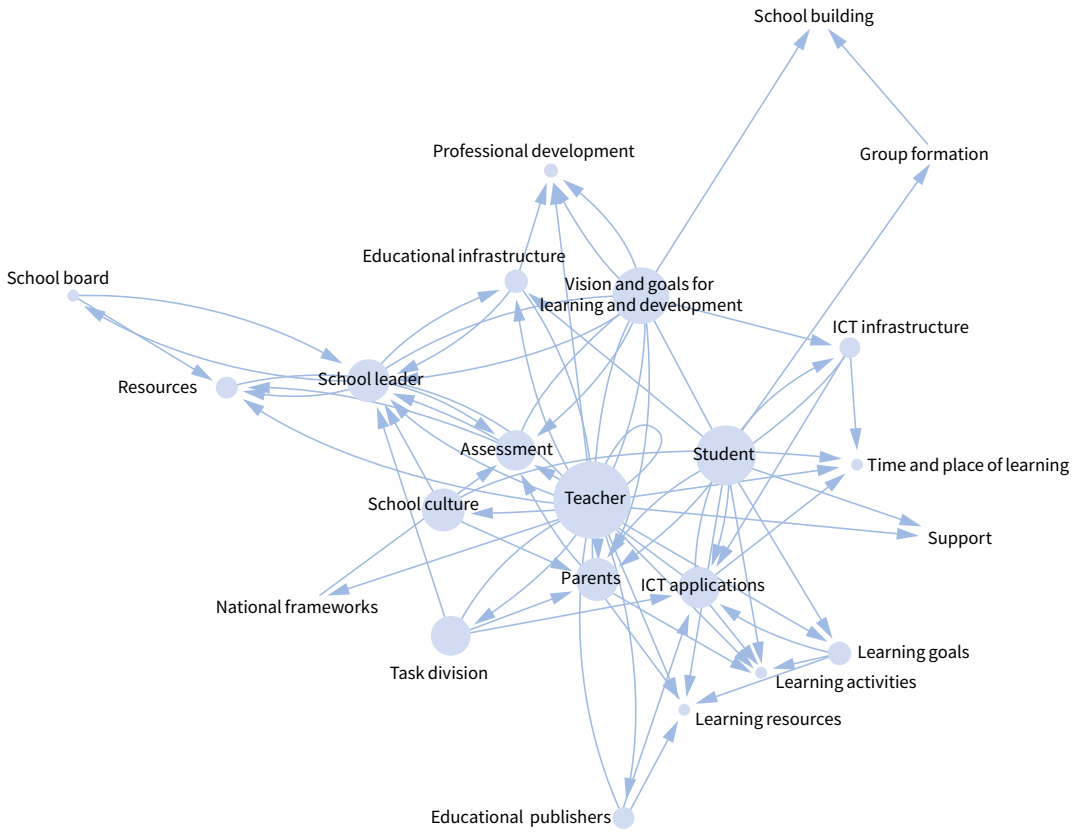

Figure 9. Illustration of actants network scenario 3.

has arrows moving from the teacher towards the learning resources, learning activities and instructional formats but also from students and parents. As a result, the learning resources, learning activities and instructional formats are more diverse. This enables personalised learning routes.

In scenario 3, arrows depart from the teacher and the student in the direction of assessment, monitoring and evaluation. The teacher gathers information about students' development, and the students follow their own development. They discuss their findings with each other.

The teacher in scenario 3 has a unique role. Teachers no longer simply teach their subjects but function mainly as coach and mentor. They work closely with other teachers who are together responsible for a group of students. Each day, the teachers divide the tasks based on their expertise (arrow from the teacher in the direction of task and function differentiation). They also teach part of the curriculum (workshops). They share this role with students, parents and experts.

This scenario also features an increasing number of arrows from parents (direction of vision for learning and development, learning resources, learning activities and monitoring and assessment, teachers and students). They have a direct relationship with the school's vision for learning and development. Parents have consciously chosen this school's educational concept and reflect on it several times a year. They actively contribute to the education and choose learning resources, for example, by offering workshops to students. In addition, they reflect together with the teacher and their child on his or her development.

In scenario 3, we see a change in the characteristics, connections and behaviours of the school leader. In this scenario, the teacher carries out many of the tasks done by the school leader in scenario 1. The teacher has a say about the task division, for example, and about professional development and the use of support and resources. The school leader plays an ever-decreasing role in developing and monitoring the vision for learning and development. It is the teachers who develop the vision for learning and development and monitor its implementation. The diagram shows this in arrows from the school leader towards the vision for learning and development, resources and teachers, as well as in arrows from teachers towards the vision for learning and development, professional development, educational infrastructure, assessment, monitoring and evaluation, and task division and function differentiation.

5 Reflections on scenarios

This chapter reflects on all three of the practical scenarios. The portrayed schools are all moving in the direction of more personalisation of education. One school has extensively implemented this and offers actual personalised learning. The other schools aspire to offer personalised learning and are taking steps in that direction but have not yet achieved their goal. This reflection on the scenarios considers the consequences for the characteristics, connections and factors of the various actants. Each actant is discussed separately. In the final section, we consider the consequences for the entire actant network.

The scenarios show that the schools are in a learning process. They are becoming aware of the consequences of their choices for the personalisation of learning, and they are looking for the right balance in the total actant network.

5.1 Student

In all the scenarios, the student has connections with the teacher, parents, learning goals, learning resources, learning activities and instructional formats, ICT applications, assessment/monitoring, the group formation and the time and place of learning. The student behaviours, however, differ a great deal in the scenarios, as do the student characteristics. The figures illustrating the scenarios show that scenarios 1 and 2 have scarcely any arrows from the student moving towards other actants, while scenario 3 has a lot more arrows. This indicates increased self-regulation in scenario 3.

Having control over one' s own learning process, as in scenario 3, places demands on the students' skills and competencies. After all, they have to be able to regulate their own learning process. The literature shows that students need good metacognitive and self-regulating skills (Devolder et al., 2012), including the skills to monitor their own progress and reflect on their learning processes (Bray & McClaskey, 2015). Scenarios 2 and 3 show that not all students possess these characteristics and are therefore not all capable of behaving in a way that suits self-regulation. We see that different solutions are used in these scenarios. The student's self-regulation is supported by the teacher (coaching role) and the parents, as well as through learning resources, ICT applications and monitoring and assessment. In addition, both scenarios curtail the self-regulation of all students (scenario 2) or some of the students (scenario 3), and teachers take over some of the actions. In scenario 2, students could at first determine which instructions to receive and when; now, the teachers decide this. In scenario 3, all students started with complete self-regulation, but not all students proved capable of this. By introducing more structure, the self-regulation of some students was partly reduced. Depending on students' ability to self-regulate their learning processes (student characteristics), the self-regulation was curtailed to a greater or lesser extent.

5.2 Teacher

In all scenarios, the teacher has connections with students, parents, school leaders, learning goals, learning resources, learning activities and instructional formats, ICT applications and assessment, monitoring and evaluation. Shifts towards individual interest and more self-regulation lead to less direct regulation of the learning process by the teachers (learning goals, learning resources, learning activities, etc.) and more regulation of the educational organisation by the teachers (including task and function differentiation, professional development, vision for learning and development). We also see that the teacher has more connections with other actants (students, parents, colleagues): there is more interaction and collaboration.

The scenarios demonstrate a shift in teacher behaviours from the teacher as manager of the entire learning track to the teacher as collaborator in the design of the learning track. The teachers collaborate and coordinate in various ways with their co-designers (students, other teachers, parents, school leader and experts) and coaches and support them where needed. In all of the scenarios we see that shifts in the teacher's role require new competencies of the teacher. The literature also confirms that teachers need more diverse competencies when the personalisation of learning is put into practice. They need an understanding of students' development and learning needs and of the learning tracks and learning goals for different subject areas (Bartle, 2015; Bray & McClaskey, 2015). They also need to be able to help students develop self-regulating skills (Marquenie et al., 2014). Furthermore, many studies emphasise the importance of ICT competencies in teachers that enable them to use technology for learning and

teaching (Ertmer & Ottenbreit-Leftwich, 2010; Hew & Brush, 2007; Uerz, Coetsier, Van Loon, & Kral, 2014; Vanderlinde & Van Braak, 2010). All of the scenarios indicate that not all teachers possess the required competencies (characteristics) to adequately shape their new role. To fulfil the new roles, teachers need to develop professionally.

5.3 Parent

In all of the scenarios, we see parents and the school together giving shape to the educational partnership. Shifts towards more individual interest lead to an increasing number of parent connections and more actions from parents towards other actants. In each of the scenarios, the parents take an ever more active role in the learning process. In scenario 1, this is limited to discussing the child's development and helping with a number of activities at certain times. In scenario 2, the parents partly determine the learning goals of their child. In scenario 3, parents reflect on the educational concept and actively contribute to their child's learning process and that of other students. In scenario 2, we see that not all parents are capable of fulfilling their role. This information was not explicitly ascertained for the other scenarios.

5.4 School leader

Shifts towards individual interest and self-regulation are linked to a less managerial and more facilitating role for the school leader. In scenario 1, the school leader has a strong managerial role. The school leader wants to move towards a situation where teachers take more leadership. In scenario 2, we also see a school leader who takes a lot of control. Unlike scenario 1, the school leader is not the only one who makes choices about task and function differentiation, support and professional development. The teachers do as well. Teachers also have more control over their own professional development. In scenario 3, the teachers carry out a lot of tasks that are performed by the school leader in scenario 1.

Only brief information was gathered about the role of the school leader in the three scenarios. In scenarios 1 and 3, the school leader aims to fulfil a facilitative and supportive role in an increasingly self-managing organisation. The literature shows that successful innovation with ICT integration in school organisations places great demands on the competencies of the school leader. The school leader is responsible for educational innovation at the school by establishing and sharing a vision of learning and ICT use in education, achieving a coherent educational organisation, distributing resources, strategically dealing with the environment, fostering collaboration, learning, professional development and research amongst all team members within and outside school, and supporting the innovative use of ICT in educational situations (Coetsier, Van Loon, Kral, & Rigter, 2016; Van Loon & Kral, 2016). In scenario 3, we see that this role is partly invested in the teachers themselves. We can thus speak of distributed leadership. The subsequent demands on school leaders and teachers require further research.

5.5 ICT applications and ICT infrastructure

The relationships between ICT (applications and infrastructure) and other actants differ per scenario. In scenario 3, the students can choose the ICT application themselves, while in scenario 1 this choice is made by the teacher. The characteristics of ICT applications differ too: the more self-regulation and individual interest, the more 'customised' ICT applications for planning and for assessment, monitoring and evaluation. The characteristics of the ICT infrastructure likewise change from a few computers in scenario 1 to a device for each student in scenarios 2 and 3.

ICT applications for planning and for assessment, monitoring and evaluation

Shifts towards more self-regulation in scenario 3 lead to changes in the characteristics of ICT applications (planning software). Planning software is used in all scenarios. In two cases, it was specifically developed in consultation with the school. This software enables teachers to offer customised learning (scenarios 1 and 2) and enables students to (partly) self-regulate their learning processes (scenarios 1, 2 and 3). In scenarios 1 and 2, teachers enter the data into the

planning program. Students use the information to (partly) plan their own learning programs. Figures 5 and 7 show this with arrows from the teacher towards the ICT application and from the ICT application towards the student. In scenario 3, it is the students who use the program to enter the planning details for their own projects. Teachers can see these details. The arrow for this starts from the student and points towards the ICT application and from the ICT application towards the teacher.

In scenario 3, the school also uses a customised digital learning environment. This provides a picture of the students' learning routes, and students can indicate whether a learning task is 'in progress', 'done' or 'to do'. The learning environment also contains the evaluation of the learning tasks. In this way, students can monitor their own learning processes and learning results. Teachers can also use the information. The student and the teacher discuss the information during a coaching session. This can be seen in Figure 9 as an arrow from the student towards the ICT application and from the ICT application towards assessment, monitoring and evaluation. We also see an arrow from the student and the teacher towards assessment, monitoring and evaluation.

The literature indicates that ICT is often used to support students in regulating their learning processes. This includes evaluating their own learning activities and monitorwwing their own study behaviour (Bannert, Sonnenberg, Mengelkamp, & Pieger, 2015) and making decisions about what and how they are going to learn by using planning tools (Bonestroo & De Jong, 2012). The literature also covers the important role of learning analytics. This concerns not only 'teacher displays' but also 'student displays'. These enable students to gain information about their own study behaviour and study activities (Marquenie et al., 2014).

ICT applications that take over the regulating function of the teacher

The schools in the three scenarios do justice to the individual differences between students through adaptive software. A feature of such ICT applications is that they monitor the student's development and use this information to determine the students' learning activities and levels. As a result, the connections and behaviours of ICT applications change. ICT takes over the regulating task of the teacher.

With the use of ICT, managing learning processes is no longer simply a matter of dividing tasks between teacher and student—possibly in combination with a course book—because the computer systems themselves play a supporting role (Marquenie et al., 2014). This is illustrated in the figures with arrows from the ICT application pointing towards the learning activities and assessment, monitoring and evaluation. The ICT application also provides the teacher with information about the student's development. The teacher can use this information to monitor the student's development.

The new characteristics, connections and behaviours of ICT applications place demands on the infrastructure. In scenarios 2 and 3, all students have their own devices, enabling them to learn irrespective of time or place. Here, we see a clear relationship between ICT infrastructure and the time and place of learning. Lack of resources prevents this in scenario 1, but the principal does acknowledge the need for all students to have their own devices.

5.6 Assessment, monitoring and evaluation

Assessment, monitoring and evaluation plays an important role in all scenarios. A shift towards more individual interest and self-regulation seems to be linked to a shift from assessment of learning (scenarios 1 and 2) towards assessment for learning (scenarios 1, 2 and 3) and assessment as learning (scenario 3). In scenario 1, the teachers check whether students have achieved the learning goals and determine the student's learning programme accordingly. There is a relation moving from assessment, monitoring and evaluation towards the teacher. In scenario 2, the teachers consult with the students and parents about whether the learning goals have been achieved and collaborate on the follow-up steps. Students also receive feedback. In scenario 3, we see that students learn to monitor their own learning processes. Monitoring is in fact part of their learning processes. The student has a direct relationship with assessment. The focus is also on monitoring the student's development. After all, there are no set learning goals for all students as the school abolished exit qualifications (national frameworks and standards) for students in

the first three years. In scenarios 1 and 2, the school does aim to achieve collective learning goals (core outcomes). Another characteristic of assessment, monitoring and evaluation concerns following the implementation of the vision for learning and development. We can see this in all scenarios.

The connections of assessment, monitoring and evaluation change with regard to ascertaining and following the students' learning results and learning processes. The same applies to monitoring and evaluating the vision for learning and development. In scenario 1, the school board and the principal mainly monitor the vision for learning and development, while in scenario 2, this is done by the school leader in consultation with the teachers. In scenario 3, teachers evaluate the progress each month. They also evaluate the vision for learning and development, sometimes together with management. Parents also play a role in this.

5.7 Group formation

Shifts towards individual interest and self-regulation in the scenarios have led to great variations in group formation (including family groups, instruction groups and level groups). The school in scenario 1 works with units (lower, middle and upper schools) which consist of mixed form groups. In scenario 2, the students are *grouped* into 'family groups' in which students of multiple years sit together. There are also instruction groups at different levels across the years. In scenario 3, students from the different levels, VMBO and HAVO/VWO sit together. There are groups based on the level of the student's independence (secondary school).

In scenarios 1 and 2 (primary school), the school has abandoned the traditional class system based on age; in scenario 3 (secondary school), the structure according to levels has been abandoned. In scenario 1, the *teacher* determines the group formation. The *group formation* determines which group a student belongs to. We see this as an arrow from the teacher to the group formation and from the group formation to the student. In scenarios 2 and 3, we see that both the teacher and the student can determine the group formation. In scenario 3, the student plays an even more decisive role in the group formation than in scenario 2. The student decides who to learn with and in which group.

The group formation also places demands on the design of the school building. The school building has to meet these demands and is therefore crucial for the types of group formations possible.

5.8 Time and place of learning, timetable

Shifts towards more individual interest and self-regulation lead to students having more control over the time and place of learning and more variations in when and where they learn.

In scenario 3, *students* decide where and when they learn. *Students* work on assignments both at school and elsewhere, both during and after school. To facilitate this, all students have their own devices as well as access to the school's digital learning environment at home. Learning therefore does not end after school because students can use a variety of learning resources at any time of the day. At first, students were completely free to decide the time and place of learning. However, it turned out they needed a bit more structure. A weekly timetable was devised so that students would work on certain activities at fixed times of the day (including the start of the day, foreign languages, and daily scrum). Certain parts of the timetable were actually proposed by the students.

This contrasts with scenario 1 in which students are not allowed to decide the time and place of learning. The school works with a set timetable divided into three work blocks. In the morning, *students* work mainly on the basic skills: reading, maths and language. The students sit in one work space, they receive instruction and start working on it straight away. Scenario 2 allows more input from students. There is a timetable indicating when students can receive instruction, follow workshops and work in the quiet zone. The family teacher decides which instruction the *student* receives, but the *student* chooses which workshops to follow and when to work in the quiet zone.

The scenarios reveal that when there is a high degree of self-regulation and individual interest, the time and place of learning becomes more flexible and diverse, depending on the *students'* learning needs. The time aspect of learning activities ranges from learning times stipulated by the school in a timetable (scenarios 1 and 2) to learning activities during school hours at times decided by the student (scenarios 2 and 3) and to learning activities that can take place at any time, also after school hours (scenario 3).

5.9 Task division and function differentiation; professional development

Shifts towards more self-regulation and individual interest result in teachers having more control of task division, function differentiation and professional development. Such shifts also lead to other roles and tasks for teachers, parents, experts and ICT applications.

Where task and function differentiation previously determined the work performed by educational staff, it can now also influence the behaviours of external parties (parents, experts) and the application of ICT. The figure for scenario 3 shows this with arrows going from task and function differentiation towards teachers, parents, the school leader and ICT application.

Although all scenarios still have positions such as school leader and teacher, the meanings of these positions have changed. It is not only the students who have more self-regulation but also the teachers and parents. The supporting role has also become more important and is carried out by more actants. As a result, the boundaries have blurred between actants' positions and roles. This can be seen from the fact that more actants are undertaking the same tasks and roles. This trend is the strongest in scenario 3: students, teachers, parents and experts select learning resources, learning activities and instructional formats. They also support the students' learning processes. ICT applications are used to select learning activities and instructional formats and support the students' self-regulation. Students, teachers and parents monitor the students' development with the support of ICT applications. Teachers, parents and the manager evaluate the educational concept and further its development. Teachers have more say about task and function differentiation and also more control over their own professional development. The school leader has a more supporting and facilitating role. Leadership is distributed.

These changes place demands on the abilities of all actors. They do not always possess the competencies to perform their new roles. Professional development plays an important but different role in each scenario. It includes both formal learning (including master's degrees and courses) and informal learning (amongst colleagues and self-study). Learning through mutual dialogue, pointing out each other's behaviour, monitoring and evaluation, and innovative practices are key aspects in all scenarios. This suggests a *school culture* focused on renewing and developing towards a 'learning organisation'. According to the literature, learning organisations need 'distributed leadership', which means the capacity for leadership lies not with one individual but with multiple people in the organisation (Huber, 2008). When leadership is shared, the people with the best leadership qualities are chosen on a case-by-case basis (Derksen, 2013). Elements of this can be found in scenario 3. Regarding leadership, Dijkstra (2013) points out the importance of allowing individuals to develop leadership qualities and to actually fulfil the role of leader. Also needed are leadership roles that reinforce the team's strength and autonomy.

Professional development in the scenarios only refers to the development of teachers. However, we also see that parents have to develop (through dialogue or pointing out behaviour) and that school leaders need professional development as well. This information was not gathered in the scenarios.

5.10 Actants in relation to each other

The previous sections describe the consequences of various choices on the dimensions of personalisation of learning for each separate actant. This section considers the actants in relation to one another. By plotting the variations of

personalisation of learning on an actant network, we gain an understanding of the most prominent changes in characteristics, connections and behaviours of the actors and factors. Actants behave differently, gain more connections, perform more or fewer actions. They also acquire different characteristics and/or need to develop these. Schools trying to implement personalisation of learning can use these insights as guidelines and sources of inspiration.

Actants start behaving differently: directing, supporting, collaborating and learning together.

In the scenarios with more self-regulation and individual interests, it is not only students who gain more control of the learning process. Teachers, parents and ICT applications also gain more control. The amount of control and what they control varies per scenario.

In the scenario that strives for self-regulation and individual interests, students can determine their own learning goals, learning resources, learning activities and instructional formats and/or monitor their own learning process. They can also partly determine the group formation and time and place of learning. Teachers, parents and ICT applications can fulfil this role as well. There is an educational partnership (student, parent, teacher). In addition, teachers gain control over monitoring the vision for learning and development, task and function differentiation and/or professional development. Parents contribute to the vision for learning and development.

What also stands out in school organisations aiming for more self-regulation and individual interests is that actants support each other more, and the boundaries between positions and roles of actants become blurred. The teacher is more of a coach to students and colleagues, for example. Parents also support their children in the learning process at the subject level. ICT applications are used to select learning activities and instructional formats and support the students' self-regulation. The school leader facilitates and supports teachers.

The changed roles of students, teachers, parents and school leader require actants to work together, communicate, point things out to each other and learn together. Collectively, they create the school culture which places demands on the abilities of all actors. The actors do not always have the necessary competencies. Because there are often new roles, it is important that actants work on their professional development.

An increase in connections between actants means a change in behaviours, more coherence and mutual influence.

A change takes place in the actants' behaviours. In the scenario with little self-regulation and an emphasis on collective interests (scenario 1), the actants at the school level, such as the school leader, mainly perform actions directed towards the teacher. In the scenario with a lot of self-regulation (scenario 3), the teacher performs actions that influence the school organisation. Teachers thus work closely together and divide the tasks between themselves based on quality and expertise. Teachers systematically reflect on the educational concept and decide together on improvements. Leadership is distributed.

Another example of actants' change in behaviour is the connection between teachers and the educational infrastructure. Where it was mainly the parties in the educational infrastructure who previously steered teacher behaviour, we now see teachers placing demands on the educational infrastructure. It now plays a more supporting role and adapts to the needs of teachers. Teachers and members of the educational infrastructure collaborate more to develop new learning resources (software developers develop customised software), educational infrastructure starts playing a role in the students' education (experts who teach) and offers schools flexibility with regulations (abandoning exit qualifications, allowing parents and experts without a teaching qualification to teach).

There is more coherence between actants: the number of relationships between actants increases in the scenarios with more self-regulation and emphasis on individual interests. For example, students gain connections with multiple teachers, parents of other students, experts, group formations and time and place of learning. Parents gain connections with learning goals, learning resources, learning activities and instructional formats, vision for learning and development, and assessment, monitoring and evaluation. The number of connections that teachers have also increases.

Finally, we see more mutual relationships between actants. The figures show this as arrows pointing in two directions. The teacher determines the vision for learning and development, task and function differentiation, professional development and school culture, which in turn influence the teacher's behaviour.

Actants gain/develop other characteristics: variation, new competencies, learning organisation.

Schools shifting towards more self-regulation and individual interests gain more variation in learning resources, learning activities, instructional formats, ICT applications, time and place of learning and group formation. This is partly because multiple actants have a say in these matters. As a result, more (individual) learning routes become possible; students learn in different groups and at different times (during and after school hours) and places (at school and elsewhere, in physical and virtual spaces).

Because students, teachers, parents, the school leader and ICT applications obtain new roles, they need to have new characteristics to fulfil these roles. Teacher competencies relate to self-regulation of their own learning process, development, monitoring, coaching and support, collaboration and leadership competencies. Students need to be able to regulate their own learning processes, teachers and parents need to have the competencies to support students in this and to regulate certain organisational aspects themselves (including the vision for learning and development), and school leaders have to be able to manage this process and equip their staff accordingly. They also need to be able to share the leadership role with others. ICT applications must include planning software, software for assessing and monitoring learning results and learning processes, adaptive software and a broad range of ICT applications.
ICT applications are indispensable

The scenarios reveal that ICT applications play an essential role in achieving the personalisation of learning. They regulate the student's learning processes, facilitate self-regulation and enable learning at any time or place. Moreover, they monitor the students' learning results and learning processes and support students and teachers in this respect. By using adaptive software, the student's development is monitored and the information gathered is used to determine the choice and level of student's learning activities. Finally, ICT covers a wide range of ICT applications, learning resources, learning activities and instructional formats and is therefore essential for the required variations in learning.

How can you as a school benefit from this?

This study does not offer a ready-made answer to how to best organise the personalisation of learning. Nevertheless, it can make schools aware of the complexity of this process. The study yields insights into the interrelated network of actors and factors playing various roles in organising the personalisation of learning. The actant-network model developed for this study is used to investigate how schools shape the personalisation of learning and reflect upon these variations. Schools can use the model to gain insights into their current situations and to reflect on the complexity of the personalisation of learning and what it means for their current and desired situations. They can also use it to consider whether the characteristics, connections and actions of actants match their school's choices regarding the degree of self-regulation and individual interest. They can also consider whether those choices are congruent and consistent.

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Appendix

Actant descriptions

This appendix contains a brief description of all the actants.

Student
Students move through a learning process. The roles of students vary on a scale of little input in their learning process to active ownership of their learning process (Mioduser, Nachmias, Tubin & Forkosh-Baruch, 2003).

Teacher
Teachers stimulate students to gain knowledge and skills, to socialise and to develop as people (Biesta, 2015). The teacher's role varies on a scale from instructor imparting knowledge to partner in the students' learning (Mioduser et al., 2003).

Parents
Parents are closely involved in raising and guiding children and play a role in their child's learning process. Parents and schools have a joint interest and can cooperate in this.

School leader/manager
The school leader plays an important role in initiating, supporting and preserving substantial and sustainable change and continual improvement for the benefit of students. The leadership role at schools is not just given to one individual but also multiple people within the organisation (Huber, 2008).

School board
School boards have the final responsibility for everything that happens at school, in other words, for the quality of education offered by the school and for the results. The school board has numerous administrative and management tasks. Think of housing policy, educational policy and staff policy. They frequently delegate tasks to school leaders, whom they direct in a general sense and monitor afterwards.

Educational publishers/software developers
Educational publishers and software developers develop the learning resources and ICT applications used in education. They have an important role in innovating education with ICT (Kozma, 2003; Lim, 2002).

Educational infrastructure
The educational infrastructure consists of all parties in the educational sector who work together to design and improve education. It also supports the schools to this end. Such parties include the Ministry of Education, schools, educational coaching services, research agencies, knowledge centres, teacher training colleges, subsidy providers and the Education Inspectorate.

National frameworks/standards
National frameworks and standards are those that schools have to adhere to, namely: the core objectives for primary education, reference levels for language and maths, qualification requirements for educational staff (BIO law), requirements concerning hours of education and assessment standards with regard to learning results (regulations for learning results in primary education).

Vision and goals for learning and development
The vision and objectives for learning and development are the visionary and ambitious picture of the educational goals the school wants to achieve. Related to this are also the tangible goals and results the school pursues to achieve its mission, vision and strategy.

Learning goals
Learning goals are about what the student is going to learn.

Learning activities and instructional formats
Learning activities and instructional formats are practices that support the learning process of the student. They concern the form in which learning takes place (including instruction, self-study, experimenting, researching, collaborating, etc.) (Valcke, 2010).

Learning resources
Learning resources are the resources with which students can learn. They include books, course books, concrete materials, assignments, ICT use and people. We can divide the term 'people' into classmates, teachers and experts from within and outside the educational field (Van der Maas, 2010).

ICT applications
This concerns ICT applications for presenting, communicating and sharing, task-oriented education, support and regulation. The latter type of application is about ICT that

takes over regulation, supports teachers with regulation, supports students with self-regulation and helps teachers to train students in self-regulation (NRO, 2016).

ICT infrastructure
The ICT infrastructure entails all available ICT resources in the school (hardware and software) and internet access.

Assessment, monitoring and evaluation
Assessment is the 'intentional gathering and processing of information about the performance of people in a certain area, with the aim of making decisions about those people (Schuurs & Verhoeven, 2010).

Monitoring and evaluation are about the last two steps in the Plan-Do-Check-Act cycle (Deming, 1986). In other words, they are about analysing the results of educational improvements and renewals and drawing conclusions from these.

Group formation
Group formation is the way in which groups of students are formed. Groups can be formed based on the similarities between students (homogeneity) or based on the differences (heterogeneity).

Time and place of learning, timetable
The time and place of learning is about where (physical space, digital space) and when students learn. Learning activities can be placed on a continuum, starting with activities carried out at times set by the school (timetable), via activities carried out at times set by the student (during school) to activities carried out at any time (during or after school) (Mioduser et al., 2003).

Task division and function differentiation
When dividing duties (task and function differentiation), one looks at the roles, possibilities and qualities of all team members. This concerns whether or not to deploy other functions or a variation of functions at the school (Stringer, 2013).

Professional development
The professional development of teachers and school leaders should contribute to their required competencies and be tailored to what is needed to bring these competencies to the desired level.

School building
A school building contains spaces for learning and teaching. Depending on the vision for learning and development, these are traditional classrooms, work spaces and quiet zones. School buildings should tie in with the vision for learning and development so it can be put into practice (Beckers, 2012).

School culture
The school culture entails the basic assumptions, norms and values, opinions and attitudes shared by the school members (Hermanussen, Teurlings, & Van der Neut, 2007).

Support
Support within a school can be described in four ways (Hew & Brush, 2007): having a vision and plan that describes the school's ICT ambitions; offering (technical) support and sufficient materials for teachers; ensuring the continual professional development of teachers; and providing sufficient encouragement not only from the school leader and ICT coordinator but also mutual encouragement between colleagues.

Resources
Resources are about time and money for the benefit or improvement of education.

Colofon

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‘To contribute to lifelong, personalised education in a social, technology-enhanced learning environment.’

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The iXperium/Centre of Expertise for Teaching and Learning with ICT (iXperium/CoE) is a network organisation of education, teacher education and research focused on sustainable educational innovation with ICT. The Research Group for Teaching and Learning with ICT of HAN University of Applied Sciences is at the heart of this network and works together with a growing number of schools and institutions for primary, secondary, vocational and higher education throughout the Netherlands. The iXperium/CoE aims to build a knowledge infrastructure with a strong impact on changing practices. Key elements in the strategy are: practice based and design based research, co-design in multidisciplinary teams, evidence-informed practice and staff development, inspiring and supporting meeting spaces (regional iXperium-labs), knowledge sharing and community-building.

iXperium/CoE is also a learning community of teachers, teacher educators, student teachers, students, researchers and ICT experts. They come together to design evidence informed, technology-enhanced, personalised learning arrangements. They share knowledge online and in community events. We aim to inspire teachers and managers, guide teachers and managers in implementing ICT-rich education at their schools, conduct research and share knowledge on learning with ICT. Of key importance here is that teachers apply recently gained knowledge and experiences in their classrooms. We develop new knowledge, conduct research and monitor the development of the teachers and their teaching practices.

The research & development programme consists of three interrelated sub-programmes:

1. Personalised learning with ICT: didactics & technologies to enhance personalised learning
2. The organisation of personalised learning with ICT at micro-, meso- and macro-level.
3. Developing digital literacies for learning, working and participating in the digital society.

Within these sub-programmes, researchers and practitioners work closely together on knowledge development and the development of professional practice in schools and in the teacher education programme.

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