Interactive instruction for students with intellectual disabilities

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Interactive Instruction for Students with Intellectual Disabilities

Enhancing Independent Learning

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Chapter 1

General introduction

1.1 Setting the scene

In the Netherlands, intellectually disabled students (ID students) follow a special stream in secondary education. This stream is geared towards adolescents between 12 and 18 years of age with an IQ between 55 and 80 and learning disabilities (van Kuijk, 2004; Schoonhoven van, Brand van den & Heerikhuize van, 2012). The American Psychiatric Association, APA (2013), refers to these students as “intellectually disabled” (ID).

Throughout the western world, the main goal of educating ID students is to teach them how to handle everyday situations on their own and to prepare them for manual work. The students learn how to execute practical tasks in the areas of technical engineering, care giving, gardening, housekeeping or cooking. They are put into small groups because then they function best. Most of them can learn to function independently, but it takes much time and effort (Wehmeyer, Buntinx, Lachapelle, Luckasson, Schalock, Verdugo, et al., 2008; Wehmeyer & Obremski 2010).

In the Netherlands, about one-third of the 18-year-old ID students leaving school transitions to a regular or sheltered job, one-third to lower vocational education, and one-third to another school offering ID education, to community service or into unemployment (about 10%). These outcomes have hardly changed since 2010 (Dutch Inspectorate of Education, 2015) and are reason to question the effectiveness of the education Dutch ID students receive.

A discussion about the effectiveness of education for ID students is also ongoing in the USA and other western countries (UNESCO, 2015). In the high schools of these countries an attempt is being made to improve the students' performance by taking them out of special classes and offering them inclusive education together with normal students (Beumer, Jeninga, Münstermann & Perreijn, 2011). In an inclusive high school, students with ID receive individual help to assist them with their studies (Wagner, Newman & Cameto, 2004; Wagner, Newman & Javitz, 2016). But so far, the success of inclusive education has not been very convincing (Cameto, 2005; Lindsay, 2007; Sermier Dessemontet, Bless & Morin, 2011). The lack of success of (“individual support” within) inclusive education is generally blamed on the low expectations that teachers often have of ID students, the high degree of individual support that the students (partly because of the

low expectations) get, and the assistants' and teachers' lack of experience with effective teaching methods for ID students (McGrew & Evans, 2004; Ferguson, 2008; Wehmeijer & Webb, 2012). In the Netherlands, it also seems that ID students receive instruction and individual guidance but no one examines their effectiveness (Blik and Harskamp, 2005). An account of a lesson for ID students in Dutch secondary education might exemplify how instruction takes place.

In a class on housekeeping, a teacher is showing students how to iron a dish towel. She places the ironing board in front of her, tilts it, and sets the catch at hip height. She takes the iron, plugs it in, and demonstrates how a dish towel can be nicely ironed by folding it twice. She shows the students how to set up the ironing board again and when she is finished asks: "Is there anything you haven't understood?" If no one reacts, she says: "Good, now you can do it yourselves." Four of the twelve students set up the ironing board right the first time. These students are allowed to plug in their irons and start ironing. The teacher gives the other students individual instruction and helps them set up their ironing boards. She demonstrates and the students imitate. The teacher then helps the students with the ironing.

The example illustrates how ID students are prepared for practical tasks through observational learning: the students try to imitate the execution of assignments the teacher demonstrates and explains.

In inclusive high schools in other western countries, ID students receive individual guidance from an assistant teacher next to the group instruction from a classroom teacher. Just like the Dutch teacher, the assistant is always close to the ID students and steps in if a student cannot do an assignment on his or her own. This makes the students dependent on their assistant teacher's help (Giangreco, Broer & Edelman, 2001; Giangreco, Yuan, McKenzie, Cameron & Fialka, 2005).

The above suggests that the method of "observational learning and individual guidance" is probably not always effective for ID students. On the other hand, there will be teachers who give group instruction, ask questions and check student's understanding before the students start working on an assignment. It is probably safe to assume that these

teachers will use a direct instruction approach: teaching a group of students by demonstration with explaining and by probing how well they understand the instruction (Blik & Harskamp, 2005; Lawrence-Brown, 2004). Direct instruction to a group is perhaps a more effective way of teaching students to work independently than the above-mentioned method of individual guidance (Spooner, Baker, Harris, Ahlgrim-Delzell, & Browder, 2007; Wehmeyer, Shogren, Palmer, Williams-Diehm, Little & Boulton, 2012). But, there is also an alternative approach that may be even more effective than direct instruction. It is called 'strategy instruction'. In the next section we discuss both models of instruction.

1.2 Effective instruction for students with intellectual disabilities

Swanson, Hoskyn and Lee (1998) have shown in a meta-analysis of research literature that both direct instruction (DI) and strategy instruction (SI) are likely to be effective instruction models for ID students. The instruction is interactive in both models. In DI, the steps to accomplish an assignment are demonstrated while questions about the steps are put to the students. However, SI is even more interactive as the teacher and students work together to create the procedure, i.e. the strategy, to complete an assignment (Hughes, Copeland, Wehmeyer, Presley, Agran, & Rodi, 2002; Montague & Dietz, 2009). Following is a short explanation.

In DI, the teacher plays a central role in offering knowledge to the students. He or she systematically demonstrates and explains assignments. The teacher asks students questions about an assignment's steps and lets them explain how they will do the assignment. Interaction is important for direct instruction. Verbalizing the assignment gives students extra impetus to create a mental representation of how the assignment is executed so that they can then perform similar assignments themselves. The goal of this approach is for students to perform assignments independently and without error (Bakermans, Franzen, van Hoof Veenman, & de Boer, 1997). DI seems to be an effective way of learning basic skills such as arithmetic, reading, and writing (Wong, Harris & Graham, 2003; Graham & Bellert, 2004).

In SI, the teacher plays a less prominent role. The teacher asks questions and the students provide answers from what they already know. Together they devise a procedure (strategy) for a learning task (Swanson, 2001; Alexander, 2006). The teacher does not give a demonstration but asks the students, in a group discussion, to suggest steps to solve an assignment. According to Fuchs, Fuchs Mathes and Martinez (2002), Ryder, Burton and Silberg (2006) and McLeskey & Billingsly (2008), SI has a positive effect on both the students' understanding of complex assignments and their independence in performing them. During SI, students create a mental representation that enables them to better oversee the assignment at hand (Montague & Dietz, 2009).

In general, researchers seem to agree that SI is just as effective as DI when it comes to teaching reading and arithmetic skills. But SI seems to be more effective when it comes to learning how to solve complex assignments (Swanson, Hoskyn & Lee, 1998; Adams & Carnine, 2006).

Both in DI and SI interactions between teacher and students are important and help students to understand how to perform an assignment before they start working on it. Especially SI makes students think and explain in their own words to someone else (*explanation to others*) how a task can be performed. Explaining prepares students better to perform an assignment independently than just observing the demonstration of an assignment (Chung & Tam, 2005; Montague, 2008; Swanson, 2001).

However, little is known about the effect of SI versus DI in vocational training for ID students. It would also be worth studying the extent to which teachers can be trained to apply these instruction models in their classrooms. For many teachers, teaching interactively with DI or SI will probably mean a shift in their teaching routines as well as a shift in their conviction that ID students are taught most effectively by individual guidance.

1.3 General research question

This dissertation focuses on the improvement of instruction for ID students. Especially students in the Netherlands. We suspect that many students watch and listen passively to assignment demonstrations and then try to execute them on their own. The students often

fail and teachers will spend most of their lesson time helping individual students accomplish their assignments (see section 1.1).

The general hypothesis of the dissertation is that involving students more actively in instruction before they perform an assignment will increase their understanding and their ability to perform it independently. To turn passive instruction into active instruction (Chi, 2009) requires the teacher to interact more frequently with the students and to use the students' ideas and suggestions during teaching. In direct instruction, the teacher can ask students to verbalize, review, and summarize the instruction the teacher provides. But in strategy instruction, the teacher enables students to participate more intensively by starting with questions instead of instruction and then discussing the students' ideas and working with the students to create a strategy to perform an assignment (see section 1.2).
The main question for research is:

Can interactive instruction help ID students perform their assignments more independently and can teachers learn to teach more interactively?

1.4 Outline of the research

Our research consists of four steps:

- Step 1: Find out how teachers in the Netherlands actually teach ID students.
- Step 2: Investigate in a group setting which of two interactive instruction models is more effective: Strategy Instruction or Direct Instruction.
- Step 3: Investigate in an individual setting whether demonstrating assignments can become more effective through interactive video instruction.
- Step 4: Investigate whether teachers can be trained to deliver interactive instruction to their students, either in a group setting or in an individual setting.

Following is a more detailed description of the four steps:

1: State of the art in teaching ID students in the Netherlands (Chapter 2)

Our research starts with an inventory of how Dutch teachers in secondary school teach ID students. The assumption is that many teachers do not or hardly ever apply an

instruction model such as direct instruction or strategy instruction (see section 1.2), but that they focus more on helping individual students (section 1.1). It is not known how either individual guidance or group instruction impacts the students' independence in working on assignments and the quality of the assignments. This is what we want to find out in the first step of the research.

2: Interactive teaching to improve group instruction: strategy instruction versus direct instruction(Chapter 3)

We expect that teachers will organize their instruction either in a group setting or an individual setting. To help teachers who prefer working in a group setting, a study will be conducted on the effectiveness of strategic instruction (SI) versus direct instruction (DI) and the impact of these forms of instruction on the students' understanding of the assignments and their ability to work independently. The difference between using SI versus using DI is outlined in section 1.2.

Studies on effective forms of instruction in special primary education seem to indicate that both instruction models are effective for skills training but that SI would be more effective for complex assignments (section 1.2). In the research, we will test whether SI is more effective for the practical assignments ID students have to perform during metalwork and woodwork courses.

3. Interactive video instruction to improve individual guidance of students (Chapter 4)

Teachers of ID students use instructional videos to support their individual guidance of students. The videos show the steps of a specific assignment that the students have to perform. Students learn by observing. But as the assignments are complex, we may question whether students learn enough by passively observing a video. Perhaps ID students would benefit more from video instruction if they have to explain it to others. This has not yet been investigated. Explaining to others would help students better direct their attention to the main points in the video and actively think about it (see section 1.2). An experiment will be conducted in which the effects of video instruction with and without explanation to others will be tested.

4: Training teachers in interactive instruction either in a group setting or in an individual setting (Chapter 5)

The last chapter of the dissertation discusses the extent to which teachers can be trained and coached to implement more interactive instruction in their classrooms. If teachers prefer individual guidance, then training can help them become more interactive instructors, for instance, by letting students explain the demonstration of an assignment to them. If teachers prefer group instruction, then training can help them do this more interactively so as to make students active participants who understand the instruction better.

Previous studies have indicated that teaching routines can be changed by using clear examples, giving feedback on the teachers' instructional behavior and the students' results, and by enabling teachers to reflect on their own instructional behavior (Joyce and Showers, 2002). In addition, instructional coaching (Knight, 2004, 2007; Cornett & Knight, 2008; Knight & Cornett, 2009) can also help make teachers change their behavior. Instructional coaching is based on the partnership between coach and teacher. The coach discusses the points for improvement with the teachers and the teachers test them in their classrooms. The teachers discuss their experiences and how to continue innovating among themselves and with the coach. Both training and coaching make it easier for teachers to implement an instructional innovation and make longer lasting changes to their practice.

We expect that teachers that have been trained and coached will use more interactive instruction in both an individual setting and a group setting. As a result, students will work more independently.

Chapter 6

Chapter 6 draws conclusions on the four research steps and the hypotheses we put forward. Recommendations will be made for further research and changes in the way ID students are instructed.

Individual Guidance

Chapter 2

Teaching intellectually disabled students practical skills in Dutch secondary schools

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Abstract

In the Netherlands, education for intellectually disabled (ID) students of 12-18 year old is organized as a separate stream in secondary education. The stream is called 'Practical Education' (Dutch abbreviation = "PrO"). The main goal of Practical Education is to teach ID students to live independently and practice a profession. There are, however, doubts about the effectiveness of PrO and the teaching methods used (Blik & Harskamp, 2005).

Thirty-eight teachers in year two from 21 schools for PrO in the north of the Netherlands were given identical technical materials and assignments for their students. They were asked to use the assignments in a regular 100-minute lesson on technical skills. Two researchers observed the lessons and the activities performed by both teachers and students.

The observations showed that the majority of teachers (58%) handed out assignments and generally gave instructions on demand, mostly one-on-one (individual guidance). As a consequence, these teachers' students asked many questions and waited for their teachers to help them. A smaller group of teachers (42%) used group instruction. These teachers instructed students before they went to work on their own. They explained a technical assignment and showed their students how to carry it out. They taught students to plan their activities before putting to work.

There were big differences between the individual guidance classes and the group instruction classes in active learning time and the number of questions of students that the teachers answered during task processing. There was also a difference between these classes in the amount of help given by the teacher. The quality of the assignments made by students was higher in classes with group instruction than in classes with individual guidance.

2.1 Introduction

Instruction for Intellectually Disabled students: state of research

In the Netherlands, education for intellectually disabled (ID) students of 12-18 year old is organized as a separate stream in secondary education. The Dutch Inspectorate of Education has ascertained that teachers working with students with learning disabilities tend to choose individual instruction over group instruction (Dutch Inspectorate of Education, 2009). Instruction aimed at individual students seems justifiable as one-on-one instruction to students with an intellectual disability seems to be more effective than group instruction (Pinnell, Lyons, Deford, Bryk, & Selzer, 1994; Wasik & Slavin, 1993, Slavin, Lake, Davis, & Madden, 2009) mainly because the interaction between student and teacher is more intensive. Individual instruction enables teachers to keep students focused and involved by addressing their individual learning needs.

However, individual instruction isn't really feasible in groups of 12 to 15 students because the time teachers can spend on each individual students is very limited (Bosker & Doolaard, 2009). In 2005, Dutch researchers (Blik & Harskamp, 2005) observed and interviewed several teachers of ID students who were teaching practical subjects such as: care and welfare, retail, gardening and technical engineering. Part of the teachers used group instruction, followed the guidelines of the direct instruction model and explained the assignments before the students set to work. But, the majority of the teachers, used what one could describe as "one-on-one help" or "individual guidance". These teachers put the students almost instantly to work. The teachers then went to each of the students and gave short instructions or demonstrations on how to handle (parts of) the assignment. Blik and Harskamp (2005) concluded that this approach leaves students dependent on their teachers.

In the USA and many other western countries ID students at high school are offered inclusive education together with 'normal' students. In an inclusive high school, students with ID are given individual study plans and special support of an assistant teacher (Spooner, Baker, Harris, Ahlgrim-Delzell, & Browder, 2007). Just like the Dutch teachers, the assistant is always close to the ID students and individual guidance is provided if a student can't handle an assignment on his own. Assistant teachers are helping students by showing them

how to progress with their learning tasks. But it seems that this approach also leaves the students dependent on their teacher (Giangreco, Yuan, McKenzie, Cameron & Fialka, 2005).

The notion that individual guidance is the best way to teach ID students seems well grounded in teaching practice in the Netherlands and other countries. Research in the Netherlands by Blockhuis and Berlet (2006) shows that many teachers believe that ID students can only perform assignments independently if they have had individual guidance and much practice. This notion is also represented in practical exams for ID students in specific industries (cleaning, retail, catering). For their exams, students are only tested in the assignments they have trained. Probably, because one assumes that ID students can be trained in job routines but not in performing new tasks independently.

After literature study in ERIC, Google Scholar and other data bases we concluded that limited research has been done in the Netherlands and abroad into the ways of teaching ID students and its consequences (see also Turnbull, Turnbull & Wehmeyer, 2007).

The research in this chapter has been undertaken in the Netherlands and looks at the relationship between the forms of instruction (pre-task group instruction versus individual guidance) on the one hand and the independence of students and the quality of their work on the other.

2.2 Theoretical framework

The above suggests that many teachers choose individual guidance as their way to organize instruction and that they put students to work on assignments without instruction beforehand. Other teachers may actually instruct their students before they put them to work. However, it is not entirely clear how teachers actually teach and how this influences their students (Blik & Harskamp, 2005).

Swanson et al. (1998) have shown in a meta-analysis that both direct instruction (DI) and strategy instruction (SI) are likely to be effective instructional models for groups of ID students. Providing these instructional models are applied properly, students will be capable of performing assignments independently and with good results (Adams & Carnine, 2006).

The DI and SI models both consist of five stages:

- Stage 1: *Orientation* stage
- Stage 2: *Instruction* stage in which an example of an assignment is provided and the construction process is explained
- Stage 3: *Guided Practice* stage in which one or more students practice the assignment together with the teacher
- Stage 4: *Processing* stage in which the students work on an assignment on their own
- Stage 5: *Closing/Review* stage in which the assignment is reviewed

Teachers using SI will differ greatly in the degree of interaction with their students during these stages compared to teachers who apply DI. Table 2.1 shows the difference in approach between both models of instruction.

Table 2.1
Direct Instruction and Strategy Instruction

Phase	Direct Instruction	Strategy Instruction
Orientation	The teacher explains what will be created in the lesson.	The teacher involves the students in the explanation (interaction).
Instruction	The teacher demonstrates how the assignment is made and asks questions.	The teacher asks the students to explain the assignment to him/her and discusses the suggestions of the students. Then, the teacher performs the steps and lets the students explain.
Guided Practice	Students work on a step of the assignment under the teacher's guidance. The teacher immediately corrects the students if necessary.	Students work on a step of the assignment under the teacher's guidance. To correct students, the teacher lets them verbalize their approach by asking questions.
Processing	The students work on the assignment following the steps demonstrated by the teacher. The teacher gives both solicited and unsolicited feedback and immediately corrects the student if necessary.	The students work on the assignment using the step-by-step plan they discussed. The students have to verbalize their approach if they do not know how to progress with their assignment.
Closing/ Review	The teacher reviews the assignment.	The teacher and the students review the process and the assignment.

Direct Instruction is aimed at teaching students to understand and carry out similar assignments as shown during instruction. Several studies have shown the effect of DI for students with learning disabilities. Ryder, Burton and Silberg (2006) studied the progress of students during reading education. Teachers were trained to give DI. The class was then observed to determine the extent to which students were able to work independently by looking at whether and how much help they received from the teacher and the extent to which they were able to continue working without help. In a recent study, Jackson (2010) demonstrated the effect of DI on the language capabilities of students with learning difficulties. The study revealed that instruction in the form of examples and explicit explanation is an effective way of expanding the language capabilities of students with learning difficulties. Similar results were also found in earlier studies (Lyon, 2004; Kinder & Carnine, 1991). Research by Hughes, Copeland, Wehmeyer, Agran, Rodi & Presley (2002) showed that DI improved the students' practical and social communication skills.

Strategy Instruction, at the other hand, is aimed at teaching students how to acquire effective strategies for complex assignments (Joyce & Chase, 1990; Swanson, 1999; Alexander, 2006). Instruction is given in the form of questions and answers during which a strategy is devised together with the students. The strategy that is devised can be mapped onto a step-by-step plan students can use independently (Graham & Bellert, 2004). The students practice with the teacher as their coach, by verbalizing how to execute the strategy and finish an assignment. If the students ask for help during individual processing, the teacher first refers to the step-by-step plan and the discussion at the beginning of the lesson.

Research by Klingner, Vaughn, & Boardman, (2007) showed that students with learning disabilities in comprehensive reading are able to effectively apply a strategy that is devised together with their teacher and are more capable of performing assignments independently and reflecting on their own actions. Montague (2008) and Montague & Dietz (2009) indicate that SI improved the capability of students with learning disabilities to perform mathematics assignments independently as well as their test performance compared with the usual way of teaching. Montague & Dietz showed that the students'

verbalization of a strategy (explaining to another person) is an important aspect of SI: it enables the students to structure an assignment better.

2.3 Research questions

Our exploration of the theory shows that there are several ways in which teachers can teach. We suspect that many teachers do not give instruction beforehand but let their students immediately get to work and provide one-on-one help (individual guidance). Other teachers probably give group instruction before students start at a task. The first research question is aimed to establish the state of the art in teaching ID students.

1. Which form of instruction do teachers use to help their students with performing assignments?

If teachers give pre-task instruction to their group of students, it would be interesting to know whether this form of instruction would improve the level of independence in performing assignments. If group instruction (DI or SI) could be compared to individual guidance one might expect that students in group instruction are more independent and therefore will finish more of their assignments successfully compared to students who receive individual guidance. The second and third research questions are aimed at investigating these expectations:

2. To what extent are ID students, in different forms of instruction, capable of performing assignments independently?

3. What is the relationship between the form of instruction, the extent to which the assignment is performed independently, and the quality of the completed assignment?

2.4 Method

The research was aimed at teachers of woodworking and metalworking in schools for practical education (PrO). Of the 177 Dutch schools for PrO, 43 are in the north of the Netherlands. For practical reasons (travel distance), 27 school boards (five provinces) were approached. Once the school boards had consented, teachers were invited to participate in the research. In total, 21 schools and 38 teachers participated. The selected schools were compared to the entire northern population (43) on school size and urbanization. It showed that the selected schools where representative as far as school size is concerned. In the sample, the average school size was 158 students (*SD* = 59). In the population the average was 147 students (*SD* = 64). Schools in the sample contained as many rural schools as urban schools.

The students, were indicated at the age of 12 by a regional referral committee and met the following criteria that also apply to all other Dutch ID students: IQ between 55 and 80, and learning disadvantage of at least three years in two or more educational domains.

Procedure

The lessons of 19 woodworking teachers and 19 metalworking teachers were observed. The teachers were given construction materials and an assignment card for the students several weeks before the observations started. The teachers used the materials and assignment card to teach a lesson to year-two students in the way the teacher and the students were used to (daily practice). The maximum duration of the lesson was 100 minutes (2 x 50 minutes).

The teachers could decide to make a prototype of the completed assignment for show to the students and to alter the assignment card in a format the students were used to. Teachers were asked to teach the lesson with the assignment during regular classes. The researchers used an observational checklist to record both the teacher's instructional behavior in different stages of the lesson as well as the behavior of students throughout the lesson.

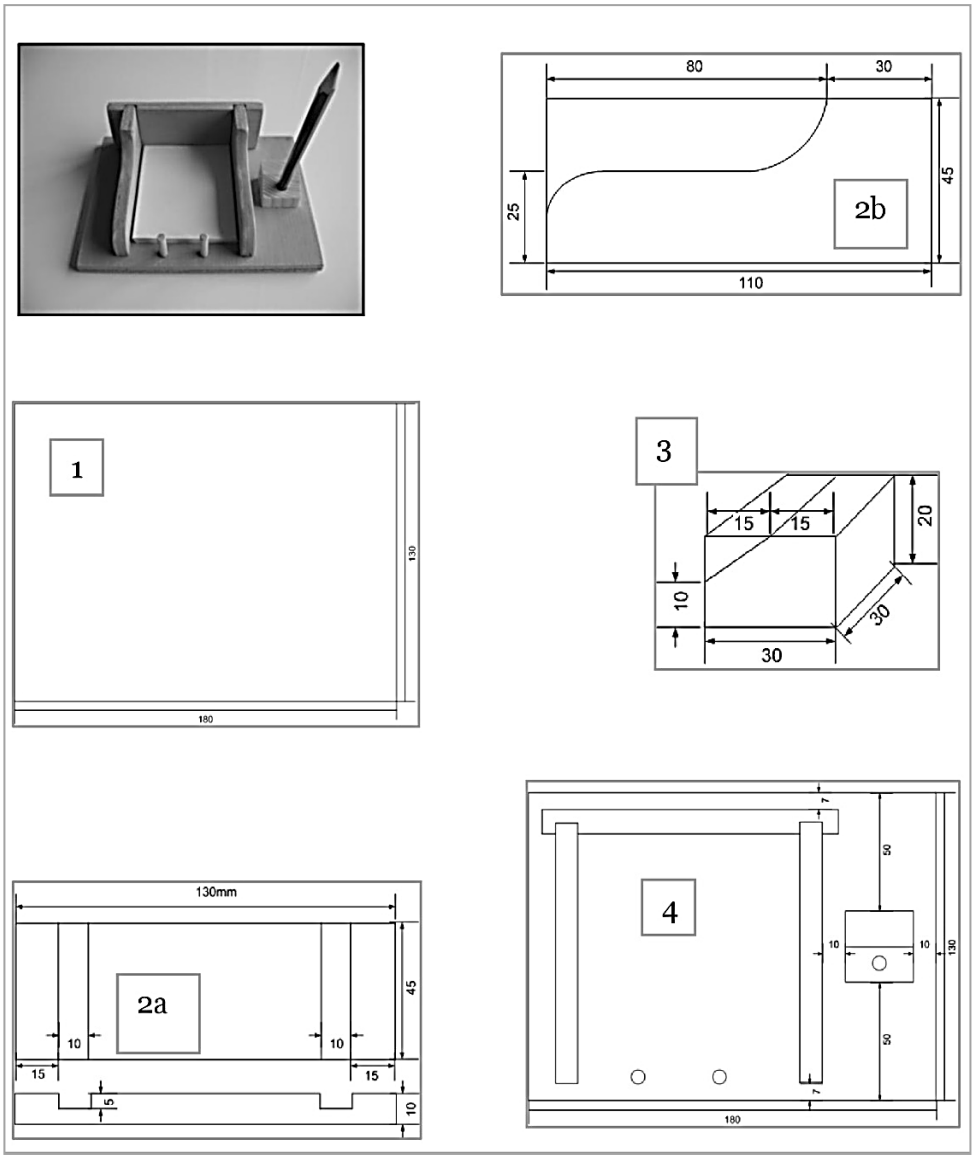

Figure: 2.1a. Assignment card for woodworking class

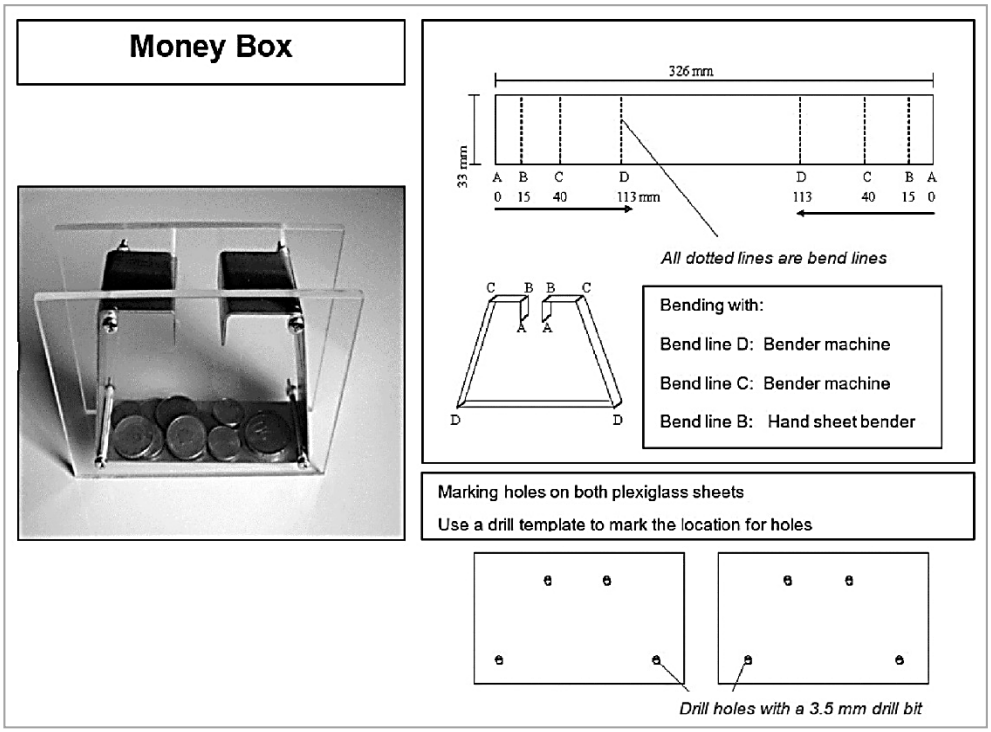

Figure 2.1b. Assignment card for metalworking class

Observational instrument

An observation form was developed based on the form of Deinum (2000). The form enables both individual guidance as well as group instruction to be observed and to distinguish between DI and SI.

The observation was divided into blocks of five minutes. The first four minutes consisted of observing the teacher's teaching behavior and the number of times the teacher helped individual students. Student activity was monitored in the fifth minute (Table 2.2). During the observation of teaching behavior (4 out of 5 minutes) four topics were checked every minute:

- Which minute of the lesson are we in?
- In which setting is the lesson organized: group instruction or individual guidance?
- What stage of the lesson (five stages) are we in and which model of instruction is used (DI or SI)?

- How often does the teacher offer unsolicited help to a student or answers questions of a student during task processing?

Table 2.2
Observation block of 5 minutes

Teachers				Students
First minute: teaching behavior	Second minute: teaching behavior	Third minute: teaching behavior	Fourth minute: teaching behavior	Fifth minute: student behavior

During the student observations (every fifth minute) one question was answered:

- How many students are inactive in this minute?

From the observations three main characteristics (A, B and C) were determined.

A. Setting of the lesson

During the lesson observations, decision rules made it possible to determine in which setting the lesson was organized. The settings were divided into four groups:

- Individual guidance (Group 1): No group activities were undertaken. During help to the individual students the teacher might use the stages: Orientation/Instruction, Guided Practice /Processing and Closing.
- Combination instruction (Group 2): If teachers used aspects of the DI as well as the SI model in the stages: Orientation/Instruction, Guided Practice/ Processing and Closing/Review.
- DI (Group 3): If teachers used at least the stages: Orientation/Instruction, Guided Practice/Processing and Closing/Review according to the DI model.
- SI (Group 4): If teachers used at least the stages: Orientation/Instruction, Guided Practice/Processing and Closing/Review according to the SI model.

B. Time spent on lesson stages

The stage the teacher was in has been recorded throughout the observation. The stage the lesson was in was easy to determine when a teacher gave group instruction.

Lesson stages were more difficult to distinguish when a teacher gave individual guidance, but it was possible to distinguish between the main stages: 1) Orientation and Instruction (a collective start in which the assignment card was presented and the materials and tools were discussed), 2) Processing stage (students working on their own, sometimes with help from the teacher), 3) Closing/Review stage (ending the lesson and possible evaluation of the assignment).

In order to be able to compare individual guidance lessons and group instruction lessons, the five lesson stages were combined into three main stages:

1. Orientation/Instruction; 2. Guided Practice/Processing; 3. Closing/Review.

The observation data were used to determine how much time a teacher spent on these distinct lesson stages.

C. Independency of assignment performance

Three indicators were used to measure independent assignment performance:

- Questions of the students answered by the teacher (Teachers Answers): The number of questions asked during task processing that were answered by the teacher.
- Unsolicited help given by the teacher: The number of times help was offered (instructions were given) during class by the teacher without a student having solicited it.
- Student inactivity: This was determined by the average number of inactive students during every fifth minute of observation.

Points 1 and 2 were observed in periods of four minutes in a five-minute block. The total amount of solicited and unsolicited help given during these four minutes was calculated for each lesson. Student inactivity was observed during the last minute of the five-minute block.

The lessons were observed by two researchers. The inter-rater reliability was established with the help of three test observations of lessons prior to the research. The researchers each observed the three lessons and the scores of the researchers were compared through calculation of Pearson product moment correlations. This produced high reliability indices. The researchers means scores per lesson for the instruction model the

teachers used the correlation coefficient was $r = 0.91$; for the number of minutes in a lesson spent on each of the five stages the correlation coefficient was $r = 0.95$. In order to compare the researchers' scores for students' independence during the processing stage of the lessons three indicators were used: the mean number of inactive students, the total number of questions answered by the teacher and the total amount of help during processing. The agreement between the two researchers was high; the correlation was $r = 0.95$.

During the course of the project the two researchers regularly discussed the manner of scoring in the observations, in particular for unforeseen events in class.

Assessing the assignment

The researchers determined the quality of the assignments after the observation.

Table 2.3
Processing steps in the four stages of readiness (woodwork)

	Process steps	**Assessment**
	Notepad/pen holder partial activities in work sequence	Scores
	Step 1	
1	Measure and draw back and sides	
2	Saw to length	1
3	Use cutting mold to mark curves	
4	Saw curves	
	Step 2	
5	Draw cutouts	
6	Make cutouts	
7	Sand back and sides	2
8	Glue back and sides together	
9	Measure bottom plate	
1o	Drill holes	
	Step 3	
11	Glue border design on bottom plate	
12	Measure and saw pen holders	3
13	Measure and saw pens	
14	Glue pens and pen holders to bottom plate	
	Step 4	
15	Drill hole in pen holder Finish neatly (sand and remove excess glue)	4
16	If there are more than three flaws in sub-activities 1 to 16, students are given three points.	

Both the woodworking and the metalworking assignment were divided into four work stages each with process steps (Table 2.3). The four work stages were scored (1 - 4) on the basis of the process steps. Table 2.3 shows the stages of readiness of the woodworking assignment. The interobserver reliability between the two researchers was tested using the assignments of three groups of students (36 assignments). The Pearson correlation between the scores the two researchers gave for these assignments was 0.84.

Considering the similarity of the two researchers' ratings, and for reasons of efficiency, it was decided to assign one researcher to the lesson observations and assignment reviews for each lesson. In the event of doubt, a photograph was taken for later consultation.

Analysis of Data

We used descriptive statistics to answer the first research question about the form of instruction the teachers used (DI, SI or individual guidance). DI and SI were taken into one category and called Group Instruction. With t-tests for independent cross-sections we compared the time teachers in group instruction versus teachers in individual guidance spent on the lesson stages Orientation, Instruction, Guided Practice, Processing and Closing/ Review.

The second research question was about the degree students worked independently and the possible differences between students who received group instruction versus students who received individual guidance. We used three indicators for student independency during processing of an assignment: a) the number of questions answered by the teachers, b) the amount of unsolicited help the teacher gave and c) the number of inactive students during processing. The analyses were done with t-tests for independent cross-sections on all three indicators.

The third research question deals with the relationship between the form of instruction, and the independency of classes of students (three indicators). We tested the strength of the correlations between these variables. We also investigated the relationship between the form of instruction and the task performance of students. The task performance of students would be influenced by the teacher's instruction and help during

class. It was not only due to the ability of the students (as in test taking). That is why we used the average scores of students of a class as the measure of performance. We expected teachers who used group instruction to divide their instruction and help more efficiently among their students and gain higher average performance scores with their classes than the teachers who gave individual guidance. We tested this hypothesis with a t-test for independent cross-sections

2.5 Results

Form of instruction

To answer the first research question, the teachers were grouped into three categories based on the form of instruction they gave: DI, SI, or individual guidance.

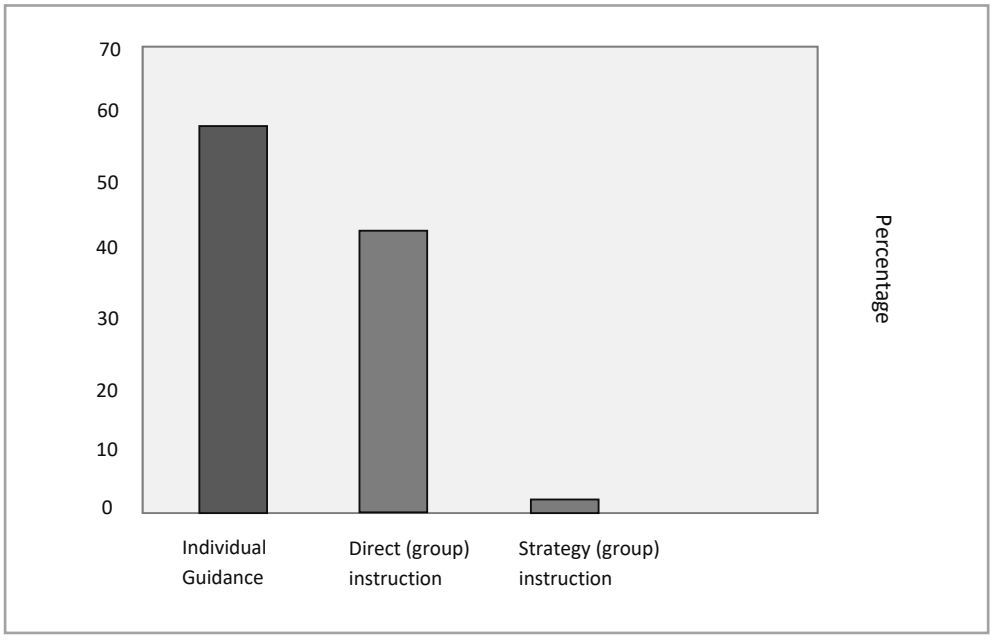

Figure 2.2. Percentage of teachers and the setting for teaching

Figure 2.2 shows that 58% of teachers gave individual guidance. After a brief opening of the lesson, they put their students to work and helped the students individually. Teachers walked around the classroom and gave instructions and demonstrations to the students.

Sometimes the quality of the work was briefly discussed at the end of the lesson, but there was generally no review in an individual guidance setting.

However, 42% of teachers gave group instruction. They used lesson stages from the DI instruction model. Only one of the observed teachers used stages of the SI model. None of the teachers gave a combination of DI and SI. The teacher who gave SI (2.6 %) and the teachers who gave DI (39.5 %) were joined into one category: group instruction (42 %).

Individual guidance:

The teachers started by handing out the assignment and the materials. The students were put to work almost immediately with the materials and the assignment card. The teachers generally had a prototype of the assignment in the classroom to show what the assignment should look like. There was no group instruction on the steps in the assignment nor on the problems that could be encountered. The teachers went from student to student giving short instructions and direct help. An average of nine students per four minutes asked for help. The request for help usually went unanswered if it meant that the teachers had to deviate from his fixed route in the classroom. The students were asked to be patient. On the other hand, the teachers gave unsolicited help (short instructions the student had not explicitly asked for). Students progressed bit by bit with their assignment. Because the teachers could only help one student at a time, they indicated that classmates could be called upon for help. But, many students copied incorrect working methods from their peers. There were always inactive students throughout the lesson.

Group instruction:

The teachers gave at least a 10-minute explanation to the group of students of how the assignment could be made. They used the assignment card to discuss the steps the students could take and the problems they could encounter. One of the teachers asked students to come up with solutions themselves (strategy instruction). This was his way of preparing students for the assignment.

Most teachers had prepared their lessons and made a prototype of the assignment. They explained step-by-step how the assignment could be made and gave examples of how the tools and techniques could be used. A phase of independent processing followed the explanation. Relatively few students called on their teacher for help and teachers offered little unsolicited help. In these lessons, most students actively worked on their assignments.

Figure 2.3. Characterization of individual guidance and group instruction

In Figure 2.3 there is a characterization of the lessons by teachers who gave individual guidance versus teachers who gave group instruction.

Time spent on lesson stages

All of the teachers, whether they gave individual guidance or group instruction, skipped lesson stages. Because stages were skipped, the five lesson stages were reduced to three in order to represent the data: 1. Orientation/Instruction; 2. Guided Practice/Processing; 3. Closing/Review (see Section 2.5).

Table 2.4 shows, as expected, a clear difference between the factual time spent on the lesson stages of teachers who gave group instruction and teachers who gave individual guidance. To verify this an independent samples t-test was conducted.

Table 2.4

Observed mean time spent in minutes (standard deviations between parentheses) of teachers who gave group instruction versus teachers who predominantly gave individual guidance

Stage	**Total** (n=38)	**Individual** (n=22)	**Group** (n=16)	**Cohen's *d***	**t-value difference**	***p***	**Confidence interval**
Orientation Instruction	8.89 (5.11)	5.18 (1.74)	14.00 (3.50)	3.19	*t(36)* = 10.24	<.001	[-10.57;-7.07}
Guided Practice Processing	68.55 (11.59)	73.27 (12.48)	62.06 (5.98)	1.15	*t(36)* = 3.32	<.001	[18.06;17.43]
Closing Review	3.89 (3.83)	3.00 (3.02)	5.13 (4.53)	0.55	*t(36)* =-1.74	.091	[-4.61;0.36]

The difference in the length of the instruction stage (*t(36)* = - 10.24; *p* <. 001; Cohen's *d* = 3.19) and the difference in the length of the task processing stage (*t(36)* = 3.32; *p* <. 001; Cohen's *d*= 1.15) are clearly present. As could be expected, the teachers who applied group instruction spent far more time at group instruction and less time at task processing. No significant difference was found between both teacher groups in the length of the closing stage (*t(24)*= - 1.74; *p* = .091; Cohen's *d* = 0.55).

As opposed to the other teachers, teachers giving individual guidance hardly spent any time on instruction prior to task processing. They spent some time on orientation and then went straight to the processing stage. In most cases, in both groups of teachers, the

researchers noticed that neither the work process nor the students' assignments were systematically reviewed.

Independence in assignment performance

The use of an instruction model (DI or SI) versus individual guidance probably has an impact on the extent to which students have the opportunity to carry out an assignment independently (see par. 2.2 and research question 2). For each form of instruction Table 2.5 shows the outcome on three indicators of students' independent work during the processing stage. The first indicator is the number of questions answered by teachers, the second the number of unsolicited help from the teacher and the third the number of inactive students.

Table 2.5

Mean number of questions the teacher answered (standard deviations between parentheses), amount of unsolicited help given, and number of inactive students per lesson

	Individual (n=22 classes)	**Group** (n=16 classes)	**Cohen's d**	**t-value difference**	***p***	**Confidence interval**
Questions answered during task processing	9.05 (3.11)	3.00 (1.86)	2.36	*t(36)* = 6.91	<.001	[4.72;7.82]
Unsolicited help given during task processing	8.05 (5.76)	2.00 (1.63)	1.43	*t(36)* = 4.07	<.001	[3.03;9.06]
Inactive students during lesson	2.02 (1.15)	0. 50 (0.73)	1.58	*t(36)* =-4.64	<.001	[0.85;2.18]

To compare the differences between both forms of instruction, an independent samples *t*-test was conducted. Teachers who gave group instruction answered fewer questions (*t(36)* = 6.91; *p* <. 001; Cohen's *d* = 2.36) during processing and gave less unsolicited help (*t(36)* = 4.07; *p* <. 001; Cohen's *d* = 1.43) than teachers who gave individual guidance to their students. The students in group instruction were less inactive than their peers who received individual guidance (*t(36)* = 4.64; *p* <. 001; Cohen's *d* = 1.58).

The relationship between teaching behavior and the students' outcomes

Table 2.6 explores the relationship between teaching behavior, the independence of the groups of students and their success at performing the assignment (third research question). The correlations in Table 2.6 confirm the analysis in Table 2.4 and 2.5 that teachers who gave group instruction had longer Instruction stages and gave fewer unsolicited help. They answered less often questions and their students were less inactive (more active).

Table 2.6

Correlations between length of instruction stage, number of questions answered by the teacher during processing, unsolicited help given, and inactive students

	Form of instruction (group versus individual)	**Length of instruction stage**	**Unsolicited help**	**Teacher's answers**
Length Instruction stage	*0.86*			
Unsolicited help	*- 0.56*	*- 0.50*		
Teacher's answers	*- 0.76*	*- 0.69*	*0.66*	
Inactive students	*- 0.61*	*- 0.44*	*0.22*	*0.43*

There is a clear negative correlation between the length of the Instruction stage and the number of questions the teacher answered (r = -0.69) and the number of unsolicited help (r = -0.50). When teachers gave instruction a longer time, their students apparently asked fewer questions during processing and the teachers gave students less often help. The students' were less inactive when instruction time was longer (r = -0.44).

Extended time for instruction seemed to have a positive influence on the independency of the students during task processing. As the instruction time was longer for students in group instruction, they profited more from instruction.

Relationship between the form of instruction and the students' performance

All students worked at the same assignments for woodworking or metalworking during the lesson that was observed. After the lesson the researcher graded the assignments with a score (1 – 4) according to a detailed rating scale (see Table 2.3).

Table 2.7 shows the results of the students from the group instruction or individual guidance condition. 22 Classes received individual guidance and 16 classes group instruction. The difference between the scores of the students in the two conditions is significant ($t(36)$= -3.49; $p < .001$; Cohen's d = - 1.17). This is a large effect. Students who received group instruction were able to finish the assignments with a higher quality. Despite the large degree of one-on-one help in classes with individual guidance, the quality of the assignments is lower than in classes with group instruction.

Table 2.7

Average evaluation of the assignments (standard deviations between parentheses) made in classes with group instruction versus classes with individual guidance (score: 0-4)

	Individual Guidance	**Group Instruction**
	(*n* = 22)	(*n* = 16)
Evaluation of assignments	2.54 (0.78)	3.48 (0.88)

2.6 Conclusions and discussion

The purpose of the research was to analyze the relationship between the forms of instruction and the degree of independence in which a class of students performs an assignment. Thirty-eight teachers were observed during woodworking or metalworking classes. We concluded that 42 percent of the teachers gave group instruction and 58 percent of the teachers offered individual guidance to their students.

In *group instruction* the teachers interacted with their students by asking questions about the assignment they instructed and they gave the students opportunity to understand the assignment and to learn how to work on their assignment independently.

The teachers answered on average 3 questions during task processing and gave unsolicited help on average only 2 times.

Teachers who gave *individual guidance* did not offer instruction in advance. In individual guidance, a class of students asked their teachers during task processing on average 9 times questions and the teachers gave their class unsolicited help on average 8 times. This is in sharp contrast to the way the teachers in group instruction acted. Hence, during group instruction, more students actively worked on their assignments than in individual guidance.

Our conclusion is that the teachers offering group instruction prepared their students better for assignment completion than the teachers who gave individual guidance. The research indicates that teachers who constantly give individual guidance deprive their students of the opportunity to become independent learners. (Wehmeyer, Shogren, Palmer, Williams-Diehm, Little & Boulton, 2012; Warnez, 2002).

The research shows that group instruction prior to an assignment has a positive impact on the degree of independent work (teachers have to answer fewer questions, have to help students less often and students spend their learning time more actively). Our research seems to indicate that instruction on task processing before the task begins has more impact on students' achievements than individual help during task processing (Wehmeyer & Palmer, 2003)

The research we did has limitations. The target population for this research consisted of the 43 schools for Practical Education in the five northern provinces of the Netherlands. Twenty-seven were randomly selected and approached and 21 were interested in cooperating. This means that approximately half of the teachers in the technical domain for ID students in the north of the Netherlands were included in the sample. That seems a large enough sample. However, the proportion of rural schools versus urban schools and the proportion of immigrant students in the less densely populated north are different from schools in the central and western parts of the Netherlands. It is hard to generalize our findings to schools and teachers with these groups of students. However, ID students in schools in all parts of the Netherlands have a similar range of intelligence scores and similar

age and gender composition. This gives rise to the expectation that our results can be generalized to a larger population.

Secondly, we did not perform an experiment, so we do not know whether students, if randomly grouped in two conditions (group instruction versus individual guidance), would progress just as we found in our results with intact classes and conditions. It is possible that teachers in our research mainly gave individual guidance to classes of students who were genuinely unable to work independently. However, given the similar mean intelligence scores of the students in both research groups and the similarities in age or gender composition, this assumption is rather improbable.

Thirdly, the research results do not distinguish between the metalworking and the woodworking classes. Such a distinction seems unnecessary as the construction processes of the assignment in this research did not differ between woodworking and metalworking. In our results we found no differences in use of the instruction methods or indicators of students' independence between woodworking and metalworking classes.

2.7 Recommendations

We know that teachers in special primary schools often have little knowledge of other forms of instruction than individual guidance. Most teachers help their students individually by giving short instructions or, taking over certain parts of the assignment (Fuchs, et al., 2002; McLeskey & Billingsley, 2008). After our research, we can conclude that this also applies to the teachers in Dutch Practical Education we studied. Training teachers in instructing their students before the students start to work on their assignment, seems required. DI or SI are the most obvious instruction models for teachers to use. The two models have proven their effectiveness in special education (see among others Ryder, Burton, Silberg, and Swanson, 2001). The models assume a stage where instruction is given in combination with guided practice, after which the students start to process the assignment on their own.

We recommend setting up a training experiment in which teachers of ID-students can learn to teach using a model for group instruction (DI or SI). This training should address both the benefits and possibilities of group instruction as well as the limitations and

possibilities of individual guidance. The effect of the training could be measured by comparing the classes with teachers trained to improve their instruction in a group setting with those who are trained to introduce instruction in an individual setting. We expect that if teachers in a group or an individual setting will be able to apply interactive instruction and make their students understand the assignment at hand, then students will become more capable in executing the assignment on their own and make good-quality assignments.

Interactive Group Instruction

Chapter 3

Strategy Instruction versus Direct Instruction in the education of Intellectually Disabled students

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A previous version of this chapter was published as:

Blik, H., Harskamp, E.G. & Naayer, H.M. (2016). Strategy Instruction versus Direct Instruction in the Education of Young Adults with Intellectual Disabilities. *Journal of Classroom Interaction, 51* (2), 20-35.

Abstract

In the Netherlands, secondary school students with intellectual disability attend a special stream: Practical Education. The teachers in this stream generally use individual guidance or group instruction as a setting for their lessons.

In this research we aim to improve the instruction method teachers use in group instruction. In practice, in a group instruction setting teachers usually demonstrate and explain how assignments can be processed. This method of teaching is a form of direct instruction and it can be reasonably effective. But, students observe passively their teacher's demonstration and explanations of assignments, and afterwards not all students remember what to do. These students will have difficulty working independently.

An alternative method of teaching is strategy instruction. It is a question-answer-based method that stimulates to think about and verbalize task strategies.

A small scale teaching experiment was conducted involving a total of 33 students aged 14 to 15 in four classes at two schools. Classes were randomly assigned to strategy instruction or direct instruction. Students who received strategy instruction had higher quality posttest assignments and were able to verbalize them better than students in the direct instruction group.

3.1 Introduction

During their study of students with intellectual disability (ID) in secondary education , Blik, Harskamp & Kuiper (2012) found that many teachers use individual guidance and some use group instruction to organize their lessons. If teachers use group instruction they start a lesson by activating the prior knowledge of their students and demonstrating how a new assignment is performed (Orientation/Instruction). Sometimes they devote a few minutes to Guided Practice. The students then work on their assignments individually (Processing) and the teacher evaluates (grades) the results at the end of the lesson (Closing/Review). This teaching method has several lesson stages and it can be described as direct instruction (DI).

Blik et al. (2012) noticed that the method works well for basic knowledge assignments with a limited number of steps to process (e.g. spelling or arithmetic). But as the assignments get more complex, ID students often find it difficult to remember the different steps. They still need individual guidance from the teacher in order to carry out their assignment correctly. Teachers often use instruction by demonstrating and explaining because they are convinced that their students can replicate their example of how an assignment is performed but believe that students are not able to reason and talk about the steps that need to be taken (the task strategy). Because students are not asked to think ahead, most students lack insight into the steps needed to carry out an assignment on their own.

An alternative way of teaching ID students is strategy instruction (Swanson, 2001; Alexander, 2006). Strategy instruction (SI) is a highly interactive teaching method that prepares students for an assignment by showing them the assignment and asking them to explain the steps (strategy) needed to complete it. The teacher provides feedback on their answers and tries to develop the students' understanding of how an assignment is done. This approach assumes that ID students can actually think about a new task and take part in discussing it before it is performed.

This research project aims to find out whether these two instruction models produce a different effect when it comes to performing complex assignments involving several steps. ID students are prepared for manual work and many male students prefer technical training.

Effective teaching is important if students are to learn how to make different types of assignments. Our research uses assignments made in a metalworking class.

Our literature search did not produce any studies on the effects of DI or SI in the technical domain. We searched for publications in research journals and handbooks between 2000 and 2013 in ERIC, Academic Search Full Text Elite (EBSCO), and Dissertation Abstracts using the following search terms: special needs students, intellectual disability, direct instruction, strategy instruction, experiments, and effect studies. We selected recent studies (after 2000) in other domains to show the effects that the two instruction models are expected to have on ID students.

3.2 Theoretical framework

Direct instruction (DI)

In the DI model, the teacher directs the learning process. The teacher teaches by demonstrating the learning assignment in small steps, guiding students through the steps during initial practice and making sure students can successfully carry out the assignment on their own. In an influential essay, Rosenshine and Stevens (1986) called this "direct instruction."

Our literature search produced only a few studies on the effect of DI on ID students. A study by Hughes et al. (2002) shows evidence that DI improved the practical and social communication skills of ID students. Ryder, Burton and Silberg (2006) indicated that DI taught by specially trained teachers improved the students' reading skills and their ability to perform assignments autonomously. Jackson (2010) showed the effect of DI on the language capabilities of ID students. Jackson's research puts forward that instruction with worked examples and explicit explanation effectively expands the students' language capabilities.

Strategy instruction (SI)

SI consists of teaching in the form of questions and answers. (Alexander, 2006; Graham & Bellert, 2004). During discussions, the teacher asks the students to present a

sequence of steps (a task strategy), helps them and shows how the steps can be taken. The purpose is to encourage students to think ahead about the steps to accomplish an assignment. Students then start 'Processing' and the teacher helps by referring to the step-by-step plan they discussed. The assignments made by the students and their learning process are reviewed at the end of the assignment.

Our literature search produced research by Klingner, Vaughn, & Boardman (2007) that shows that students with reading comprehension problems are able to effectively apply a strategy when it is chosen together with their teacher. Consequently, they were more capable of performing assignments autonomously and reflecting on their own actions. Montague (2008) and Montague & Dietz (2009) compared SI with DI in a study on word problem solving for ID students. They concluded that both the students' autonomous execution of word problems during the program and their performance in a posttest improved more through SI than DI. The research also shows that letting students verbalize solution strategies before they solve a problem is an important aspect of SI. Verbalizing solution strategies helps students structure their work on an assignment (see also Roy & Chi, 2005; Larkin, 2002; Larkin & Ellis, 2004; Rosenshine, 1997 for the effect of students verbalizing assignment strategies in different domains). However, SI seems only successful in small groups in which the teacher makes all of the students answer questions and lets them put forward suggestions (Englert & Mariage, 2003; Hegarty, 2005).

As indicated above, several studies have shown that SI enhances students' understanding of how to carry out an assignment more than DI does. Most of the studies comparing SI with DI were conducted using complex assignments, such as learning to solve word problems or learning reading comprehension. But Adams & Carnine (2006), Kroesbergen (2002), and Swanson & Deshler (2003) have shown that both DI and SI could be effective instruction models in teaching ID students. The research they refer to is often in the field of skills teaching, such as reading, spelling, or mathematics facts and procedures. Still, SI may be more effective when it comes to accomplishing complex assignments where student have to execute several steps and apply different skills (e.g. word problem solving).

Both instructional models can be taught in the stages of a lesson. A lesson consists of different stages that can be followed by both instruction models, namely Orientation,

Instruction, Guided Practice, Processing and Closing/Review. The main differences between the models are in the stages of Instruction and Guided Practice. Here, the SI model is less teacher centered and directed more at student initiative, thinking and planning.

3.3 Research hypotheses

ID students struggle with strategic performance because of their very low problem-solving capacities (Kroesbergen, 2002; Reid & Lienemann, 2006; Melzer, 2007). In DI teachers show and explain students how to make a new assignment but do not invite them to discuss the steps required to make the assignment. In contrast, in SI the teacher and the students discuss a strategy to make an new assignment.

Figure 3.1 shows the main difference between the two instruction models and the possible additional effects instruction according to the SI model could have on student independency during individual processing and on posttest accomplishment of students.

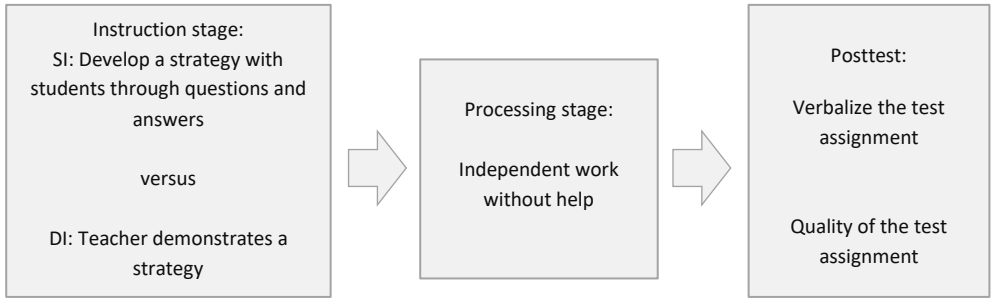

Figure 3.1. Research model

Based on our literature search and our expectations of the effects that SI and DI could have on complex assignments, we have postulated two hypotheses:

1. *SI will result in more student independency during the Processing stage than DI.*
2. *SI will result in a higher quality assignment in a post-test compared with DI.*

3.4 Method

Research design

Table 3.1 sets out the research design. Two teachers were trained and practiced the correct use of the two instruction models in trial lessons before the experiment started. A researcher observed the lessons and gave feedback until the models were applied correctly. The experiment was then carried out. Both teachers instructed one class in their school using DI and another class using SI. None of the students had taken part in the trial lessons. The teachers taught each instruction model in four lessons of 100 minutes. In each lesson, the students had to make a different metal assignment. All of the lessons were observed by the same two researchers who had monitored the correct and consistent use of the two instruction models during the trial lessons.

Sample

Two teachers from two PrO schools in the North of the Netherlands took part in the experiment. The teachers were selected because of their well-structured lessons, their teaching experience, and their interest in learning to teach ID students in different ways. Thirty-three students in the second year of PrO (13-14 years old) participated in the study. Within the two schools the students were randomly assigned to a DI or an SI class. There were 17 students in the SI condition (4 female, 13 male) and 16 in the DI condition (3 female, 13 male).

At both schools, two groups of 8 or 9 students were taught in one of the two conditions. There was no difference in gender composition and general intelligence between the groups.

The mean IQ score for the SI group was 71.47 (*SD* = 5.83) and for the DI group 71.75 (*SD* = 8.03).

Table 3.1

Research design

Stage	Contents
Training and trial lessons	Inform teachers about the differences between teaching a SI and a DI lesson. Teachers and researchers develop four construction assignments, including the step-by-step plans for the students. Teachers are coached during trial lessons, which focus on the correct use of the instruction models.
Pretest	Collect background information on students including IQ scores. Students take the pretest and verbalize it.
Intervention	Lessons 1 to 4 Strategy instruction: Group 1 in school A and group 2 in school B. Lessons 1 to 4 Direct instruction: Group 2 in school A and group 1 in school B. Researcher observes teachers' use of the DI and SI models, the question-answer interaction, and the independency of the students.
Posttest	Students take the posttest and verbalize it.

The intervention

In both conditions, the students performed the same four metalworking assignments. The difference between the conditions was the way of instruction on how to make the assignments. Table 3.2 (page 50) describes the SI and DI models of instruction and the differences and similarities during for five stages of the lessons teachers gave. There was one lesson for each assignment.

Figure 3.2 presents the construction drawing used in DI. The teacher demonstrates the steps needed to arrive at the final assignment while pointing at the drawing. The students in DI are given a card with the construction drawing that helps them observe and replicate what the teacher is demonstrating. Students can also use the card as a cheat sheet in the Guided Practice and Processing stages.

Figure 3.3 shows the students the final assignment in SI. The teacher asks what the assignment entails and how it can be made. Then he asks the students how they would make the assignment step by step and he discusses the sequence of steps that is most practical for them. The teacher shows a large card with the steps they have discussed and

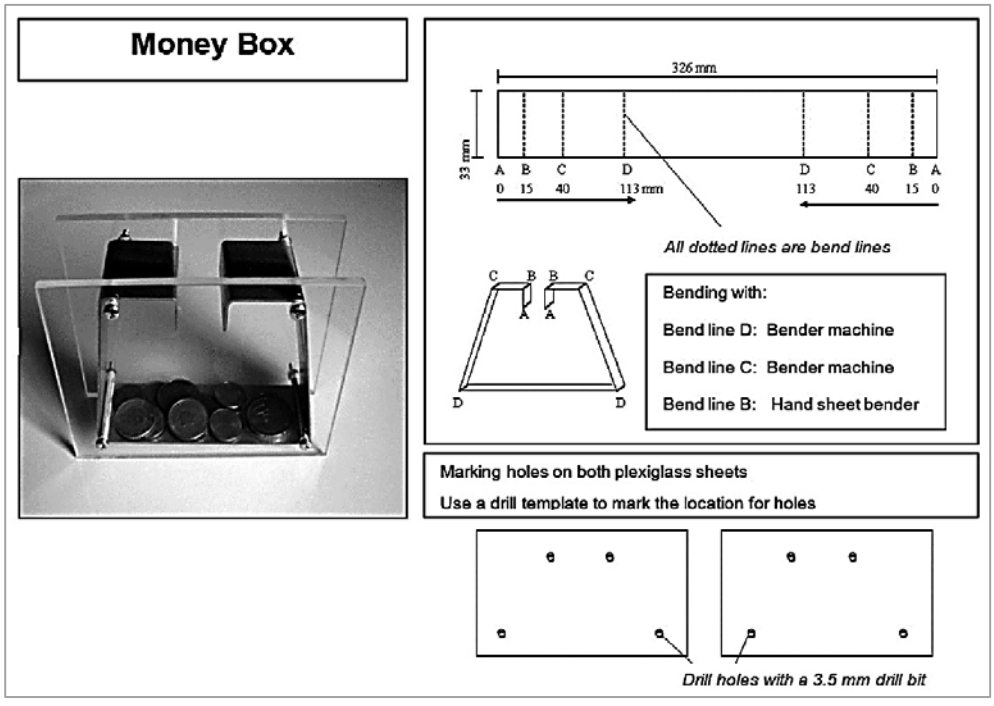

Figure 3.2. Construction drawing for demonstration in DI

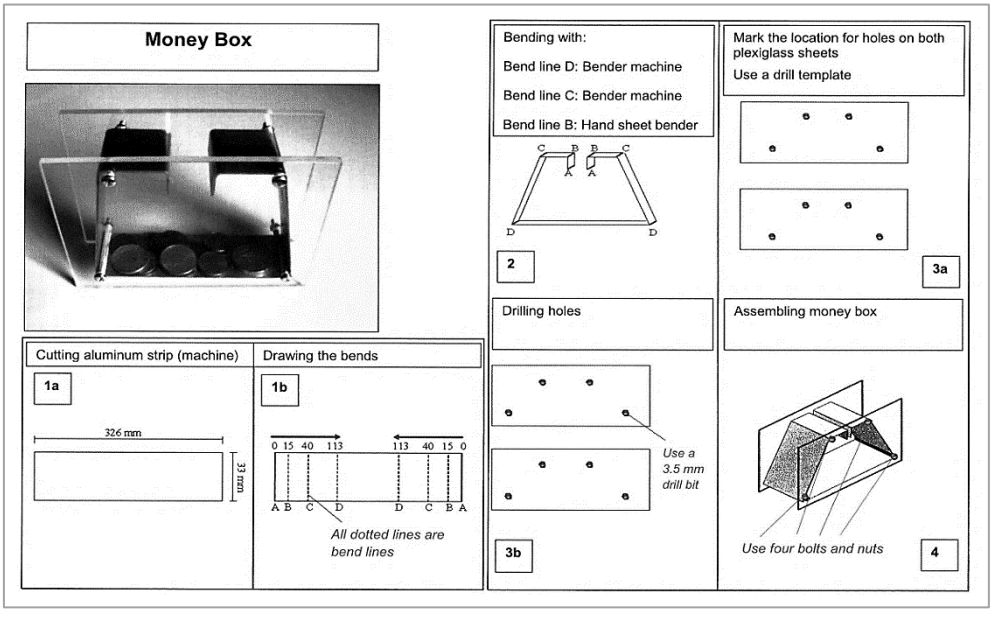

Figure 3.3. Step-by-step plan for discussion in SI (4 steps)

Table 3.2

The two instruction models: A different approach in each stage of teaching

Stages	Direct Instruction	Strategy Instruction
Orientation (1 aspect)	1. The teacher explains what will be made in the lesson and shows a finished assignment.	1. The teacher shows a finished assignment and asks the students what they are going to make and if they already know how to make it.
Instruction (3 aspects)	1. The teacher demonstrates how the assignment is made using a construction drawing (Figure 3.2).	1. The teacher asks the students to tell him/her how to carry out the steps and lets the students verbalize. During discussion the teacher puts the steps on a card for all students to see.
	2. The teacher demonstrates how the assignment is assembled.	2. The teacher asks the students to explain the sequence of the steps. The students each receive the card with steps
	3. The teacher asks if the students understand.	3. The teacher repeats the process and asks the students to verbalize the steps
Guided Practice (2 aspects)	1. One or more students demonstrate how the assignment is made.	1. The teacher asks if the steps can be carried out in a different sequence. A final step-by-step plan is agreed with the students.
	2. The teacher corrects where necessary.	2. One or more students use the step-by-step plan to show the agreed work sequence. The teacher asks the students questions.
Processing (2 aspects)	1. The teacher gives feedback: solicited and unsolicited by the students.	1. The teacher walks around the classroom and monitors the students.
	2. The teacher corrects where necessary.	2. The teacher helps the students by referring to the step-by-step plan and by asking questions.
Closing/Review (2 aspects)	1. The teacher and the students review the students' assignments.	1. The teacher and the students review the process and the students' assignments.
	2. The teacher evaluates what went right and what did not, and grades the assignment.	2. The students are asked how they made the assignment and how they would grade their work. The teacher assigns grades after the discussion.

lets the students tell him how to make the assignment. The students receive their own card. It helps them verbalize the sequence of work and the processes involved.

Observations

The observation was divided into blocks of five minutes. The first four minutes consisted of observing the teacher's use of the instructional models and the help the teacher gave students. Student activity was monitored in the fifth minute.

Teaching behavior

During the observation of teaching behavior (4 out of 5 minutes) two topics were checked every minute:

- Which *stage of the lesson* (five stages) are we in, which model of instruction is used (DI or SI) and how well? Table 3.2 shows the five stages and the ten aspects of the instruction models that were graded. During a lesson, grades were given (1 for no use, 2 for little use and 3 for full use) for the aspects of the stage that was observed. At the end of a lesson a mean score for correct use of each aspect was calculated. The total of these 10 mean scores could vary from 10 (no use of the model) to 30 (full use).
- How often does the *teacher put questions* to a student during a lesson? For each student, the researchers kept track during the 20 episodes of instruction of how often a student answered an assignment-related question asked by the teacher. At the end of each lesson the number of times a student answered a question asked by the teacher was calculated.

Student independency

In Chapter 2 we examined different indicators of student independence during processing: number of answers the teachers gave to students, teachers' unsolicited help to students and students' inactivity. It turned out that the three indicators were highly correlated. We decided for this research to use students inactivity as indicator for independency and to observe individual student's interaction with the teacher more closely (see *Teaching behavior*).

During the processing stage, in each fifth minute of an observation period, the students' inactivity was observed. Students who were not actively at work or with assistance from the teacher (who showed them how to make a part, took over, or asked

questions), were given a score. Thus a measure for the inactivity of students could be established by adding the total number of times a student had not been actively at work. From this score the proportion of periods that students were actively at work during the processing stage was calculated. After four lessons, the mean percentage of active and autonomous time was calculated for each student in order to determine the student's independency.

Interobserver reliability

All lessons were observed by two researchers and were filmed. After watching the video footage, the observations were reviewed and graded.

Teacher behavior. The inter-observer reliability between the two observers regarding the scores that were given for use of the instruction models in the four lessons was sufficiently high (Cohen's Kappa = 0.81). The number of questions the teacher asked and students answered during the instruction stage were transformed into a rank order scale (1= low, 2= average and 3= high) and the inter-rater reliability was sufficiently high: Cohen's Kappa 0.77

Student behavior. The number of times students were inactive in a lesson were transformed into a rank order scale (1= low, 2= average and 3= high). The inter-rater reliability was high: Cohen's Kappa = 0.85.

Pre- and posttest

The students' ability to make an assignment by themselves using a construction drawing was measured by means of a pre- and posttest.

Each student carried out the test assignment. The pretest assignment was somewhat simpler than the posttest assignment. The two test assignments are shown in Figures 3.4 and 3.5. The figures show a worksheet with a picture of the assignment and a construction (drawing) with a few instructions. As there were no further instructions, the students needed to come up with a step-by-step sequence themselves.

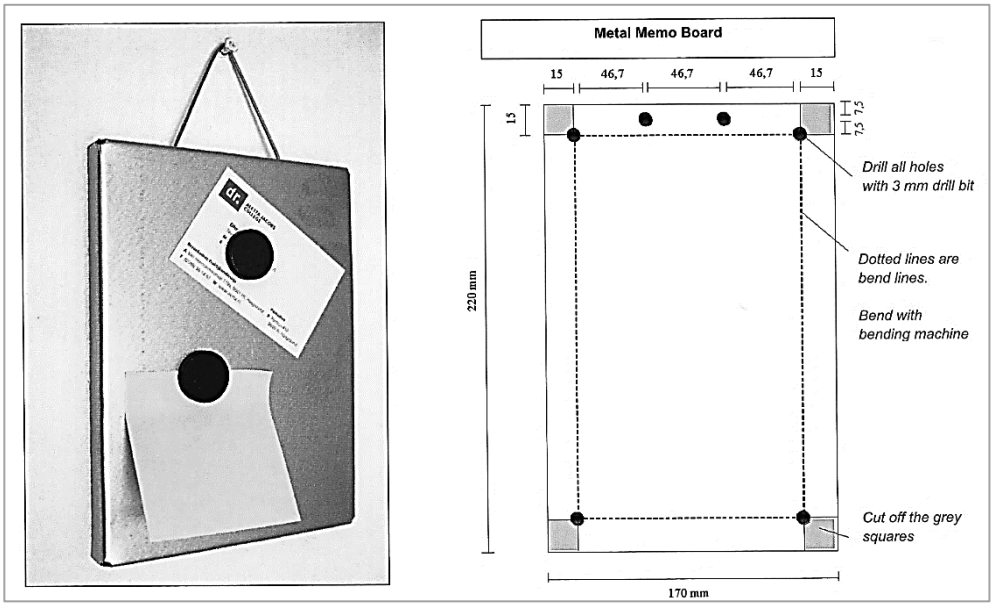

Figure 3.4. Pretest, magnetic memo board

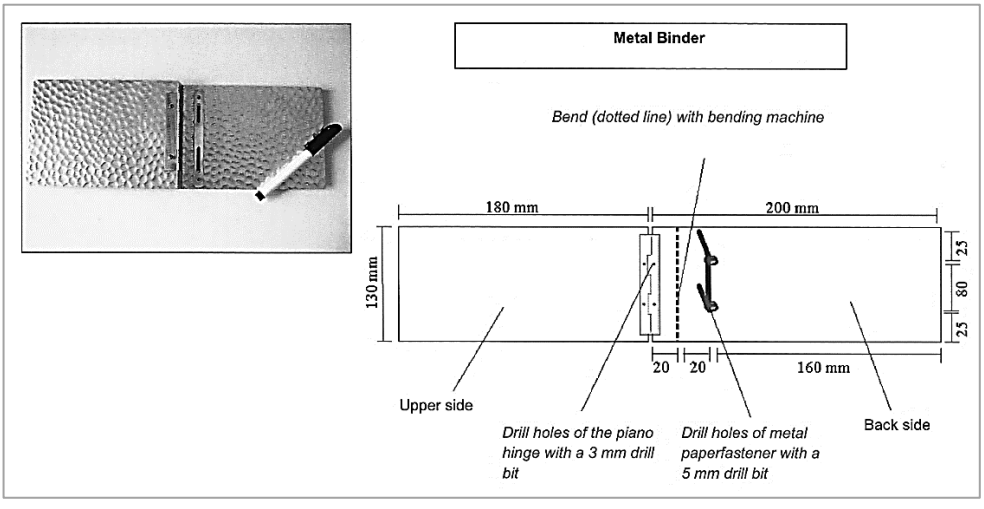

Figure 3.5. Posttest, binder made of metal

The students were observed closely by a researcher. In the pretest, students had to follow five steps to finish the assignment, while the posttest consisted of six steps (Table 3.3). The students were filmed during the test.

Table 3.3
Grading the verbalization of students on pretest and posttest assignments

Pretest	**Assignment: Memo Board**
Max. score: 5 points	Draw bend lines and holes
	Drill four holes in the corners
	Drill two holes on top
	Cut the corners
	Bend sides 90° and fasten iron wire
Posttest	**Assignment: Paper Binder**
Max. score: 6 points	Draw bend lines and holes
	Drill two holes for paper fastener
	Drill four holes for piano hinge
	Bend bottom with angle bending machine
	Fasten the hinge with rivets
	Fasten paper fastener and finish the work piece

After each test, the quality of the students' assignment performance was graded by a researcher based on a checklist (Table 3.4). Students received a score of 0 – 3 depending on the steps they completed and the relative quality (finishing) of the assignment. If students asked and received help with their assignment, their unfinished assignment before help was graded.

Table 3.4
Grading the quality of the assignments of pre- en posttest

Quality of the assignment	**Grade**
None of the subtasks were carried out correctly	0
Insufficient – Assignment was not assembled correctly; steps were ignored or were carried out incorrectly	1
Sufficient – Assignment was assembled correctly but student did not work neatly and/or the assignment was not finished correctly	2
Good – All steps were carried out correctly and the assignment nicely finished	3

Verbalization

The students' verbalization of the assignment was measured after the test. Students were invited to tell the researcher how they had worked on the assignment and which steps they had taken. A maximum score of 5 was given for the pretest if the student could verbalize the steps correctly. The maximum score for the posttest was 6 because of the 6 different steps (as shown in Table 3.3).

The *Interobserver reliability* between the two observers for the quality scores and the verbalization scores on the pre- and posttest was calculated. We found Kappa 0.81 to Kappa 0.85. This indicated a high interrater reliability for the two tests on both aspects.

Data analysis

The design of this study implies that two teachers with two classes were nested in the experimental factor: condition SI and condition DI. Each teacher taught SI with one group of students and DI with another. Although the number of teachers was too small to allow for multilevel analysis (Snijders & Bosker, 2012), each teacher's characteristics could still influence the students' outcome. This is why we used 'Teacher' as a factor in a two-way analysis of variance with 'Condition' as the other factor. For all analysis, we first checked whether there was an interaction effect of 'Condition' x 'Teacher' on the dependent variable. If there was no the interaction effect, the possible main effect of 'Teacher' was tested. If there was no main effect of 'Teacher' then this is not reported because it is mainly a control variable in this study. The significance level was $p > .05$ and two-sided testing was applied. Even if there were no interaction or main effect of 'Teacher,' we showed the mean scores of the two teachers within each condition in order to allow observation of the size of the difference between the teachers.

If there were no 'Teacher' effects, a t-test was performed for the effect of 'Condition' on the implementation variables, namely the implementation scores of the DI or SI model and the frequency of question-answer patterns. An analysis of covariance was used (with the pretest assignment as covariate) for the effect of 'Condition' on students' independency (students mean scores of active and autonomous time in four lessons), quality of posttest assignment and verbalization of the assignment.

3.5 Results

Implementation of the instruction models

During the observation of the four lessons, the researchers checked the stage(s) the teacher used and graded aspects in these stages on a scale of 1 to 3 (Table 3.5).

Table 3.5
Implementation of instruction models, averages by teaching aspect (SD)

Stages	**Teaching aspect**	**Strategy Instruction (n=17)** M (*SD*)		**Direct Instruction (n=16)** M (*SD*)	
		Teacher 1	Teacher 2	Teacher 1	Teacher 2
Orientation	1.1	2.50 (0.58)	2.50 (0.58)	3.00 (0.00)	2.75 (0.50)
Instruction (3 aspects)	2.1	3.00 (0.00)	2.75 (0.50)	2.75 (0.50)	3.00 (0.00)
	2.2	2.50(1.00)	2.75 (0.50)	2.75 (0.50)	3.00 (0.00)
	2.3	2.75 (0.50)	2.75 (0.50)	3.00 (0.00)	2.75 (0.50)
Guided Practice (2 aspects)	3.1	2.25 (0.96)	2.25 (0.96)	2.25 (0.96)	2.00 (0.82)
	3.2	2.25 (0.96)	2.25 (0.96)	2.25 (0.96)	3.00 (0.00)
Processing (2 aspects)	4.1	3.00 (0.00)	2.75(0.50)	3.00 (0.00)	2.75 (0.50)
	4.2	2.50 (1.00)	2.75 (0.50)	3.00 (0.00)	2.75 (0.50)
Closing/Review (2 aspects)	5.1	3.00 (0.00)	2.50 (1.00)	2.00 (0.82)	1.50 (0.58)
	5.2	3.00 (0.00)	2.50 (1.00)	3.00 (0.00)	2.50 (0.58)

Direct instruction

Both teachers implemented the stages Orientation, Instruction, and Processing very well. For the Guided Practice stage, teachers in two lessons thought that getting individual students to repeat the instructions took too much time. Instead, the teachers repeated the construction of an assignment by showing the steps in the construction plan. Furthermore, the Closing/Review stage was not fully implemented because in two lessons Teacher 1 had limited time to end the lesson properly.

Strategy instruction

Both teachers implemented the five stages very well, with the exception of Guided Practice. In two lessons, the teachers found that this stage was already included in the Instruction stage. The interactive instruction of the assignment and the verbalization of the steps by the students had shown that the students understood the steps in the process. The teachers let individual students repeat and verbalize the steps again before starting Processing.

Conclusion: Both teachers used the two instruction models as designed during most lessons. In one or two lessons, the Guided Practice stage was shortened to save time.

Question-answer patterns

Direct instruction	**Strategy instruction**
Teacher: We are going to make a money box. If you look at the construction drawing, you will see that the money box is divided into three parts: one part is metal, two parts are plexiglass. Teacher: In order to make the money box, we have to use the hand tools that are shown on the construction drawing: pencil, ruler, saw, hand bender….. (teacher picks up or points to each of the tools). Teacher: Look at the construction drawing for the correct sizes: x… mm and .... x... mm. Teacher: First, I will show you how to draw the metal part……..First, I draw the bend lines. Notice which side I draw them on. Teacher: The parts are assembled with nuts and bolts. Watch how I do it. First, I put …… then ….. Teacher to one of the students: Can you show us how to assemble the parts? *Student: Demonstrates the assembling of the three parts*	Teacher: Please look at the construction plan. Can anyone tell me what we're going to make? *Student 1 answers; Student 2 answers, etc.* Teacher: What can you do with a money box? *Student: I could save my pocket money in it……* *Student: You could use it as a gift box!* Teacher: Take a good look at the step-by-step plan. Try to find out what hand tools and machines you need to make this money box. *Students pick up the tools one by one.* Teacher: Look at the step-by-step plan. What are the dimensions of the components, and how do you draw the parts*?* *The students make suggestions and the teacher draws*. Teacher: Do you still know how to saw the plastic and metal parts? The teacher shows part of the sawing. The other part was already made by the teacher. Teacher: What do we use to assemble the parts? *Student 1: We use screws.* *Student 2: No, we need four nuts and bolts.* Teacher asks student 3: Who is right? *Student 3 hesitates……..: I think we have to put the bolts through the plastic and screw the nuts onto them.* Teacher: Correct! Teacher: Who would like to show the others how this is done? *A student demonstrates while another student reads the instructions from the plan …..*

Figure 3.6. Sample of the Instruction stage in DI and SI

The researchers kept track of the question-answer patterns between teacher and students during the observation in the Instruction stage. The number of times a student answered a question asked by the teacher was calculated.

Table 3.6 shows the average number of question-answer patterns in SI and DI for the four lessons (Lesson 1 – Lesson 4). The Table shows an increase in the number of question-answer patterns for the second two lessons compared with the first two. This is especially the case in SI, where the difference seems to be greater than in DI. Table 3.6 displays the averages and standard deviations for the four lessons.

Table 3.6
The average number of question-answer patterns in SI and DI

Condition	**Question-answer patterns in SI and DI**		
	n	*M*	*SD*
Strategy instruction	17		
Lesson 1		5.41	2.45
Lesson 2		6.29	3.04
Lesson 3		8.06	4.01
Lesson 4		7.71	4.75
Direct instruction	16		
Lesson 1		3.31	1.82
Lesson 2		3.88	2.13
Lesson 3		4.19	1.56
Lesson 4		4.50	2.66

As we expected, Table 3.7 shows that teachers gave their students more questions to answer in SI than in DI. Students were taught in groups of 8 to 9 participants (see Research design). In SI, students answered 6.9 assignment-related questions on average during a lesson.

In DI, students answered 4 such questions. The difference was analyzed with a t-test for independent samples ($t\ (26.02)$ = 3.46; p = .002) and showed a substantial effect size (*Cohen's d* = 1.20). The result confirmed that teaching according to the SI model was more interactive than teaching according to the DI model.

Table 3.7

Mean number of questions answered by individual students during four lessons

Condition	Question-answer patterns by lesson		
	n	*M*	*SD*
Strategy instruction	17	6.87	2.96
Teacher 1	10	6.68	3.07
Teacher 2	7	7.14	3.01
Direct instruction	16	3.97	1.72
Teacher 1	9	4.14	1.98
Teacher 2	7	3.75	1.45

Further analysis was done to find out if teachers had more interaction with students who scored lower in the pretest assignment. In the SI group, the product moment correlations between the number of teacher questions and the pretest scores of students was r = - 0.60. In the DI group it was r = - 0.53. These results indicated that teachers had more question-answer interactions with weaker students. However, the correlations were not strong enough to suggest that the teachers only interacted with weaker students. The above results show that teachers asked more questions in the SI group and that, just as in the DI group, more questions were directed at weaker students than at stronger students.

Student independency during classes

The students' independency was observed during the lessons and we counted how much time students were inactive or helped by their teacher during the Processing stage of a lesson and from these data we calculated the proportion of time students worked actively and independently on their assignment. An overview is provided in Table 3.8.

The students in SI seemed to be more actively involved (90% of the observed lesson time) than the students in DI (78% of the observed lesson time). The difference between the two instruction models has statistical significance (t *(17,24)* = 4.73; p < .001), (Cohen's d = 1.67). It can be concluded that students in the SI group were more actively involved in their assignments and by that showed more independency than the students in the DI group.

Table 3.8

Percentage of active learning time during four lessons

Condition	Percentage of active and independent engagement by student		
	n	M	*SD*
Strategy instruction	17	0.90	0.03
Teacher 1	10	0.91	0.03
Teacher 2	7	0.88	0.02
Direct instruction	16	0.78	0.10
Teacher 1	9	0.75	0.12
Teacher 2	7	0.82	0.04

Student test results

Quality of the assignments

The students' pre- and posttest assignments were graded on a scale of 0 - 3 (totally insufficient - very well finished in all details). The pretest assignment (magnetic board) was less complex than the posttest assignment (binder). Table 3.9 shows the average scores for both instruction groups.

Table 3.9

Mean pre- and posttest quality scores (standard deviations between parentheses)

	Direct Instruction (DI)		Strategy Instruction (SI)	
	Pretest	Posttest	Pretest	Posttest
Test quality scores	2.13 (1.03)	1.77 (0.90)	1.71 (1.11)	2.24 (0.90)
Teacher 1	2.11 (1.05)	1.69 (0.95)	1.90 (0.99)	2.10 (0.88)
Teacher 2	2.14 (1.07)	1.86 (0.90)	1.43 (1.27)	2.43 (0.98)

It can be concluded that the students did relatively well on both assignments. In the pretest, the average quality of the assignments in the DI group (2.13) is somewhat higher than in the SI group (1.71), while in the posttest it is the other way round (1.77 vs. 2.24) The difference in the pretest is small (Cohen's d = - 0.39) and not significant (t *(31)* = - 1.13; p = .27) but was nevertheless taken into account when testing the effect of SI against DI in

the posttest. An analysis of covariance (using the pretest assignment as covariate) was used. First, there was a check for a possible interaction effect of condition and pretest on the posttest. But this effect was not evident [$F(1, 29) = 0.34$; $p = .56$]. Next, the main effect of condition was analyzed. The results showed that students in the SI group had significantly higher posttest scores than students in the DI group after correction for pre-test scores [F 1, 30) = 6.37; $p = .02$].

Verbalizing

The pretest (magnetic board) and posttest (binder) assignments were completed within 50 minutes. After the assignment, each student had to try to verbalize the steps and sequence them correctly. Table 3.10 shows the average number of steps the students verbalized correctly.

In comparison with the pretest, the posttest contained one additional step that had to be verbalized in order to obtain the maximum score (see Table 3.3). In the pretest, there was hardly any difference between the students of the two conditions.

Table 3.10
Average scores for verbalizing in the pre- and posttest

	Direct Instruction (DI) M (*SD*)		**Strategy Instruction (SI)** M (*SD*)	
	Pretest	Posttest	Pretest	Posttest
Verbalizing	3.00 (1.71)	4.63 (2.16)	2.65 (1.84)	5.47 (1.51)
Teacher 1	2.44 (1.59)	4.67 (2.65)	2.30 (1.34)	5.40 (1.90)
Teacher 2	3.71 (1.70)	4.57(1.51)	3.14 (2.41)	5.57 (0.79)

In the posttest, students in the DI group correctly verbalized on average 4.6 of the 6 steps. Most of these students could verbalize at least two steps. Students in the SI group had an average score of 5.5. Almost all of these students could verbalize at least four steps.

It was decided to take the pretest assignment scores into account when comparing the mean posttest scores of the two groups. An analysis of covariance was used with the pretest as covariate. It can be concluded that the students did rather well on both

assignments. In the pretest, the average quality of the assignments in the DI group (3.00) is somewhat higher than in the SI group (2.65) (Cohen's *d* = 0.20), while in the posttest it is the other way round (4.63 vs. 5.47) (Cohen's *d* = 0.45). The difference in the pretest is small (Cohen's *d* = 0.20) and not significant (*t (31)* = - .57; *p* = .57) but was nevertheless taken into account when testing the effect of SI against DI in the posttest. An analysis of covariance (again using the pretest assignment as covariate) was used. First, there was a check for a possible interaction effect of condition and pretest on the posttest. But this effect was not evident [*F*(1, 29) = .072; *p* = .79]. Next, the main effect of condition was analyzed. The results showed that students in the SI group had higher posttest scores than students in the DI group after correction for pre-test scores, although these differences were not significant, [*F* 1, 30) = 2.29; *p* = .14].

3.6 Conclusions and discussion

This study was an effort to find a way to improve the instruction of young adults with intellectual disability. In the education of these students in the Netherlands (Practical Education) most teachers use individual guidance as a setting for education. Some teachers apply group instruction. These teachers have as method a form of direct instruction (DI). They show how an assignment is carried out and students replicate the example. Then students go to work individually and the teacher walks around and helps students. But, when assignments get complex and have many process steps, even students taught through direct instruction find it hard to remember what to do and in which sequence.

The aim of this study was to explore if a different way of teaching could increase the independency of students and improve the quality of the assignments students make. Strategy instruction (SI) fits this purpose. In SI, students receive interactive instruction on the steps to complete an assignment. They have to think ahead and verbalize the steps required to complete an assignment (task strategy).

We decided to test the effectiveness of SI in Practical Education on a small scale and compare it with DI. Two teachers were trained beforehand in the correct way of teaching both instruction models in metalworking classes. In the ensuing experiment, both teachers

taught two groups of students, each with a different instruction model (DI or SI), for four lessons. The implementation of the instruction models was observed by two researchers during all lessons. The teachers implemented the DI and SI models according to plan, with a few adaptations. As expected, the students in the SI condition engaged in more question-answer patterns with their teachers than students in the DI condition. They discussed the steps needed to complete an assignment with their teacher before starting an assignment. Students in the DI condition were given examples of how an assignment should be processed and fewer questions were asked.

The first research question was about the independency of students during individual processing of their assignment. Throughout the four lessons of this intervention, in the SI condition on average 86% of the students worked actively and without help or asking questions. In the DI condition, this was 76%. Our research shows that the teachers using the SI model were especially successful at getting students to work autonomously.

The second research question was about the quality of the students' posttest assignment. Students in the SI condition finished the posttest at a higher level of performance. We expect that this is a result of their new verbalization and planning skills.

Third research question was about the skills of students to verbalize the steps to make an assignment. As expected students in the SI condition were indeed better at verbalizing the steps they had to take to make their posttest assignment. There was an intermediate effect for students in the SI condition compared to students in the DI condition.

This study can be seen as a first support of the hypothesis that SI can effectively improve the planning and working skills of ID students. However, there are some restrictions to the research outcome. First, teachers were intensively trained and their implementation of the lessons was closely monitored by researchers. For the sake of this experiment, teachers were willing to assign students randomly to two groups and were willing to follow lesson plans prepared by the researchers. They taught the classes in different ways. This is not a normal classroom setting. It remains to be investigated whether teachers can or will follow the instruction models and lesson plans as closely without a researcher in their classroom.

Second, the sample we used was small. But this did not threaten the power of our statistical tests because we expected the SI and DI condition to differ substantially and no large sample was needed. As for the generalizability of the outcome in terms of the selection of students in our sample, we are confident that our students are representative of the Practical Education student population because entrance to this stream in secondary education in the Netherlands is subject to strict terms (general intelligence between 55 and 80, three years behind in cognitive skills compared with their peers in regular education, no behavioral disorder). For this reason, the student population does not differ very much between Practical Education schools. In fact, the mean IQ scores of the students in our sample (71.8) are close to the mean score of a sample of all students in Dutch Practical Education (Mean of 73; Blik and Naayer, 2012).

Third, the number of SI lessons was limited (four lessons of 100 minutes). We expect that more extensive instruction in an experimental setting will increase the effect of SI and increase students' ability to think and verbalize their assignments and to work independently on the execution.

3.7 Recommendations

We assume that the effect of Strategy Instruction is especially due to the question-answer teaching approach and letting students explain how an assignment can be performed. We expect that this enables students to learn to think ahead when they have to perform an assignment. We recommend further research to test this assumption.

First, we recommend measuring one's thinking about one's action - the core of SI - using think-aloud research, for example, with test assignments that are repeated over time. This will provide more insight into the development of students' thinking during a series of lessons (Reid & Lienemann, 2006). If SI is found to improve the development of students' thinking more than DI, the hypothesis that better thinking ahead will lead to a more independent processing of assignments and a higher quality of the outcome will be supported. This study points in that direction.

A second recommendation for further study is to find out whether SI also works on a larger scale. In a quasi-experiment, teachers can be trained to use either the SI or the DI model in their (metalworking) classes. If teachers are trained and are guided by a consultant in their practice they will implement a model sufficiently and it is interesting to observe what the results will be (Joyce and Showers, 2002). From meta-analysis we know that the effect of an instructional innovation is usually higher if researchers monitor its implementation than if the teachers are left to their own devices (Kuhn and Dean, 2004). That is why research on implementation is needed to study the effect of training and consultation in SI for teachers of ID students.

A last recommendation is the possibility of applying SI in other areas besides the technical domain of metalworking or woodworking. Education for ID students has practical domains such as cleaning, cooking, and gardening. The research could focus on the differences in the effect of SI compared with DI between girls and boys. Mostly boys participated in our research, which was carried out in a metalworking setting. It would be interesting to see if boys perform differently in SI during typical boy subjects and if SI is also effective for them in more traditional girl subjects, such as cooking and housekeeping (see Montague & Dietz, 2009, for gender differences in SI).

Video Instruction with explanation to another person

Chapter 4

Video instruction with explanation to another person for intellectually disabled students

This chapter is published as:

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Abstract

Intellectually disabled (ID) students in secondary education are often taught in an individual setting where video instruction is used. Especially, when the instruction is about complex assignments many students may forget parts of it. In this study we tried to find out if prompting ID students to explain video instruction would help them to improve their performance. Research with regular students indicated that explaining instructional materials can be effective (Roy & Chi, 2005).

In a first experiment with 41 ID students in Dutch secondary education, we varied the complexity of assignments and compared students who first watched and then explained video instruction of assignments (*n* = 21) with students who watched twice but were not required to explain (*n* =20). It turned out that only for complex assignments, explaining to another person was more effective for students' task performance than just watching video instruction.

In the second experiment with 58 ID students, we repeated the study with complex assignments. The students in the experimental group (*n* = 29) improved more after explaining video instructions than the students who only watched videos (*n* = 29). The experimental group also had a more complete mental representation of an assignment and could better assess how well they had performed it. This supported the assumption that explaining leads to better remembrance and understanding of an assignment.

4.1 Introduction

Instructional videos are often used in secondary and higher education to motivate students or briefly explain a process or procedure (Kay, 2012). Instructional videos are also used in the education of intellectually disabled (ID) students. The Diagnostic and Statistical Manual of Mental Disorders (APA, 2013) describes the characteristics of ID students.

In the Netherlands, ID students aged 12 to 18 are placed in a stream in secondary education called: Practical Education (Pro). The students are taught how to perform practical assignments such as: trimming hedges, mopping floors, following a cooking recipe or folding napkins. Students learn by observing their teacher's demonstrations or the instructions from videos. Video instruction can be very effective especially, when certain conditions in presenting the information are met (Clark & Mayer, 2014).

ID students often have trouble absorbing instructions if the assignments are complex and involve a series of steps (Hansen & Morgan, 2008). If assignments are complex, just watching and listening to instructional video may not be challenging enough for the students to actively process and remember the steps (Blik, Naayer, Van Leeuwen & Hoekstra, 2016).

A method to stimulate students to consciously process the instruction for a complex assignment is to ask them to retell what they saw and heard. Prompting students to explain the instruction improves students' comprehension of a task more than no prompting or teacher explanation (Chi, 2009; Rosenberg, Westling & McLeskey, 2011). As yet, it is not fully understood why explaining to oneself or to another person improves one's understanding of new information. Supposedly, explaining helps learning because it requires the learner to recognize the main parts in written information or video instruction and relate them to a pattern or rule (Lombrozo, 2013; Roy & Chi, 2005).

Roscoe and Chi (2007) concluded from their research that it is often more effective to get students to explain the material to themselves than to a teacher or a classmate. This conclusion is, however, challenged by others. According to Hoogerheide, Deijkers, Loyens, Heijltjes & van Gog (2016) and Fiorella & Mayer (2013, 2014), explaining an assignment to another person is a more effective way of stimulating students to absorb video instruction. According to them, if students know that they have to explain an assignment to someone

else, they not only focus on the main points in the instruction but also on details that are important to performing the assignment correctly. Telling the students upfront that they have to explain the instructional video to another person creates more *teaching expectancy* than asking them to explain it to themselves (Fiorella & Mayer, 2013).

The above studies were mainly conducted on procedural assignments (in mathematics and science, among others) in high school and college. Most studies examined whether students' explanations resulted in transfer of knowledge and no literature was found pertaining to ID students or practical assignments (see section 4.2).

This study focuses on practical procedural assignments that have to be performed as demonstrated (folding napkins). We chose to let the students explain the assignment to another person. It is probably easier for ID students to explain an assignment to another person than to themselves because it requires less self-control (Liu & Xin, 2016). In our study, the main question is:

Which effect does explaining an instructional video to another person have on the assignment performance of ID students?

4.2 Theoretical framework

Though there is ample research literature about the effect of students' explanations on students skills and transfer of knowledge, we are unaware of studies in which ID students were involved. We did a thorough literature search in the electronic databases: ERIC, PsycInfo, PsycArticles SmartCat, SocINDEX and Web of Science with the keywords *self-explanation, learning disability, intellectual disability* and *video instruction*. We only found publications about ID students' self-regulation, self-determination and video modeling, but not about self-explanation.

In the next two sections we will discuss research with students in high school and college on the effect of students' explanation of video instruction.

Instructional video and explanation to another person

When an instructional video demonstrates a complex assignment, students will need additional stimulation in order to remember it (de Koning, Tabbers, Rikers & Paas, 2009; Renkl, 2005). Students are more likely to make an additional effort to remember what they see and hear in the video if they are told that they will be explaining it to another person after watching it (see section 4.1) and are asked to think about the steps in their own words while watching it (Humphrey & Underwood, 2011).

Several researchers have demonstrated that ID students are capable of verbalizing instructions (Montague, 2008; Short et al., 1991; Swanson, 2001). Verbalizing instructions may help students create a mental representation of an assignment, meaning that they can recall each of the steps and activities after the instruction (Montague, 2008; Nelson & Dunlosky, 1991). Students will generally not verbalize what they see and hear out loud without being prompted to do so. It benefits them to verbalize the instructions step by step in their own words.

Various researchers have studied the effect of explaining video instructions to another person. Hoogerheide, Loyens and van Gog (2014a, 2014b) demonstrated that students in college who study a text and then explain it to another person have a better understanding of the contents and are able to apply the acquired knowledge better to exercises and new assignments (knowledge transfer). In their study, self-explanation had less effect than explaining the instruction to another student. Fiorella and Mayer (2013) studied the effect of explaining an instructional video to a fictitious other student in a computer program. Explaining the instructions to a fictitious other student was considerably more effective. Roscoe and Chi (2008), on the other hand, observed that explaining something to a fictitious other person by recording a video fragment was not as effective as self-explanation. Hoogerheide, Deijkers, Loyens, Heijltjes, & van Gog (2016) point out that there are a few methodology issues with Roscoe and Chi's study (2008). For example, it is not clear how much time students spent in the study groups explaining something to themselves and to someone else and how much time they spent on exercises. For the time being, we will assume that explaining instruction to another person after watching the instruction is more effective than explaining it to oneself.

Hoogerheide and colleagues (2016) concluded from their study that explaining an instruction to another person is not the only factor that activates the students' ability to process information consciously but that 'social presence' also plays a role. In other words, explaining instruction to another person only really helps students remember what they saw and heard if they have to explain it to another person whose presence they acknowledge and with whom they want to interact.

In summary, explanation to another person is probably more motivating to students than self-explanation. Research findings seem to indicate that actively explaining an instructional video to another person is a way of getting students to follow instruction more attentively and therefore retain it better. Students will create a better mental representation of an assignment.

Possible effects of 'explanation to another person' for ID students

In this study, we examine whether the positive effects of explaining instruction to another person also apply if the explanation is given by ID students. In contrast to students in a 'normal' classroom, ID students are mainly given practical assignments that they have to perform in the same way as they are shown and explained to them (observational learning by modeling). Our expectation is that explaining the instructions to another person will stimulate students more than if they just watched an instructional video.

Explaining will be especially effective for complex practical assignments. The complexity of an assignment can be determined by the number of steps the assignment has in relation to the capacity of the working memory of the student who has to remember and perform the assignment (van Merriënboer, Kester & Paas, 2006). We assume that assignments for ID students are cognitively more complex when they contain five or more steps and if the steps contain subactivities. ID students often have difficulty remembering such complex assignments in their entirety (see also Harvey, Galletly, Field & Proeve, 2009).

Having to explain the instruction to another person will motivate students to pay more attention while watching the video and rehearse mentally what they see and hear (Fuchs, Fuchs, Phillips, Hamlett, & Karns, 1995).

If by explaining to another person students perform an assignment better, then it is interesting to find out if they have a better mental representation of the assignment's steps than students who only watch the instructional video. We can measure the mental representation by the subsequent explanation of the steps the student has to perform to complete the assignment. Chi (2009) recommends letting students explain an assignment that is representative of a specific field in a one-on-one discussion. Our assumption is that the more completely the steps can be described, the more complete the mental representation of the assignment will be.

We would like to examine whether students, after explaining an instructional video to another person, are also able to better assess how they performed an assignment. This assessment is referred to by Nelson and Dunlosky (1991) as judgment of learning. A correct self-assessment of one's own performance indicates that the student knows how well he or she has performed. In order to do that the student needs a good understanding of the steps required to perform an assignment and the ability to compare them with the steps he or she performed. Good self-assessment is an essential metacognitive skill and indicates how well a student can reflect on his or her own work (de Bruin & van Gog, 2012; Thiede, Anderson, & Therriault, 2003; Schraw, 2009).

4.3 Research questions and expectations

To our knowledge no research has been conducted on the effect of explaining an instructional video for practical assignments to another person by ID students. It is also not clear at which level of complexity of an assignment active explanation of the instructional video has more effect than passive observation of the video. Yet, demonstrating the effect of the explanation to another person is important for the further development of instructional videos for ID students.

In Study I we asked research questions about the complexity of the assignments and in Study II about the different effects that explaining complex assignments to another person may have on task performance and self-assessment. In both studies we compared

two groups: one group that watched and listened to an instructional video twice and another group that watched and listened to it once and explained it the second time.
In Study I, the research question is:

> *At which level of complexity does explaining an instructional video to another person have an effect on the execution of practical assignments by ID students?*

We had less and more complex assignments. We assumed that practical assignments with five or more steps, with subactivities in some of the steps, are complex. These assignments would put a greater demand on the students' working memory than less complex assignments which could be remembered by just watching the instructional video. We wanted to find out whether the effect of explaining to another person only occurred with complex assignments and not with less complex assignments that could be remembered by just watching the instructional video.

In Study II, the research question is:

> *Which effect does explaining the instruction of complex assignments have on how ID students perform the assignment, on their mental representation and on their self-assessment?*

We assumed that explaining a complex assignment to another person stimulates the student to watch the instruction more closely and retain the assignment better. The student needs to ask himself or herself whether he or she will remember enough to explain the steps in the assignment clearly to another person who is not familiar with it. This will enhance the student's mental representation of the assignment. We expected that when a student explains a complex assignment to another person, the student will perform the assignment more completely than a student just watching the video (see section 4.2). It is likely that explaining an assignment to another person will also result in a better self-assessment of the number of correctly performed steps (see also Metcalfe, Kornell & Son, 2007).

4.4 Study I – Method and results

The instructional video

In order to test the effect of complexity of the assignments, we created four instructional videos. The assignments consisted of four different napkin folding techniques used in the hospitality industry. The steps were pretty much the same, but we varied the number of sub-activities in the steps. A sub-activity can be folding a napkin and turning it at the same time. Subactivities make the instruction of a step harder to grasp and retain.

The videos were all about the same length: 102 to 116 seconds. The number of steps was pretty much the same too: 5 or 6. But the assignments differed in the number of steps with subactivities (see Table 4.1).

Table 4.1
List of assignments in Study I

Folding assignments	Assignment 1	Assignment 2	Assignment 3	Assignment 4
	Fan 1	Fan 2	Envelope	Miter
Duration	116 sec.	102 sec.	116 sec.	104 sec.
Steps	6	5	5	6
Steps with subactivities	0	2	1	2

We expect Assignment 2 and 4 to be the most difficult to remember and perform. Both assignments consist of two steps with subactivities. Assignment 3 is the next difficult assignment and has a step with one subactivity. We expect Assignment 1, which does not have any steps with subactivities, to be the easiest.

We applied multimedia principles to the composition of the instructional videos (Ibrahim, Antonenko, Greenwood & Wheeler, 2012). The following is a summary of our implementation.

- *Duration*: The videos should not be too long. Students often stop paying attention after five or six minutes of video instruction (Hsin & Cigas, 2013; Guo, Kim & Robin, 2014). We made videos that lasted about 2 minutes. We wanted to show each video twice.

- *Emphasizing the main points:* The steps that are shown must be clearly separated and their relationship specified (Spanjers, van Gog & van Merriënboer, 2010). In the videos, we showed how to fold napkins according to a number of techniques. Each assignment had a step-by-step plan with 5 or 6 steps. The video showed each step separately with a brief explanation of how a step relates to the previous step. There is a 2-second pause between two steps to give students time to process the new information and link it back to what they had already learned about the assignment. The camera was aimed at the steps that were key to performing the assignment. The video started with a brief introduction by the model who demonstrated the four assignments. The camera was focused on the model's hands (Figure 4.1) during the demonstration.

Figure 4.1. Camera aimed at the right place at the right time

- *Synchronization of images and voice*: The oral explanation in the video must be fully in sync with the images (Clark & Mayer, 2014). The explanation must clearly describe how a procedure is carried out in relation to the images without going into too much detail. The videos demonstrate step-by-step how to fold a napkin using a technique and the model explains the folding process at each step in a few sentences. Simple terms were used to explain straight, diagonal, and back folding.
- *Personal approach:* The video started with a model explaining in a clear voice what the students were going to do. The model also explained the assignment by describing the images in informal language (Clark & Mayer, 2014). Informal language and cues were used to show the students how to perform the steps in each assignment.

Procedure

The target group for our research were grade 7 ID students in the north of the Netherlands. The students attended Practical Education (PrO) in secondary schools. For the experiment two schools were randomly chosen and the principal and teachers were convinced to take part in our studies with their grade 7 students. In the experiment there were 41 ID students. The students were, as usual in grade 7 (first class) PrO, 12 to 14 years of age. Within schools students were randomly assigned to an experimental or a control condition. The students of the same school were first grouped in pairs by sex and IQ scores and then the students in each pair were distributed randomly between the two research conditions. As a result, in the first experiment there were 21 students in the experimental condition and in the control condition 20 students. The experimental condition of 9 boys and 12 girls and the control condition consisted of 9 boys and 11 girls. The average IQ score in the experimental condition 69.14 (*SD* = 6.52) and in the control condition was 69.30 (*SD* = 8.97). The students were in the first year of their training in PrO and had not done any hospitality-related activities and napkin folding.

The researchers visited the schools and students were taken out of the classroom one by one during the study. The study was conducted in a separate room that was occupied only by the student and a researcher. The researcher told students in both groups that they would learn four napkin folding techniques that are used in restaurants. Two assignments at that point in time and two at a later stage. The student and the researcher sat opposite each other at a table with a laptop with a 16-inch screen that the researcher could not see (Figure 4.2). The 164 folding sessions (41 students x 4 sessions) were videotaped so that the researcher could later analyze them and give them a score.

There was a program with four video instructions of napkin folding assignments. Before the instructional video started, the student saw the teacher in the video. The teacher explained the goal of the folding assignments and that students had to pay attention during the instruction because they had to perform the assignments to the best of their ability after watching the video. For each assignment the video showed how a napkin could be folded in a number of steps using a special technique. The instruction of an assignment lasted almost 2 minutes for each assignment (see Table 4.1).

In the *experimental group,* after the students had watched the instructional video once with sound, the researcher asked the students to verbalize the second viewing (without sound). The students gave the researcher an eyewitness account of what they saw in the video. When necessary, the researcher encouraged the students in the experimental group to say as much as possible when they watched the video for the second time. After the students had explained the instruction they performed the folding assignment.

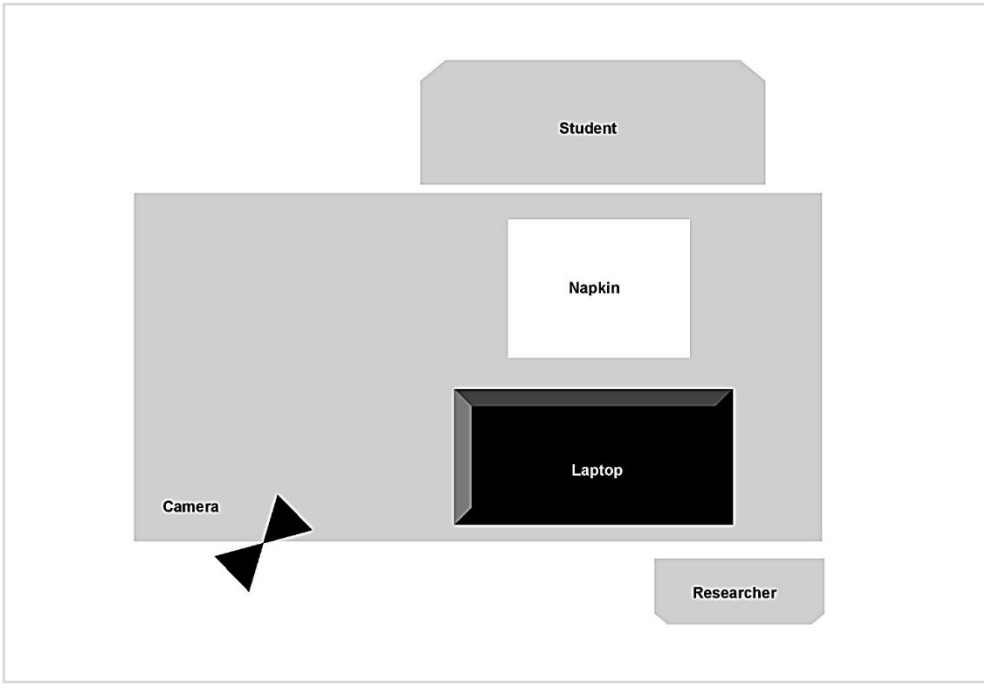

Figure 4.2. Setup for the experiment

After the program started, the *control group* was shown the same instructional video twice with sound. Between the first and the second viewing, the teacher told the students to think about the things they hadn't understood and to pay attention to them during the second viewing. The control group did not verbalize the folding assignment beforehand. The four folding assignments were spread over two sessions. Table 4.2 provides an overview.

Table 4.2

Design of Study I

Group	Session 1		
	Instructional videos 1 and 2		Folding assignments 1 and 2
	First time	Second time	
Experimental (*n* = 21)	Image and sound (Passive)	Image only, the student explains (Active)	Execution
Control (*n* = 20)	Image and sound (Passive)	Image and sound (Passive)	Execution
Group	**Session 2**		
	Instructional videos 3 and 4		Folding assignments 3 and 4
	First time	Second time	
Experimental (*n* = 21)	Image and sound (Passive)	Image only, the student explains (Active)	Execution
Control (*n* = 20)	Image and sound (Passive)	Image and sound (Passive)	Execution

Instruments

The execution of the folding assignments

For each of the four assignments the students received a score that varied from 0 to 3 (Table 4.3).

Table 4.3

Evaluation schema for the performance of the assignments

Independence	Quality of the execution	Score
Did not work independently	Insufficient – the student did not work independently and asked for help.	0
Worked independently	Insufficient – one or more steps were skipped or executed incorrectly.	1
Worked independently	Sufficient – all of the steps were executed but the end product was not finished correctly.	2
Worked independently	Good – all of the steps were executed and the end product was finished correctly.	3

The four observations were made by two researchers. The assignments were videotaped (Figure 2) and scored by a researcher with help of evaluation schema in Table

4.3. The twenty recorded assignments were used to measure the interobserver reliability between the two researchers. The agreement was sufficiently high (Kappa = 0.84).

Data Analysis

Students performed four folding assignments during the intervention. The experimental group and the control group were compared in terms of the number of steps completed in the execution of the assignments. The analysis were done with t-tests for independent cross-sections. The reliability intervals were studied and a significance level of 0.05 used for the assessment.

Study 1 results

Implementation of the study conditions

The students in the experimental group were able to verbalize the assignments in all of the sessions. The explanation of the video instructions for the four assignments varied in completeness from very clear explanation with additional points that need attention to explanation in very short sentences and general references to the videos.

In the control group, most of the students were attentive and silent when they watched the video for the second time. Although some students indicated that they understood the assignment and didn't think it necessary to watch the video again, all of the students watched the video twice.

The four folding assignments were designed to have different degrees of difficulty. We expected differences between the two study groups in the execution of the assignments especially for the two most complex assignments (2 and 4). The average scores per study group for each of the four assignments are shown in Table 4.4.

Table 4.4 shows that the score for the more complex Assignment 4 shows the clearest difference between the two study groups (Cohen's d = 0.70). Assignment 2 also has a larger difference (Cohen's d = 0.58) and assignment 1 (Cohen's d = 0.41 and assignment 3 (Cohen's d = 0.48) have the smallest and not significant differences. Table 4.4 shows the statistical data (means and standard deviations) and analysis (effect sizes, t- tests and confidence intervals) of the four assignments.

Table 4.4

Comparison between the study groups in the execution of the assignments

Assignment	Condition	*n*	Mean (*SD*) (0 - 3)	Cohen's *d*	*t*	*p* value (one-tailed)	Confidence interval
1	Control	20	1.65 (0.93)				
	Exp.	21	2.05 (1.02)	0.41	- 1.30	0.101	[-1.02; 0.22]
2	Control	20	0.85 (1.09)				
	Exp.	21	1.43 (0.87)	0.58	- 1.88	0.034	[-1.20; 0.04]
3	Control	20	1.30 (1.08)				
	Exp.	21	1.81 (1.03)	0.48	- 1.55	0.065	[-1.18; 0.16]
4	Control	20	0.40 (0.82)				
	Exp.	21	1.10 (1.14)	0.70	- 2.25	0.015	[-1.32; 0.07]

First conclusions on Study I

As expected, the effect of explaining the assignment to another person is clearly visible for the more complex assignments. The effect is less prominent for the simpler assignments. The findings are in line with earlier studies that show that verbalization is effective for complex assignments with a number of related steps and subactivities, but not for easier assignments (Harvey et al., 2009; Schunk, 1986). It seems that explanation to another person of video instruction only has effect with complex assignments that have at least five steps and several subactivities in some steps (see Table 4.1). Our next Study II was designed to tests this assumption.

4.5 Study II – Method and results

In this study, we tested whether explaining an instructional video of a complex assignment to another person had a positive effect on ID students' task performance. To date, no research has been conducted on how explaining something to another person affects ID students' learning ability. This is why we also tried to establish if students had a more complete mental representation of the assignment and better self-assessment. There was an experimental group of 29 students who explained five videos to a researcher after watching them for the first time and a control group of 29 students who watched the videos

twice. We used a one-on-one research setting in the same way we did in Study I. The research question was (see Section 4.3): *"Which effect does explaining instructional videos for complex assignments have on ID students' performance of the assignments, their mental representation and their self-assessment?''*

The instructional video

In this experiment, five folding assignments were devised based on the two most complex assignments in Study 1. The complexity of the assignments was in the number of steps (6 to 9) and in the number of additional subactivities they contained. For example, the combination of folding the napkin, turning it over and turning it upside down.

Method

Random sample and procedure

The same sampling procedure as in Study 1 was used. From the target group of first-year students (grade 7) of schools for Practical Education in the north of the Netherlands. The students of two schools were selected at random.

Table 4.5
Design of Study II

Condition	**Five instructional videos shown twice** During three sessions: Assignment 1+2; 3+4 and 5		**Folding Assignments 1 to 5**	**After Assignment 5**	**After self-assessment**
	First time	Second time			
Experimental (*n* = 29)	Image and sound (Passive)	Image only Student explains to researcher (Active)	Execution	Self-assessment of Assignment 5	Verbalize Assignment 5 (mental representation)
Control (*n* = 29)	Image and sound (Passive)	Image and sound (Passive)	Execution	Self-assessment of Assignment 5	Verbalize Assignment 5 (mental representation)

There principals and teachers agreed to participate in the research. There were 58 grade 7 students in the schools: 38 boys and 20 girls. Within schools, the students were first paired by sex and IQ. The IQ score was established by the Wechsler Intelligence Scale for

Children (WISC-III-NL). The pairs of students were distributed randomly between the two research conditions: 29 in the experimental condition and 29 in the control condition. In Study II, we applied the same procedure as in Study I. Table 4.5 shows the design of Study II.

Instruments

Degree of completeness in the execution of an assignment

The 240 folding sessions (58 students x 5 sessions) were videotaped so that the folding assignments could be later analyzed and assigned a score. Students were given 1 point for every step that was performed correctly. The folding assignments increased in complexity, the purpose being to continue stimulating students to pay attention during the videos. The researcher stopped assigning scores as soon as a step was performed incorrectly. However, in order to encourage students, they were allowed to continue folding if they made a mistake they didn't notice. A session was not ended unless the student indicated that he or she was lost or unable to continue. The scores for the folding assignments varied from 0 to a maximum of 6 or 9. The scores were added to reach a total score for the completeness of the execution of the assignments (score 0 – 36). The internal consistency of this total score is sufficiently high to conclude that the individual scores measured the same concept (Cronbach's alpha = 0.71).

Self-assessment

After the completion of the last folding assignment, the students in both conditions were asked the following question after a one-minute break: "*You followed the video as much as possible for this assignment. If I told you now that the video shows seven folding steps, how many do you think you did?"*

If the students answered the question, the number of steps the students thought they had done was their score (at least 0 and at the most 7 steps). Students who could not state the exact number of steps were asked to estimate how many they had done: 'Two or three', 'Four or five', 'Six or Seven'. The numbers were averaged (e.g., 2.5, 4.5, and 6.5 respectively). The accuracy of the self-assessment was calculated by taking the absolute

difference between the self-assessment score (0 -7) and the execution score (0 - 7). If the difference was 0, the accuracy was optimal. Bigger differences represented less accuracy in the self-assessment.

Mental representation of the instructional video

One minute after the self-assessment, the students were asked the following question: *"Can you tell me which steps you saw in the video on how to execute the assignment?"* If the students answered the question by describing a number of steps in the video and got the sequence right, the number of verbalized steps was their score. If a student answered: "I can't remember anymore" the student was asked the following question: *"What step did you start with?"* A student who couldn't remember or whose explanation of a step was unclear was then asked the following question: *"What was the step after .... ?" (The researcher repeated the step that the student mentioned last).* A student who listed the steps in the wrong sequence or hesitated too long was asked the following question: *"What step did the assignment start with again?" or "What was the step that came after the step to ....?"* (The last correct step that the student mentioned). Scoring stopped if the student was not able to state a next step in the correct sequence. The scores for the verbalization were placed on a scale of 0 – 7 (correctly verbalized steps).

Data analysis

Students performed five folding assignments during the intervention. The experimental group and the control group were compared in terms of a) the number of steps completed in the execution of the five assignments, b) the degree to which students were able to assess the number of steps they had performed correctly in Assignment 5 (self-assessment), and the degree to which they were able to correctly repeat the steps in the same Assignment 5 (mental representation).

The analysis were done with t-tests for independent cross-sections. The reliability intervals were studied and a significance level of 0.05 used for the assessment.

Study II results

Description of the study groups

At the beginning of the experiment, there was no reason to assume that there were differences between students in the knowledge of napkin folding. The students were all first-year students at two schools for PrO and these techniques had not yet been taught. In terms of intelligence, both groups appeared to be very similar. The average IQ score in the experimental group was 72.48 (*SD* = 8.95) and in the control group 74.03 (*SD* = 8.35).

The two experimental conditions each had 29 students. There were 18 boys and 11 girls in the experimental condition and 20 boys and 9 girls in the control condition. We concluded that the two conditions were very similar in terms of the students' prior-knowledge, sex, and IQ scores.

Implementation of the study conditions

Sixty ID students took part in the study and 58 students were able to attend all of the sessions. Over a period of five weeks, these 58 students (29 in each condition) performed five folding assignments, the self-assessment, and the verbalization assignment. Students performed the assignments independently in a separate room in which only the student and the researcher were present. The research procedure was the same as in Study 1 and was followed successfully. The students in the experimental group were able to verbalize the five assignments. The verbalizations varied in completeness from extended explanations to explanations in short sentences referring to the main points in the video that was shown. In the control group, most of the students were attentive and silent when they watched the videos, also when they did it for the second time.

Degree of execution of the five assignments

The scores for the execution of the five assignments were added into a total score ranging from 0 - 36. Table 4.6 shows that the students in the experimental group scored higher on average than the students in the control group. In the experimental group, the students scored on average 22.14 steps correctly (*SD* 5.38) and in the control group 16.41 steps (*SD* 6.48). The difference is statistically significant. The effect size of the total score for

the degree of execution of the five assignments expressed in Cohen's *d* = 0.97. It confirms the assumption that explanation to another person helps ID students perform complex practical assignments.

Table: 4.6
Overview of the results of the execution, self-assessment, and verbalization

	Condition	***n***	***M* (*SD*)**	**Cohen's *d***	***t***	***p*** (one tailed)	**Confidence** interval
Execution of folding assignments (scale: 0-36)	Control	29	16.41 (6.48)	- 0.97	- 3.66	0.001	[- 8.86; - 2.59]
	Exp.	29	22.14 (5.38)				
Self-assessment (scale: 7 – 0)	Control	29	1.02 (1.03)				
	Exp.	29	0.62 (0.70)	0.46	1.71	0.046	[- 0.07; 0.86]
Mental representation (scale: 0 – 7)	Control	29	2.66 (2.22)	- 0.82	- 3.12	0.002	[- 3.06; - 0.67]
	Exp.	29	4.52 (2.32)				

Self-assessment

After finishing Assignment 5, students were asked to estimate how many steps in the instructional video they had performed correctly. Their estimate was compared with the steps that they had actually performed correctly. In the control group, the average difference between the estimated score for the execution of the assignment and the actual score for the assignment was 1.02 (*SD* = 1.03). The difference was smaller in the experimental group, namely 0.62 *(SD* = 0.70). The students in the experimental group were able to assess the steps they had performed better than the students in the control group (see Table 4.6). The difference is statistically significant. Explaining the instructional video to another person had a small but positive effect on the students' ability to accurately assess how they executed the assignment (Cohen's *d* = 0.46).

Mental representation of the video

The students were asked to verbalize the instructional video after Assignment 5. This took place about three minutes after the student finished the folding assignment.

The control group was able to verbalize 2.66 of the 7 steps. The experimental group was able to verbalize an average of 4.52 of the steps. The difference between the two conditions is statistically significant. Explaining the video to another person has a large effect on the students' mental representation of the video and enables students to better verbalize the instruction at a later stage (Cohen's *d*= 0.82).

Explorative analysis

In this explorative analysis we want to find out if the students who explained video instruction performed all five assignments better than their counterparts in the control condition who did not explain. This assumption could be derived from theory (Roy & Chi, 2005).

The results in table 4.7 show that in all but the first assignment the assumption that the experimental group would outscore the control group could be supported.

Table 4.7
Results of the execution of the 5 assignments

Assignment	**Condition**	***n***	***M (SD)***	**Cohen's *d***	**t**	***p* value** (one tailed)	**Confidence** interval
1 (Scale 0 – 6)	Control	29	2.83 (1.67)	- 0.24	- 0.90	0.185	[- 1.22; - 0.46]
	Exp.	29	3.21 (1.52)				
2 (Scale 0 – 6)	Control	29	2.83 (1.54)	- 0.61	- 2.32	0.012	[- 1.80; - 0.13]
	Exp.	29	3.79 (1.63)				
3 (Scale 0 – 8)	Control	29	4.21 (2.41)	- 0.92	- 3,48	0.001	[- 3.26; - 0.88]
	Exp.	29	6.28 (2.10)				
4 (Scale 0 – 9)	Control	29	2.72 (1.98)	- 0.62	- 2.36	0.011	[- 2.04; - 0.17]
	Exp.	29	3.83 (1.56)				
5 (Scale 0 – 7)	Control	29	3.83 (2.04)	- 0.62	- 2.39	0.010	[- 2.22; - 0.20]
	Exp.	29	5.03 (1.80)				

The first assignment was not different in complexity from the other assignments. It might be that the students had to get used to applying their explanation to the execution of their assignment.

4.6 Conclusions

In Study I, we explored at which level of complexity of practical assignments explaining to another person has an effect on students' performance. Several researchers (Harvey et al., 2009; Schunk, 1986) indicated that the task to be observed during instruction should not be too easy to remember. In that case explaining has no extra value for understanding and remembering. We assumed that instruction in practical assignments would be more difficult to remember for students if there were five or more steps and if the steps contained extra subactivities. The study results show that explaining the instructional video to another person has effect. Cohen's *d* ranged from 0.41 and 0.48 for the simpler assignments to 0.58 and 0.70 for the complex assignments. Especially explaining the complex assignments had great effect on students' performance.

The results of the study are in line with research on cognitive load (van Merriënboer, Kester & Paas, 2006) which shows that students learn more from complex assignments. The, complexity of assignments depends on students prior knowledge. If instruction has several new elements or novel relationships between elements, then the complexity of the task will suffice and students must pay attention in order to understand it (de Koning, Tabbers, Rikers & Paas, 2009).

Study II supports the results of study I: ID students in the experimental group who explained the five instructional videos of complex assignments achieved a clearly higher score for the execution of the assignment than the ID students in the control group who only watched and listened. Only the first assignment was not completed at a higher level. But, this may be due to the lack of training the students had in applying their explanation to the execution of an assignment. In general, active explanation of the images shown in the video had a big and positive effect on the execution of the assignments (Cohen's *d* = 0.97).

Theory claims that the main reason for students to improve their completion of an assignment after explaining will be that students have a better mental representation of the assignment and remember it better when they start to perform it (Roy & Chi, 2005; Fiorella & Mayer, 2014). We determined that students who explained to another person were much more capable of a mental representation of the steps in the video than students who had only watched the video (Cohen's *d* = 0.82). This outcome seems to support the theory mentioned above. The analysis indicates that if students are cued to explain the video instruction then this leads to better mental representation and in turn this may result into better performance. But, we could not test this assumption. In our study better understanding and remembering of the assignment (mental representation) is also displayed by another effect: After the fifth assignment, students in the experimental group were better at assessing the number of steps they had performed correctly than students in the control group. Our study shows that the experimental group of students was more capable of determining how far they got with an assignment after explaining the instructional video. They had improved insight into their execution of the assignment more than their peers in the control group. The results seem to be in line with research in which interventions for improvement of self-regulation of ID students are studied (e.g. Bielaczyc, Pirolli & Brown, 1995, McNamara, Levinstein & Boonthum, 2004). Actively involving students in instruction not only deepens understanding but also improves the monitoring skills of ID student in how well they execute their tasks.

4.7 Discussion and recommendations

The aim of this study is to improve the video instruction students receive and add self-explanation to make learning from video more active and constructive for students. In this section we discuss constraints for effective use of explanation as an instructional tool (de Koning , Tabbers , Rikers & Paas, 2011). The aim is to put forward information to design a multimedia learning environment with video instructions. The constrains we investigated so far are: the necessity of complex assignments and the ways students can be cued to effectively explain video instruction.

Complexity of assignments

Study I indicates that practical assignments that are sufficiently complex to illicit effective explanation from students consist of five or more steps with subactivities in some of the steps. For simpler assignments with fewer steps and without subactivities, actively explaining the video instruction will not show an effect. This study in the technical domain does not show the maximum complexity at which an assignment becomes too difficult for ID students to remember and explain to other persons. This is worth further study.

In education for ID students acquisition of skills in cleaning, cooking, technical training and the maintenance of public green spaces are important. The application of the skills is trained with practical assignments that often have a fixed sequence of steps and with extra subactivities in the steps. In order to generalize our findings, it is important to find out if the complexity of assignments in other domains can be determined in the same way as we did for the technical domain.

It is also important to determine for which group of students (e.g. grade 7 to 10) which degree of complexity of assignments *explaining instructions to another person* can have a positive effect compared to repeating the instruction. As stated by Roy & Chi (2005) and Wiley & Chi (2014) complexity of tasks depends on the students' prior learning.

Cueing for student explanation

In *study II* we examined the effect of explaining an instructional video to another person mainly as a cognitive process. The researcher asked the student to explain and he or she was the one the student explained to. Literature suggests that the person who gives the cue and the person receiving the explanation from the student are probably important for the students' motivation. Hoogerheide et al. (2016) studied with pre-university students the difference in effect of explaining a study text to another person on paper as opposed to explaining it orally to a virtual person in a computer program. They found an effect to the advantage of explaining something to a virtual person. They concluded that explaining something to another person will motivate students more to study a learning task if the person is present rather than absent. But, Hoogerheide et al. did not take the difference between oral (person present) and written (person absent) into account. There seems to be

more effect of explaining if the student can do this in a natural fashion, this is mostly orally and not written (Wylie & Chi, 2014). For ID students oral explanation will take less effort than written explanation.

Still, the 'social presence' of a person may be an important motivating factor for students to explain something to another person (Fiorella & Mayer, 2013) There is the choice to let the student explain to a fellow student or a teacher sitting next to him or a virtual person in a multimedia environment. Probably, for ID student, who are greatly in need of a structured learning environment, the teacher will be an important person (Kroesbergen & van Luit, 2003).

In a follow-up study for ID students, three versions of a computer program can be used to test the difference in effect between explaining something to a virtual person (less 'social presence') and explaining something to an actually present person (more 'social presence'). In the third version of the program, students can be asked to explain the steps in an instructional video to themselves (no social presence, but self-explanation). In all three versions the students are asked to record their explanation. In this way the quality of the explanations in the three versions can be investigated. The structuring of the cues (Wylie and Chi, 2014) can be the same in all conditions: the student is asked by the same voice-over to explain video instruction of complex tasks. Only the person receiving the explanation differs.

Such a study is not only interesting in terms of the theoretical question of what causes the effect (see Fiorella & Mayer, 2014), but also in terms of the practical question of which form of explanation is achievable and will be effective in teaching ID students the application of practical skills.

Teacher Training

Chapter 5

Training teachers of ID students in interactive instruction

A previous version of this chapter was published as:

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Abstract

In the Netherlands, teachers of students with an intellectual disability do not instruct their students interactively. The teachers demonstrate assignments, but the students often fail to fully understand them and remain dependent on the teacher when working on their own (Blik, Harskamp & Kuiper, 2012). This instructional practice is also seen in other countries (Wehmeyer, et al, 2008). Research conducted by Swanson (2001) and Chung & Tam (2005) in special education shows that interactive instruction where students explain procedures or cognitive strategies to their teacher, has a positive effect on students' independency during task performance.

In this study, we examined the effect of in-service training to change teachers' routines into interactive instruction. The teachers could learn to teach more interactively in the form of instruction they preferred: individual guidance or group instruction. The training and coaching were developed especially for this study based on the principles of Joyce & Showers (2002), and Cornett & Knight (2008).

After the training, thirteen teachers participated in an investigation. In the first period, before the summer vacation, teachers succeeded in changing their instructional behavior towards much more interactive teaching and students worked more independently. In the second period, after the summer vacation with new classes of students, the effects of the training could still be observed.

5.1 Introduction

A number of different initiatives have been developed around the world to promote the professionalization of teachers working with ID students (Turnbull, Turnbull, & Wehmeyer, 2007). The aim of this study is to find out whether we could contribute to the professionalization of this particular group of teachers.

Previous studies show that most teachers of ID students prefer to give individual guidance to their students and some prefer group instruction (Blik, Harskamp, Kuiper-Bakker, 2012; Spooner, Baker, Harris, Ahlgrim-Delzell, & Browder, 2007). In both forms of instruction, the teachers instruct students through demonstration of the tasks they need to carry out. The tasks are often practical assignments to prepare students for basic level jobs. However, demonstration as a teaching method leaves students with little opportunity to actively participate in the instruction process. Especially when tasks are complex ID students find them hard to remember. As a result, many students cannot work on the tasks independently and often ask their teacher for help (see Chapter 2).

The question we set out to answer in this study was whether we could train teachers to use interactive instruction instead of demonstration. We wanted to find out whether this change in teaching method would help ID students to understand their assignments better and work more independently. In order to answer this question, teachers needed to be trained and coached. After the training was completed, we examined whether the teachers could carry out interactive instruction in their classes both short and long term and whether this improved their students' ability to work independently.

5.2 Theoretical framework

Interactive instruction and current teaching practice

Several studies have examined whether the way in which an assignment is explained to ID students matters (Hughes, et al., 2002; Montague & Dietz, 2009). The conclusion from these studies is that, of all of the ways of teaching, students benefit the most from direct instruction (DI) or strategy instruction (SI).

In DI, new assignments are presented in small steps. The teacher demonstrates and explains how the assignment is performed, asks the students questions and lets them practice with guidance before they start working on the assignment independently. The students' learning activities are steered in the desired direction by asking questions, helping them, and giving corrective feedback (see Adams & Carnine, 2006; Graham & Bellert, 2004; Veenman, 1992).

Strategy instruction (SI) is recommended when teaching students how to apply procedures. SI consists of the teacher asking questions with the aim of creating a specific approach (strategy) together with the students. In order to do this, the teacher must interact heavily with the students and challenge them to think about the steps to carry out the assignment. According to Fuchs, Fuchs, Mathes and Martinez (2002), Ryder, Burton and Silberg (2006) and McLeskey and Billingsley (2008), SI has a positive effect on students' understanding of the sequence in which assignments need to be performed and their ability to perform them independently. Researchers generally agree that both DI or SI are effective teaching methods. It does matter, though, that methods are given interactively and that students can explain the procedures to the teacher and their peers. Explaining an assignment to themselves (self-explanation) and to others (explanation to another) increases their chances of understanding and performing assignments independently (Chung & Tam, 2005; Montague, 2007; Swanson, 2001).

Current teaching practice in education of ID students in the Netherlands as well as other western countries is that most students receive instruction in an individual setting. They choose their assignments and are given individual guidance. A minority of the teachers give group instruction with assignments for all students in a class and extra assignments for students who finish their assignment sooner (Blik, Harskamp, Kuiper-Bakker, 2012; Spooner, Baker, Harris, Ahlgrim-Delzell, & Browder, 2007). The explanation for the teachers' focus on individual students is that it is easier for the teachers to keep students on track and they can give the students immediate feedback (Pinnell, et al., 1994; Wasik & Slavin, 1993). One of the problems, though, is that classes are generally too big for this type of instruction. Individual instruction with intense interaction is difficult to give to classes of eight or more students (Bosker & Doolaard, 2009). In larger classes, teachers are often

unable to spend more than a few minutes per lesson on individual students. Their "fragmented" instruction focuses mainly on the practical execution of assignments (demonstrating the procedure) and not on students' understanding and planning of assignments. Teachers who give group instruction, on the other hand, can spend more time on instruction and probing to make sure students understand an assignment. But just like the teachers who give individual guidance, these teachers also tend to take their students too much by the hand instead of asking the students to explain (Blik, Harskamp, Kuiper-Bakker, 2012; Woolfson & Brady, 2009; Allday & Yell, 2013).

In light of the above, the question we asked was whether lessons could be optimized for both ID students and teachers in the Netherlands. We tried to find the answer in the form of a training and coaching intervention aimed at changing the instructional behavior of teachers in the technical domain in Practical Education.

Effective teacher training

It's not easy to change a teacher's ways of giving instruction. In order to make any changes, teachers would first have to be convinced of the benefits and improvements. One way of doing this is by showing them their instructional behavior and putting them in a group (network) with peers who also want to change or see the need for change (Joyce & Showers, 2002; Shulman & Shulman, 2004). Researchers concluded that another favorable condition for change is that the group of like-minded professionals works in the same type of education and teach the same subjects because it stimulates them to exchange ideas quicker (Franke et al., 2001; Gregoire, 2003; Shulman & Shulman, 2004).

Joyce and Showers (2002) performed a meta-analysis of some 200 studies and concluded that the professionalization of teachers is built on five components of actions the trainer-coach should take:

- *Provide information on the theory of the teaching skills to be acquired*. In both of our conditions (group and individual), the researchers address theory first. According to Joyce and Showers, it is key that concrete examples of the presented (subject) knowledge and skills are given together with demonstrable improvements in the

classroom. In the teachers' perception, this makes the content of the training convincing and feasible (see also Gregoire, 2003).

- *Let teachers observe the skills they need to acquire*. The teachers are shown video examples of interactive instruction. The videos were made before the seminar in classes for ID students. The videos show that students can be instructed interactively in an individual condition by working more systematically. In the group condition, the videos show how teachers can increase the amount of interactive instruction and differentiation in the classroom. The teachers of the two groups watch the videos with a checklist for individual or group interactive instruction. The videos make it possible for teachers to compare their current and desired state of affairs and to discuss the feasibility of changing their teaching method and the benefits of more interactive instruction.
- *Let teachers practice the skills in simulated classrooms.* Joyce and Showers (2002) show that role play can provide a better understanding of new teaching methods. The participants are given student assignments that they can use to prepare a short lesson. They then give the lesson to their peers in the form of role play. Teachers in individual condition practice in systematic instruction with questions for the students. Teachers in the group condition practice strategy development by a question-and-answer method. The coach demonstrates how the teachers can differentiate within their group so that students who work fast have a more complex assignment than the other students, but can still benefit from the group instruction.
- *Give teachers feedback about the way they use the skills they learned and discuss the results with them.* In both conditions, teachers receive feedback from their fellow participants and trainer-coaches. By practicing in the training environment and receiving *feedback*, teachers gain better insight into the changes they need to make to their own teaching method. With the trainer-coach and their fellow trainees they discuss how they can apply the changes in their classrooms and which adaptation they can make (Zimmerman & Schunk, 2004; Gabelica, Bossche, Segers, & Gijselaers 2012).
- *Coach the teachers in their classrooms by observing lessons and giving feedback to them.* Joyce and Showers' fifth component, coaching in a realistic classroom environment, is

also referred to as *instructional coaching* (Knight, 2004, 2007; Cornett & Knight, 2008). Knight and Cornett (2009) showed that teachers must not only be involved in the issue that needs to change, but they must also have ample opportunity to influence the change process and its practical implementation. In the coaching phase, the teacher plans the interactive lesson together with the trainer-coach. The teacher gives a lesson that the trainer-coach observes and discusses. During the discussion, the teacher is explicitly asked to find and implement improvements for the next lessons. After this intensive coaching period, teachers and researchers map out subsequent actions on whether and how the support will be continued.

Instructional coaching can also take place through video recorded lessons. The teachers send the videos of their lessons and their self-evaluations to the trainer-coach. The trainer-coach can watch the teachers' videos, check the teachers' self-evaluation sheets, and give feedback. Research conducted by Sherin and Han (2004) shows that this form of remote coaching is an effective supplement to "face-to-face" coaching.

5.3 Research questions

The aim of the teacher training and coaching (done by the researchers) was to enhance teachers interactive instruction during classes in practical skills so that their students got a better understanding of the assignments to be performed and worked more independently. The research questions were:

1. *Would training and instructional coaching enable teachers of ID students to give their lessons more interactively and would such training have a lasting effect on their instructional behavior?*
2. *Does more interactive instruction increase students' ability to work independently?*

5.4 Method

The study was carried out in 11 schools for Practical Education (PrO) of ID students in the four northern provinces of the Netherlands. Based on a previous study on teaching methods in secondary education of ID students in the Netherlands (Blik, Harskamp, Kuiper-Bakker, 2012), we chose to carry out this study with woodworking teachers. A total of 13 teachers took part in the training and the corresponding study, which was carried out in two periods: before and after summer vacation (Table 5.1).

Period I centered on the implementation of the five components of Joyce and Showers: theory development, demonstrations by the coach, simulated practice, real classroom practice, and feedback from the coach. In Period I, all of the teachers gave lessons to one group of second-year students (age 13-14). A total of 135 students from 13 classes took part in Period I.

In Period II, the teachers applied the interactive instruction skills they had acquired in Period I to classes in the next school year. A total of 165 students from 16 classes took part in Period II. Three teachers taught two classes the other teachers taught one class. In both study periods, a group consisted of approximately 10 students. Two-thirds of the students were boys. The girls were proportionally spread across the classes.

Teacher training

Starting situation

Before the training started, the teachers filled out a short questionnaire on their teaching methods. Based on the answers, the teachers were grouped into two preliminary training groups: eight teachers appeared to have a preference for the individual approach and five teachers for the group approach.

Then, a first lesson was organized to establish the teachers starting situation. Teachers were asked to present the same woodworking assignment to all of their students and teach as they normally would (i.e. following their own teaching method). To prepare the lesson the teachers were given a card with the steps needed to perform the assignment. The observations of the lessons were used as the baseline measurement, of to what degree

Table 5.1

Training design and research activities

	Week	Activity	Components Joyce & Showers	Specifics
Period I - Training period		**Pretest**		Teacher selection (n=13) and division into groups.
	1	Baseline measurement by researchers		Observation of the teachers' current routines. Determine level of student independence. Post-discussion with instructions for the teachers on how to become aware of their own teaching methods. Cultivate willingness to do more interactive teaching.
	2	Professionalization by trainers	Theory development	Information: Theory of interactive instruction and sample lessons on video.
	3	Professionalization by trainers and teachers	Theory development Lesson demonstration	Seminars: Role play, composition of teacher practice and feedback: Role play with interactive teaching methods. Teachers help put together assignments and instruction cards. Discuss self-evaluation sheet. Receive video camera to record own lessons.
	4	Lesson 1 by teachers and coaches	Practice skills in the classroom; feedback and coaching from trainer-coach	Instructional coaching, self-evaluation and feedback: Teachers give 3 interactive group or individual guidance lessons. Lessons are recorded on video and evaluated by the teachers themselves using the checklist. Teachers get face-to-face coaching during the first lesson and remote feedback on the recorded lessons 2 and 3.
	5	Lesson 2 by teachers and coaches		
	6	Lesson 3 by teachers and coaches		
	7	**Posttest** Effect measurement of the training by researchers		Observation of the teachers' level of interactive instruction. Determine level of student independence.
		Summer vacation		
Period II - Research period	17	Lesson 1 Retention measurement 1	Application of skills in the classroom	Teachers are given assignments and instruction cards to give six lessons of interactive group or individual guidance to a new group of second-year students. The lessons are recorded. There is no further coaching. Researchers do three classroom observations in each class (retention-effect measurements)
	18	Lesson 2		
	19	Lesson 3 Retention measurement 2		
	20	Lesson 4		
	21	Lesson 5		
	22	Lesson 6 Retention measurement 3		

the teachers used interactive instruction in the “individual condition” and in the “group condition” (see Table 5.1). The lessons were video-recorded by the researchers.

The training

The teachers were already familiar with using an individual or a group approach in their lessons. To give them better insight into their own teaching method, the lessons were broken down into lesson stages and key aspects (Table 5.2). Five lesson stages with ten key aspects of interactive instruction were distinguished (see Scruggs & Mastropieri, 2003; Swanson & Deshler, 2003).

The first stage of the training consisted of explaining the theory of interactive instruction using video examples. The videos contained exemplary lessons to ID students that was recorded especially for the training. The sample lessons were delivered in individual and group settings and displayed the use of the ten key aspects of interactive instruction in Table 5.2.

In the training, the teachers observed the sample lessons and, after each one , filled in a checklist with questions about the lesson stages in Table 5.2: *1. Orientation:* description/discussion of the assignment, *2. Instruction*: the way it was explained and the presentation of (sub)assignments, *3. Guided Practice*: offering help, *4. Processing:* the extent to which students were able to work without help, *5. Closing/Review:* the use of the lesson closing and process evaluation.

When the teachers finished watching the videos, they practiced the lesson in the form of role play. The lesson was discussed with the teachers using the checklist with the 10 key aspects. They role played and discussed the lesson twice. In the second session, the teachers and the researchers worked out six assignments with blueprints and assignment cards. The cards showed the steps needed to carry out each assignment.

After the role play, each of the teachers' starting situations in their own classrooms was discussed with the trainers-coaches and peers and ideas on how they could improve instruction were put forward.

Table 5.2

Lesson stages and key aspects of the interactive instruction model in an individual or group condition

Lesson stages and key aspects	**Individual Guidance** (Every student works in his/her own time on a series of assignments)	**Group Instruction** (Students are given group instruction and work, at the same level, individually on the same assignment)
1. Orientation (1 key aspect)	1.1 Teacher gives a short description of the assignments and the assignment cards. Students work on their assignment from the previous lesson or choose a new assignment to work on. Prior knowledge is activated by asking about the corresponding assignment card.	1.1 Teacher discusses the basic and extra assignment with the students with help of examples and the assignment cards. They ask students questions (what are we going to make?; what do we need to make it?). Activate prior knowledge in the group using previous lessons and techniques.
2. Instruction (2 key aspects)	2.1 Teacher walks around and demonstrates individual students how the assignment is executed (using the assignment card, photo card and the end product). 2.2 Teacher determines whether the students have understood. Asks questions about the assignment card with photos.	2.1 Teacher demonstrates the assignment to the whole group (using the assignment card with photos and the end product). Teacher asks different students to explain the step that is shown. 2.2 Teacher asks different students to repeat the steps and explain them**.**
3. Guided practice (1 key aspect)	3.1 Students practice a subtask under the teacher's guidance and the teacher corrects using the assignment card.	3.1 Students practice a subtask individually. The teacher monitors the students' work. Teacher discusses the subtask by asking questions to the students and discusses the extra assignment with the stronger students.
4. Processing (4 key aspects)	4.1 The students are at work individually and the teacher answers questions by referring to the assignment card. 4.2 Teacher walks around the room and gives feedback by indicating what students are doing well and correcting what they are not doing well. 4.3 Teacher differentiates by giving more attention to weaker students and referring to the assignment card; pointing out more efficient techniques. 4.4 Teacher differentiates by helping stronger students prepare for the next assignment.	4.1 The students are at work individually and the teacher answers questions by referring to the assignment card. 4.2 Teacher walks around the classroom and asks questions about the assignment cards: "where are you and what do you still have to do?" 4.3 Teacher differentiates by giving more attention to weaker students and referring to the assignment card; by pointing out more efficient techniques. 4.4 Teacher gives the small group of stronger students extra instruction (if necessary) for a subtask (step) of the extra assignment.
5. Closing/review (2 key aspects)	5.1 Teacher reviews the work process and evaluates what went well and what didn't with each student. 5.2 Teacher evaluates the end product individually with the students.	5.1 Teacher reviews the work process and evaluates what went well and what didn't with the whole group. Which steps were hard and which were easy? Teacher lets the students explain. 5.2 Teacher evaluates the end products in the group.

In the *individual condition* the Pretest showed that most of the teachers used direct instruction in the Orientation and Instruction stages. But, they paid little attention to interaction with the students. The teachers decided to change their teaching routine and instead explain and demonstrate the assignment to the students in pairs. This would increase efficiency in instruction. For further improvement, the researchers suggested that the teachers would give the students a sub assignment to perform after the Instruction stage. This would enable the teachers to determine whether each student understood the sub assignment and had the ability to perform it. The teachers were advised to help students find the strategy to execute an assignment, by referring to the assignment cards and prototypes of the assignments. They should not do the students' sub assignments for them.

The teachers were also given advice on how to evaluate the assignments the students finished and the way students worked at the assignments. The researchers indicated that an evaluation is more effective if it focuses on the steps on the assignment card and the process itself.

In the *group condition*, most of the teachers used direct instruction in the Orientation and Instruction stages. They were advised to guide students through the steps and make the instruction more interactive by asking questions such as: “What should the next step be?”, “Which materials do you need?”, “Which tools should you use?” In order to determine whether students understood the instruction, teachers decided to let the students demonstrate sub assignments and think about the sequence of the steps. During their training, teachers learned how to correct students by letting them explain the steps on the assignment card rather than by demonstrating or performing the steps for them, and to only help students when they asked for help, and thus to give as little unsolicited instruction as possible.

At the end of the training sessions, all of the teachers were given a video camera and instructions on how to record their own lessons.

Coaching and implementation of interactive lessons in Period I (week 1 to 7)

In the *individual condition,* the teachers let each of the students chose an assignment from the selection of assignments the teachers had designed together with the researchers (see Table 5.1). The teachers let the students start working on a next assignment as soon as they finished the one they were working on and it had been evaluated by the teacher.
In the *group condition* students used the same assignments as in the individual condition. But, the teachers chose the assignment, gave instruction and the students finished one assignment per lesson. In order to differentiate, next to the basic assignment a more elaborate "extra" assignment was added to the assignment card. For example, if the basic assignment consisted of making a wooden box, the extra assignment consisted of making a lid for it.

In both conditions, the three lessons in Period I were recorded on video and analyzed. The first lesson was always attended by a researcher. The observations, made during the first lesson, showed that a small number of teachers in both conditions did not correctly perform some of the steps in the interactive instruction model in Table 5.2. They demonstrated the sub assignments instead of asking the students how to do it. Their instruction was not question-driven and students worked at the assignments without first verbalizing or practicing. The teachers were again convinced that to demonstrate or perform sub assignments for the students did not enhance the students skills. Interactive instruction requires that the teacher lets the students ask questions and find the answers and correct their errors themselves.

In the second and third lessons that were recorded by the teachers themselves, the teachers improved in interactive teaching. They appeared to apply the Orientation and Instruction stages almost entirely according to the interactive instruction model. During these lessons, teachers were better at letting the students perform the sub assignments with their guidance.

The teachers sent their videos and completed self-evaluation sheets to the researchers and received feedback on the recorded lessons. In Period I, a total of 13 x 4 lessons (Pretest and three normal lessons) were recorded on video and evaluated.

The first effect measurement at the end of Period I (Post1) was done on the students and teachers in week 7 of this experiment, before the summer vacation. Every teacher used the same assignment, which was given to them by the researchers. The researchers observed the lesson in the classroom.

Further implementation of the lesson in the classroom in Period II

Ten weeks after the end of Period I, the 13 teachers gave a lesson series of 6 assignments to 16 new groups of second-year students using the interactive instruction model (see Table 5.2). The six assignments with instruction cards and photos for the students were provided by the researchers. Of the six lessons that a teacher gave two or three were used to measure the teacher's retention of the use of interactive instruction. In Period II, teachers received no more coaching and feedback with the exception of a few comments on the first lesson.

The teachers recorded 45 lessons of their 96 lessons on video. The researchers watched the videos and coded them using an observation form.

Observational Instrument and Interobserver reliability

An observation form was used based on an instrument from previous research (see Chapter 2). A lesson of 100-minute lesson was divided into observation blocks of five minutes. The teacher was observed in the first four minutes of each of the five-minute blocks. The students' activity was monitored in every fifth minute (see Table 2.2).

Both researchers observed three lessons in Period I and three lessons in Period II. The observation data of the two researchers from these lesson were compared to test interobserver reliability of:

a. The use of the interactive instruction model by the teacher,
b. The students' independency during the processing stage of the lesson in three aspects: teacher's answers to students' questions, teacher's unsolicited help and students' inactivity.

Use of interactive instruction

Both researchers observed *the use of interactive instruction model of Table 5.2* during the lesson in either individual guidance or group instruction. The extent to which teachers in the individual condition or group condition applied the five lesson stages and the corresponding ten key aspects were measured. A maximum of two points could be scored for each aspect: 0 (not applied), 1 (partially applied) or 2 (applied according to plan). The scores of the researchers of the six lessons they observed were compared through calculation of Cohens' Kappa. We found a high agreement of $K = 0.88$.

Student independence

In order to determine *student independence* during the processing stage of a lesson three indicators were used (see Chapter 2): a) the mean number of inactive students, b) the number of questions the teachers answered and c) the number of times the teachers gave help. The reasoning behind this is that the fewer inactive time of students, the fewer questions the teachers had to answer and the less help they had to give, the more independently the students would work.

The total number of students that were inactive during processing, the total number of questions teachers answered and the total of times the teachers gave help was divided by the number of observation blocks in the processing stage (every five minutes of observation). This is how the average number of inactive students, questions asked and help given was determined. The agreement between the two researchers on these three aspects of students' independence was good. The scores of the researchers for the mean number of inactive students in each of the six lessons was very high; the correlation was $r = 0.99$. The agreement between the researchers in mean number of questions answered by the teachers during processing in each of the six lessons was also high: $r = 0.97$. As was the agreement in scores of the researchers for the mean number of unsolicited help given by the teachers: $r = 0.90$.

We reported data about the percentage of inactive students during the processing stage. The percentage was calculated by dividing the mean number of inactive students through the total number of students in a class.

Data analysis

The sample in this research was relatively small. Although this does not mean that meaningful conclusions cannot be drawn from the outcome, we believe that it would be irresponsible to use measurements such as significance tests and reliability intervals. The number of participants was also relatively low. To answer *research question 1*, whether training and coaching of teachers would lead to more interactive instruction in the short and longer run, descriptive statistics were used for the ten aspects of the interactive instruction model. To answer *research question 2*, whether more interactive instruction increases students' ability to work independently, descriptive statistics were also used to determine the degree of student independence during the processing stage: average percentage of time that a student was paying attention to the assignment, average number of questions that a teacher had to answer and the average number of times a teacher gave help.

Based on these descriptive data, only preliminary conclusions can be drawn on the effects of teacher training.

5.5 Results

Baseline measurement (Pretest) for the teachers in Period I

Using a checklist, the extent to which teachers in the individual or group condition applied the five lesson stages and the corresponding ten key aspects (Table 5.2) was measured in the baseline measurement (Pretest).

Table 5.3 shows that in the Pretest on a scale of 0 to 2, the aspects “Orientation” (Key aspect 1.1) with average scores of 0.88 and 0.40 respectively and “Guided practice” (Key aspect 3.1) with average scores of 0.38 and 0.20, were hardly applied by the teachers. They did not really check whether the students had understood the instruction (“Checking understanding” – Key aspect 2.2) and scored 0.38 and 0.60 respectively. The aspect that was applied the most was “Presentation” (Key aspect 2.1) of how the assignment was made, the average pretest scores were 1.13 and 0.80. In the Processing Stage, teachers spent most of their time helping students. In the individual guidance condition, help consisted mainly

of instruction and correction and mainly of questioning in the group condition. When differentiating, teachers seemed to spend more time on weak students (0.88 and 1.20) than on strong students (0.25 and 0.40).

Verbalizing the actions on the assignment card (Key aspect 2.2) was hardly applied in both groups. Teachers also gave insufficient attention to the discussion of the assignment in the Review-Closing Stage (Key aspect 5.2), especially in the guidance group (0.50). Finally, the teachers in both groups spent very little time on evaluation (0.63 and 0.40 respectively).

As expected, the Pretest indicated that teachers hardly used the model of interactive instruction: teachers in both the individual and group condition scored an average of 0.66 of the maximum 2.00 points.

Effect measurement (Post1) for teachers in Period I

Table 5.3 shows that the teachers in both conditions strongly improved on application of the 10 aspects of interactive instruction. On a scale of a maximum of 2.00 points, teachers in the individual condition scored on average 1.43 points per aspect (an increase of 0.77) and in the group condition on average 1.48 points (an increase of 0.80). This is more than a doubling in both conditions.

There were differences in development between the groups of teachers. With the exception of the already mentioned application of Guided practice, there was also a difference in the extent to which teachers differentiated for weak students. This was greater in the individual condition than in the group condition (2.00 versus 1.60). The key aspects of the closing stage (review of processes and evaluation of products) seemed to have a more prominent role and function than in the individual condition.

There are very large effects for the use of the interactive instruction model. For coaching in individual guidance Cohen's *d* is 3.85 and 3.72 for coaching in group instruction.

Table 5.3

Teacher development before (Pretest) and after (Posttest) the training in period 1

	Teaching stage and aspect	**Teachers** (*n*=13)					
		Individual Guidance (*n* = 8)			**Group Instruction** (*n*= 5)		
		Pretest	Posttest		Pretest	Posttest	
		M (*SD*)	M (*SD*)	Differ. score	M (*SD*)	M (*SD*)	Differ. score
1	1.1 Orientation	0.88 (0.83)	1.88 (0.35)	1.00	0.40 (0.55)	1.60 (0.55)	1.20
2	2. Instruction						
	2.1 Presentation	1.13 (0.64)	1.75 (0.46)	0.62	0.80 (0.45)	2.00 (0.00)	1.20
	2.2 Checking understanding	0.38 (0.52)	1.38 (0.52)	1.00	0.60 (0.55)	1.40 (0.55)	0.80
3	3.1 Guided practice	0.38 (0.74)	1.25 (1.04)	0.87	0.20 (0.45)	0.60 (0.89)	0.40
4	4. Processing						
	4.1 Respond to requests for help	0.63 (0.74)	1.75 (0.46)	1.12	1.00 (0.71)	1.60 (0.55)	0.60
	4.2 Feedback and extra instruction	1.00 (0.00)	1.25 (0.46)	0.25	0.60 (0.55)	1.40 (0.55)	0.80
	4.3 Differentiation weak students	0.88 (0.64)	2.00 (0.00)	1.12	1.20 (0.45)	1.60 (0.55)	0.40
	4.4 Differentiation strong students	0.25 (0.46)	0.50 (0.93)	0.25	0.40 (0.89)	0.80 (1.09)	0.40
5	5. Closing/Review						
	5.1 Review of process	0.50 (0.53)	1.38 (0.52)	0.88	1.00 (0.00)	1.80 (0.45)	0.80
	5.2 Evaluation of product	0.63 (0.74)	1.13 (0.83)	0.50	0.40 (0.55)	1.40 (0.89)	1.00
	Average total score	**0.66 (0.17)**	**1.43 (0.23)**	**0.77**	**0.68 (0.22)**	**1.48 (0.21)**	**0.80**

Delayed posttests for the teachers in Period II

After using interactive instruction before summer vacation the teachers applied their skills in teaching again after the summer vacation with new classes of students. There were three classroom observations during this period with the same checklist as in period I. The (delayed) observations measured the teachers' use of interactive instruction. Again, the scores could range from 0 to 2. In Figure 5.1 Pre is the pretest and Post1 is the posttest of Period I. The first delayed measurement (Post 2) seemed to indicate that the training had a lasting effect if one compares Post1 mean scores to the depicted Post2 mean scores.

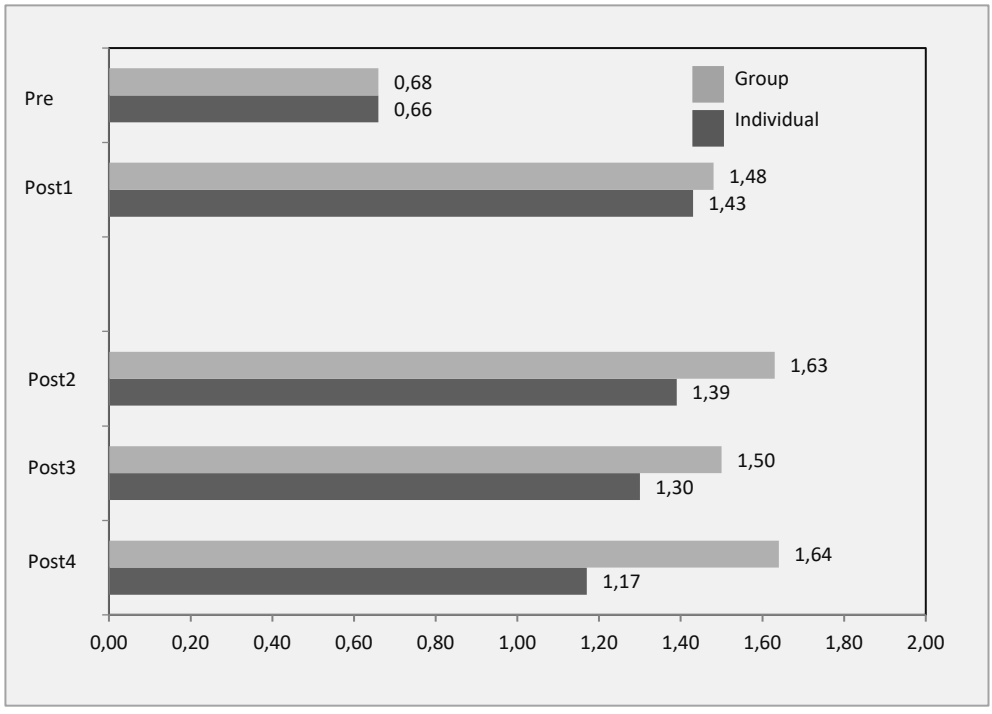

Figure 5.1. *Use of interactive instruction in Period I compared to Period II*

In the individual condition the execution of the instruction model used during the first delayed measurement (Post2) produced a score of 1.39, that is almost the same as in the posttest (Post 1) in Period I. But, in the delayed Post3 and Post4, when teachers had done most of the six lessons, the measurement showed a declining trend, overall (to 1.17). Although teachers had taught more lessons in Period II, their application of the 10 aspects

of interactive teaching had declined somewhat compared to Post1 in Period I (from 1.43 to 1.17). But, teachers in the individual condition still used more of the interactive instruction aspects at the end of Period II (Post4) than at the pretest (1.17 versus 0.66).

In the *group condition* there was continuous development (from 0.68 in the pretest to 1.64 in Post4). The teachers made sure students had a good understanding of what they were supposed to do before letting them work on their own. This created more time during the processing stage for individual guidance for both weak and strong students.

Students' independence during the processing stage

We report on three indicators of students' independence: a) the percentage of inactive students, b) the average number of questions the teachers answered and c) the average number of times the teachers gave help.

Active involvement during processing

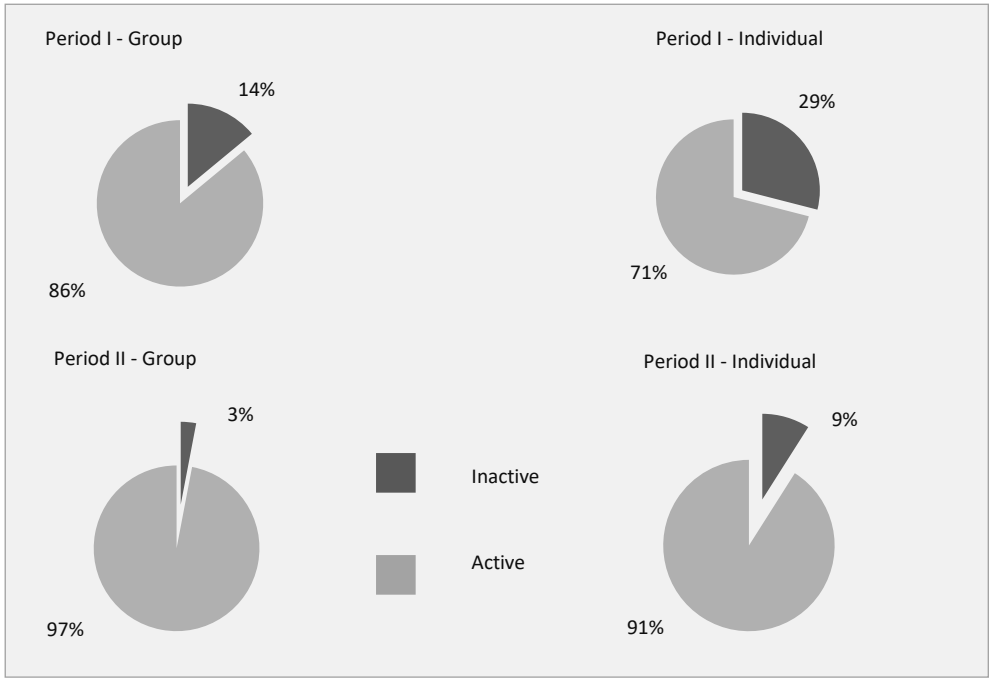

Figure 5.2. Average percentages of students that are active and inactive in Period I and Period II

To measure how actively students participated in the lessons, data from 13 groups (8 individual guidance and 5 group instruction) in both periods before and after the summer vacation were used. We show the percentages of inactive students during Period I and during Period II.

Figure 5.2 shows that in the group condition in the lessons during period I, 14% of the students were not actively involved in their assignment. In the individual condition this was 29%. During period II students' inactivity was 3% in the group condition and 9% inactivity in the individual condition. So, it seems that students in the group condition spent their time more actively, both in period I and period II.

The average number of questions the teachers answered during the processing stage

The average number of student questions the teachers answered in an observation block, broken down by condition and period, is shown in Figure 5.3.

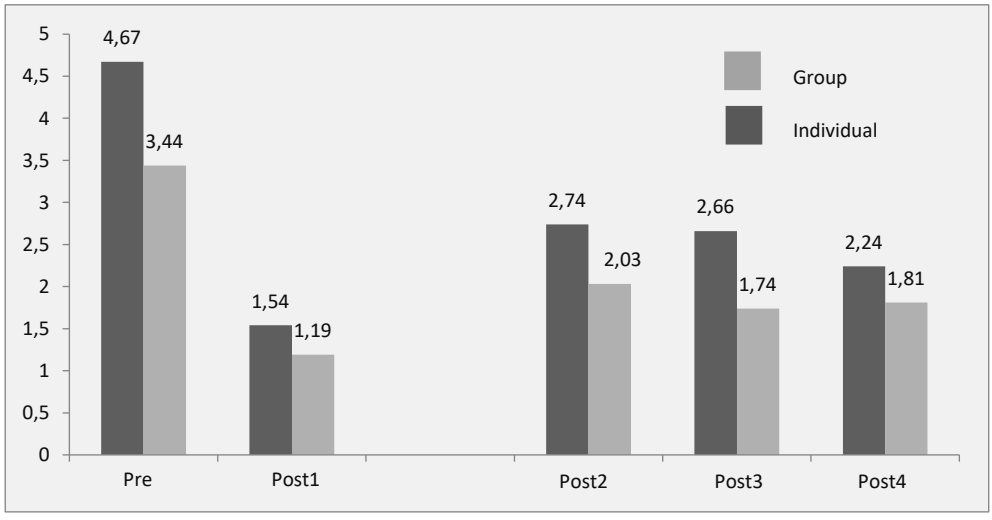

Figure 5.3. Mean number of student questions that teachers answered during the processing stage across both groups

In Period I, teachers in both conditions had to answer fewer questions from their students. In the individual condition teachers answered on average 4.67 questions in an observation block of 4 minutes during the baseline measurement (Pretest) and only 1.54

questions during the first effect measurement (Post1). For group instruction, the average number of questions answered by the teacher decreased from 3.44 to 1.19.

Figure 5.3 also shows that the questions answered in Period II (Post2, Post3, Post4). At the beginning of the new school year, we expected new students to ask more questions. Indeed, the new students in period II (Post2, Post3, Post4) still had more questions during the processing stage than the more experienced students in Period I (Post1).
Overall in Period I and II, students in the group condition asked fewer questions compared to students in the individual condition.

Teachers' help during the processing stage

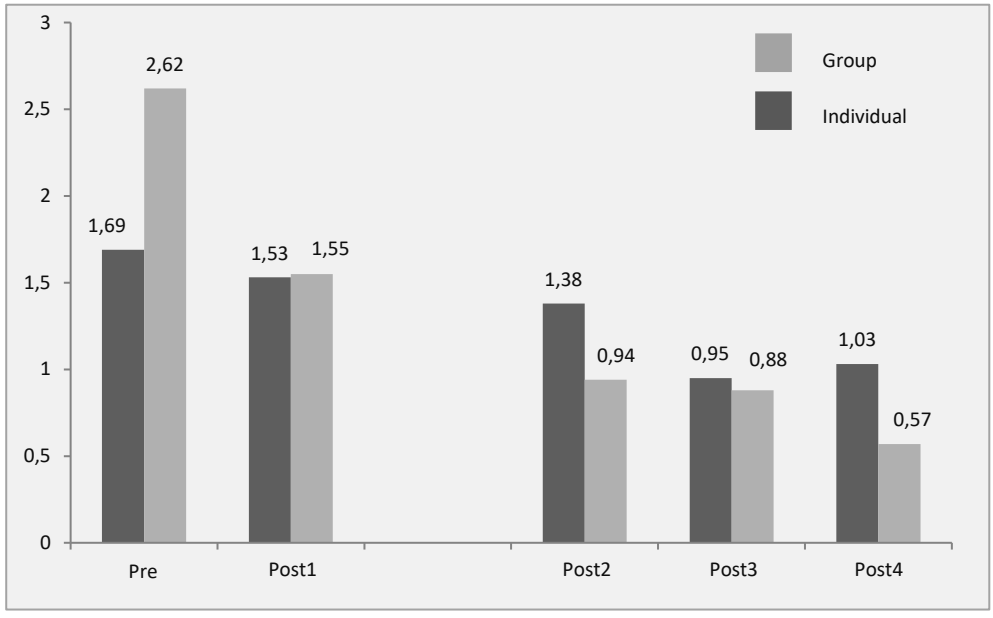

Figure 5.4. Mean number of times the teacher gave students help during the processing stage across both groups

Figure 5.4 shows the help the teachers gave students during the processing stage of their lessons in Period 1 (from Pretest to Post1) and in Period II (from Post2 to Post3 and Post4).

Figure 5.4 indicates that in Period I, as intended, the teachers gave less help during the processing stage. In the individual condition, during the baseline measurement (Pretest), teachers gave on average 1.69 times help in an observation block of 4 minutes

and 1.53 times during the post test. For group instruction, the average times help was given decreased from 2.62 to 1.55.

In Period II the amount of help given by the teachers in the new classes was lower than in the more experienced classes before the training (see Pretest). This is an indication that the new students understood the instruction better and needed less technical or content related help while executing the assignments.

In conclusion, throughout the lesson series we observed in the processing stage: a decrease in the average number of questions the teacher had to answer and in number of times students had to be helped. This outcome seems to indicate that the application of interactive instruction throughout the lesson series was fruitful. As expected, student independence increased as they needed less support from their teacher.

5.6 Conclusions and discussion

The question we asked in this study was whether training and coaching of teachers of ID students would result in sustained use of interactive instruction in the classroom. And also if interactive instruction would enable their students to work more independently.

At the time of the baseline measurement (Pretest), on average, the teachers applied one-third of the ten aspects that effective interactive instruction must meet. After the baseline measurement, teachers were trained and coached in interactive instruction. During their training, teachers were shown videos of interactive instruction. They gave each other short lessons on the application of the examples they were shown, discussed how to plan interactive instruction in their own classrooms and how they could use the assignments they prepared during the training. After the training, the teachers taught nine lessons spread over two periods. Three lessons were given to second-year students before the summer vacation. The teachers received “face-to-face” coaching for one lesson and remote coaching for two lessons by submitting the video recordings of their lessons and receiving feedback on their self-evaluation of the lessons. After the summer vacation, six more lessons using assignments developed in the training were given to different classes of second-year students.

After the first series of three lessons, all of the teachers were better at applying the ten key aspects of interactive instruction. The scores doubled for the application of the ten aspects. This seemed to show that a short but intensive period of training and coaching can result in substantial positive changes in instructional behavior.

After the summer vacation, the teachers' instructional behavior in the new series of lessons given to second-year students showed a high level of retention. The scores for the teachers in the group condition seemed to be higher and more consistent as the lesson series progressed than for the scores of the teachers in the individual condition, but all of the teachers continued to teach interactively up till the last lesson.

The study also examined the independence with which students performed assignments. There are positive indications, the students participated more actively, the number of questions the teachers answered during the processing stage and the amount of help to students was substantially lower before the training and coaching than direct after one month (period I) or after five months (period II).

But, it remains to be seen whether a positive conclusion can be drawn. The positive effects could also be the result of the students' spontaneous development and the influence of more motivated teachers because of the intervention. However, there are reasons to assume that het changes in teacher and student behavior were initiated by the intervention. At the beginning of the new school year, it quickly became apparent that younger students in both conditions, after interactive instruction, asked less questions than the "old," experienced group before the summer vacation. We have reason to assume that interactive instruction had this effect on the students' participation and independence. Our observations support the argument that interactive instruction gives students opportunities to explain to other persons the steps to make an assignment. This would increases the students´ insight into the teachers instruction of the assignment and thereby the students´ independence in executing it. Research by Chung and Tam (2005), Montague and Dietz (2009) and Swanson (2001) with young students in special education supports this hypothesis.

The positive results in changing teacher behavior were in support of Joyce and Showers' (2002) training model and the instructional coaching principles of Knight and

Cornett (2009). Knight and Cornett's principles of “dialogue,” “equality” and “reciprocity” as fundamental parts of the training may have contributed to the great change in teachers behavior we observed. In this study, feedback on the execution of the innovation in the lesson was based on video recordings of the classes: first, the current teaching method and later the teaching method used during the innovation. The coach discussed the feedback with the individual teachers as equal partners and again in the group of teachers. Thoughts were exchanged on how the practical application of the innovation could be improved and decisions were made by the teachers. However, from our research one cannot conclude that the teaching skills based training and coaching on teachers had a positive effect on teachers. The research is only descriptive in nature. But, there is also little research from other sources to support our observations. There is a general lack of empirical evidence on the effect of training and coaching on teachers´ change in instructional behavior. Little experimental research has been done, and the available studies are not clear which training approaches were implemented (Fletcher and Mullen, 2012). The research designs of the studies also leave a lot to be desired as regards the control of disturbing factors in the implementation of the innovations at the classroom level (Desimone et al., 2009; ; Sailors and Price, 2010).

5.7 Recommendations

As the results of our training are positive for teachers changing towards more interactive instruction and higher student independence, this study is cause for follow-up research.

This research should have a bigger sample of teachers and a comparative design with a training group and a control group for both the individual and group conditions. The teachers and the classes can be randomly assigned to a training in their instruction condition (group or individual). Such a comparative study can be undertaken to examine the possible effects that training and coaching of teachers has. We recommend not only studying the effect that teacher training has on the teacher's ability to instruct interactively and the students' ability to work independently, but to also examine the effect interactive instruction has on the quality of the assignments students make. The students can be

submitted to independent assignment construction tests before and after the training. This would enable the researchers to estimate the indirect effects that the interactive instruction training and coaching of teachers might have on the quality of the assignments the students make. Little research has been done in this area (e.g. Chung and Tam, 2005; Montague and Dietz, 2009; Swanson, 2001), but we expect that when teachers become skilled in letting ID students explain the processing of tasks to another person their students´ independent performance will increase.

Independent processing

Chapter 6

General conclusions and recommendations

6.1 Introduction

The goal of educating intellectually disabled (ID) students in the Netherlands and other western countries is to teach them how to live an independent life and get basic job training so they can find employment in minimum wage jobs (Blik, Harskamp & Kuiper, 2012; Tideman, 2015; Kirjavainen, Pulkkinen & Jahnukainen, 2016; Wagner, Newman, & Javitz, 2016).

One would expect education for ID students to focus on teaching them to perform assignments independently. But, this isn't always the case. ID students get a lot of individual guidance and sometimes group instruction. In both cases they watch and listen to the demonstration of an assignment (Blik & Harskamp, 2005; McLeskey & Billingsley, 2008; Alghazo, 2005). But, students often don't understand the instructions well enough to start working on their own. The result is that teachers spend much time helping individual students and they often depend on their teacher's help for a long time (Giangreco, Yuan, McKenzie, Cameron & Fialka, 2005).

Involving students more actively in the instruction process rather than just letting them watch passively could reduce their dependence on the teacher. Interactive instruction, whereby a new assignment is discussed with students, for example, by means of questions and answers (Chi, 2009), is a good way of doing this. Interactive instruction during the training of language and mathematics seems to improve the skills of elementary school students more than just demonstrating an assignment does (Hughes, et al, 2002; Montage & Dietz, 2009). It's not clear whether interactive instruction will improve the technical skills of ID students in secondary education who train for a job.

In this dissertation, the main question was therefore:

> *Can interactive instruction help ID students perform their assignments more independently and can teachers learn to teach more interactively?*

The question was answered in four steps:

- Step 1: *Status of affair* into how Dutch teachers instruct ID students. The research question we studied was: Which variations in instruction do teachers apply and will there be a relationship between the variations and the students' ability to perform assignments independently?
- Step 2: *Experimental study into possible improvements to group instruction.* We examined the question whether strategy instruction (highly interactive) enabled students to perform assignments more independently than direct instruction (moderately interactive).
- Step 3: *Experimental study into possible improvements to individual guidance.* We investigated the question whether interactive video instruction that was given to individual students helped them perform assignments more independently than passive video instruction.
- Step 4: *Study on the effect of training teachers in interactive instruction*. We examined the question whether teachers could be trained—in a group setting or an individual setting—to teach more interactively and to what extent the changes in their teaching behavior affected the students' independence in performing assignments.

6.2 Conclusions and discussion

Step 1: Status of teaching ID students

In Chapter 2, as regards the variations in instruction, the status of research revealed that about 58% of the teachers gave individual guidance in their technical lessons. The other 42% gave mainly group instruction. The students that were given group instruction were able to successfully complete their assignment more often (Cohen's d = -1.17) than the students that were given individual guidance.

The relationship between the variations in instruction and students' independence at work was evident. In the condition with group instruction, a positive correlation was observed between the use of the direct instruction model and the students' independence: the more lesson phases of the instruction model were applied correctly, the more independently the students were in working at their assignment. The correlation between

the phases of direct instruction and the students' independence was not present for classes in which the teacher mainly gave individual guidance. The direct instruction model was used less (especially less verbal interaction with the teacher) in individual guidance classes than in group instruction classes. The difference in verbal interaction was probably why students in classes with group instruction were more able to perform an assignment than students in classes with individual guidance. See also Chi, 2009, who concluded that students who were actively involved in the instruction of complex assignments perform better.

We need to state that no experiment was conducted in this study, it was ex post facto research. The fact that we found a substantial correlation doesn't mean that there was a causal relationship between the form of instruction (group instruction versus individual guidance) and the students' ability to perform an assignment independently. It is also possible that teachers who knew that their students could work more independently gave more group instruction and involved the students more actively in the lesson, but were more inclined to guide students individually when they were working with a less independent group (see also Wentzel, 2003; Opdenakker & van Damme, 2007).

But, for the time being, the conclusion we are drawing, is that teachers who gave group instruction interacted more with their students and, by doing so, probably helped them work more independently. The decision to give group instruction or individual guidance seemed to be based primarily on the teachers' idea of good education for ID students (Blockhuis & Berlet, 2006).

Step 2: Improving group instruction: strategy instruction versus direct instruction

In Chapter 3, the effect of a very interactive method for group instruction, 'strategy instruction' (SI), was compared with a less interactive instruction method, 'direct instruction' (DI). Our hypothesis was that discussing the assignment strategy more intensively with SI students enables them to better understand the task at hand and therefore perform the assignment more independently. The results showed that the students in SI conditions were in fact able to explain the steps better (Cohen's d = 0.45), were more actively involved in their assignments and worked well on their own (Cohen's d = 1.67). The research supports the hypothesis that SI as a proponent of highly interactive

instruction can improve ID students' understanding and performance of practical assignments more than DI, which is less interactive. Our research outcomes are in line with previous research on the effects of SI in academic subjects for students with learning difficulties (Montague, 1992; Larkin & Ellis, 2004; Boulware-Gooden, Carreker, Thornhill & Joshi, 2007).

A limitation of our study is that it has not been conducted in a normal classroom setting, but that a researcher was present to ensure the SI or DI method was used correctly. Moreover, only two teachers who used each of the instruction methods took part in the study. The teachers were trained beforehand to instruct in the two methods and were closely followed by a researcher during their lessons. Therefore, the study was not about the use of SI and DI by a random sample of teachers in their normal classroom setting. The study shows the potential effect that can be achieved with each of these instruction methods in favorable classroom conditions.

Step 3: Interactive video instruction as a tool in individual guidance

Many teachers are convinced that individual guidance is important for ID students. Chapter 4 shows that video instruction can be used to help students understand practical assignments better. The assumption was that a student would watch an instructional video more closely if he had to explain it afterwards than if he just had to watch it. In a preliminary study, we observed that ID students benefited from explaining a video to another person when the assignment was complex (at least 5 steps and subactivities in some steps) but not when the assignment was easy. Our assumption was that students would pay extra attention to the video when they had to explain it and that verbalizing the steps to make an assignment would result in better understanding and therefore better performance.

Indeed, the results show that ID students retain the steps in a video better by explaining them to another person than just by watching the video twice (Cohen's $d = 0.82$). The students who explained completed their assignments better (Cohen's $d = 0.97$) and they were also able to estimate better how well they completed the assignment (Cohen's $d = 0.46$). The study seems to support the results of previous studies in higher and secondary

education on the effect of explaining video instruction (Hoogerheide et al, 2016; Fiorella & Mayer, 2014).

This study, however, has a limitation: It was conducted in a controlled situation in which students followed a strict procedure under the guidance of a researcher/teacher. This is an unusual setting in education. Additional studies need to be conducted in a normal classroom setting to determine whether the regular use of video instruction in a classroom setting is feasible and whether this type of instruction is more effective if students explain the contents to another person. It might be possible to embed the explanation in a computer program so that students can use video instruction on their own (see Hoogerheide, Loyens, & Van Gog, 2012).

The current study mainly indicates that explaining to another person can benefit ID students' understanding of a video instruction and improve the execution of an assignment for which the instruction was given.

Step 4: The training and coaching of teachers in interactive instruction

In the study in Chapter 5, teachers followed a training with coaching on the use of interactive instruction. The teachers were asked to choose between group instruction and individual guidance. The use of interactive training was taught in both settings (conditions).

The results of the first sub-study reveal that the teachers' teaching behavior underwent positive changes after a short but intense period of training and coaching (in the Individual guidance condition the effect was: Cohen's d = 3.85 and in the Group condition: Cohen's d = 3.72). Overall, teachers gave more interactive instruction and during individual processing the teachers had to answer less questions from the students. The teachers gave less direct help to the students.

In the second sub-study with new groups of students, the teachers and students in the individual condition seemed to make substantial progress. The teachers had to answer fewer student questions during the processing phase and the teachers in the group condition gave less direct help than at the beginning of the study.

A limitation of this study is that in the individual condition differentiation of assignments was more limited compared with normal practice. Students weren't given

different assignments to choose from but did the assignments in a fixed sequence. This made individual guidance easier to control for the teacher than in their regular lessons. The positive changes for the teachers in the individual condition we found may be more difficult to achieve in usual practice.

Not with standing this limitation, the present study reveals that the intervention - consisting of both training in knowledge and skills, and coaching in the classroom with feedback for the teachers - can change the teachers' instructional behavior. Our conclusion matches that from studies conducted by Shulman & Shulman (2004) and Joyce & Showers (2002). These studies also emphasize the importance of coaching in the classroom and entering into a partnership with the teachers (see also Knight, 2007).

6.3 Recommendations for further research

Improvement of instruction in a group setting: the effects of different degrees of interactive instruction

The study in Chapter 3 assumes that the effect of SI was chiefly due to the question-answer teaching approach and the interactive creation of a step-by-step plan. During instruction, the students suggested how an assignment could be performed and the teacher amended their proposals. In this way, SI enables students more than DI to understand a practical assignment and remember the steps they're going to perform (see also Swanson, 1999; Graham & Bellert, 2004; Alexander, 2006; Bosson, Hessels, Hessels-Schlatter, Berger, Kipfer& Büchel, 2010). We recommend further research to test this assumption. First, it is recommended to measure students' understanding of an assignment after SI or DI by asking them immediately after instruction to put (pictures of) the steps in the correct sequence.

Next, students should execute the assignment and self-assess how much of the assignment they completed successfully. The ordering of the steps and the self-assessment will be indicators of how well the students understood the assignment. After a series of assignments, it can be investigated whether students in an SI condition develop a better understanding of assignments than students in a DI condition (Reid & Lienemann, 2006; Rosenzweig, Krawec & Montague, 2011). If SI is found to improve the development of

students' (metacognitive) understanding of assignments more than DI, the hypothesis that higher interaction during instruction results in better understanding will be supported.

In testing the effect of SI versus DI it would be interesting to see whether boys perform differently in SI during typical boy subjects and whether SI is also effective for them in more traditional girl subjects, such as cooking and housekeeping. SI could be especially effective for subjects that are gender specific (see Montague & Dietz, 2009, Martin & Dinella, 2012 for gender differences in curriculum domains).

Improving the instruction in an individual setting: video instruction for ID students with explanation to a virtual other person

The study in Chapter 4 indicates that explanation to another person after watching an instruction video as opposed to only watching the instruction video seems to improve students' understanding of an assignment, their task achievement, and their self-assessment.

The first recommendation is to generalize our findings to other domains than spatial assignments (napkin folding). It is important to test the effect of explaining video instruction in other domains relevant to the education of ID students such as cleaning, cooking, technical training, and the maintenance of public green spaces. These domains often have practical assignments with a fixed sequence of steps and subactivities. In other words, the assignments for ID students can be complex and explaining the instruction to others could be effective.

The second recommendation is to broaden the scope of the theory. In this research, we examined the effect of explaining to another person mainly as a cognitive process. However, students' motivation to relate to other people may play an important role in triggering the process (Hoogerheide et al, 2016). In our research, we asked students to explain to a researcher. But will the students also be prepared to explain to other people with less status?

In a follow-up study, three versions of a computer program could be used to test the difference in effect between explaining instruction to a virtual person (a virtual teacher with less 'social presence') and explaining instruction to a person that is actually present (a live

teacher with more 'social presence'). In the third version of the program, students could be asked to explain the steps in an instructional video to themselves (no social presence but self-explanation, which may be the most effective according to Wylie and Chi, 2014). In all three versions students respond orally and record their explanations on video. Such a study is not only interesting in terms of the theoretical question whether self-explaining is less effective for ID students than explaining to another person (Fiorella & Mayer, 2013), but also how the status of the other person affects the students' motivation to learn from video instruction before explaining it (see Fiorella & Mayer, 2014).

Testing the effect of instructional coaching of teachers on students´ achievement

The study in Chapter 5 indicates that training and coaching in which teachers played an active role and gave feedback to their peers considerably changed the teachers' interactive instruction behavior. The results suggested that students benefited from it and worked more independently.

We recommend conducting follow-up research with a larger sample of teachers and a comparative design with a training group and a control group. The teachers and the classes can be randomly assigned to a training condition (group or individual) and a control condition (group or individual). We advise not only studying the effect that teacher training has on the teacher's ability to instruct interactively and the students' ability to work independently, but also to examine the effect interactive instruction may have on the quality of the assignments students perform. To achieve this, the students could be submitted to independent test assignments before and after the training. This would enable researchers to estimate the effects that changing teachers' interactive instruction behavior has on their students' performance in posttest assignments. Little research has been done on training teachers for effective instruction to ID students in secondary education. Only a limited number of studies have been conducted on special education at the elementary level (e.g., Chung and Tam, 2005; Montague and Dietz, 2009; Swanson, 2001).

Based on our research, we expect that training and coaching teachers in interactive instruction will lead to an increase in interactive instruction and an improvement in ID

students' ability to work independently on assignments as well as an improvement in the quality of the assignments they complete.

6.4 Recommendations for educational practice

Improve the organization of lessons

The Dutch Inspectorate of Education recommends personalizing practical education as much as possible starting with individual development plans (see Dutch Inspectorate of Education, 2015). In our opinion, personalizing education for ID students does not mean that students will be getting individualized instruction. On the contrary, students with the same education profile can be placed in groups where they get group instruction with shared assignments that are differentiated by level of complexity (see also Tomlinson, 2001, on differentiated instruction for ID students). This prevents the instruction from becoming fragmented into individual educational pathways.

The studies in this dissertation show that interactive instruction can help increase ID students' ability to perform tasks independently. For practical reasons, we recommend giving interactive instruction in a group setting rather than an individual setting. Because in individual guidance in everyday practice there is more diversity in assignments that students work on, there is less insight into the students' activities and less time for instruction per student than in group instruction. But, changing from letting students choose their assignment to giving them a mandatory assignment can perhaps improve the organization of individual guidance (see Discussion in Chapter 5).

Using video as extra help for students

Video instruction could potentially help improve the quality of instruction to ID students. Video instruction will be effective especially if students have to explain the instruction before performing the assignment, for example, by recording their explanation on a computer and getting feedback. Explaining the steps in the video instruction will probably improve the students' understanding of the instructions and also their performance of the assignment.

But the effect of interactive video instruction has not been studied in a classroom setting. We don't know yet which type of explanation is the most effective (see the research proposal in the previous section) and which feedback the teacher has to give to motivate students to continue watching and explaining the videos. For the time being, we recommend to let students work in dyads (see Fuchs, Fuchs, Mathes & Martinez, 2002): in turn, one student can explain the steps in the video instruction that was just shown and the other student will monitor the steps with a checklist (see Figure 3.3).

Using interactive instruction

The study described in Chapter 5 indicates that teachers can learn how to use interactive instruction in their classrooms and that it will help their students to perform assignments more independently. In order to achieve more interaction in instruction, teachers will need help adapting the current teaching materials. Clear steps will have to be distinguished in the assignments used in the teaching materials and videos will have to be made showing how these assignments can be taught interactively.

In this research, a network of collaborating teachers was an important driver for change in the classroom. The interactive teaching models and the assignments in our research can be used as examples to adapt current teaching materials used in schools and can provide examples of how interactive instruction is effectively introduced in practice.

Samenvatting voor een breed publiek (Dutch summary)

Introductie

In Nederland volgen bijna één miljoen leerlingen voortgezet onderwijs (VO). Hiervan gaan er ongeveer 30.000 naar het praktijkonderwijs (PrO). Het betreft jongeren tussen 12 en 18 jaar met een lage intelligentie - IQ tussen 55 en 80 - en een leerachterstand van minimaal drie jaar ten opzichte van hun leeftijdsgenoten. We noemen deze leerlingen met een intellectuele beperking in dit proefschrift 'ID Students' (Intellectually Disabled Students).

In Nederland is het praktijkonderwijs ondergebracht in zelfstandige scholen of in deelscholen binnen scholengemeenschappen voor VO. In het buitenland is dat vaak niet het geval en zijn leerlingen met een intellectuele beperking ondergebracht in het reguliere onderwijs (vergelijkbaar met het Nederlandse vmbo). Deze leerlingen volgen, met behulp van onderwijsassistenten en andere individuele ondersteuners, lessen en doen praktijkstages. Zowel in Nederland als in het buitenland bestaat het onderwijs aan leerlingen met intellectuele beperkingen voor een groot deel uit het aanleren van praktische vaardigheden die nodig zijn voor een eenvoudig beroep en voor het zelfstandig kunnen wonen en leven. Zo kent het Nederlandse PrO naast algemeen vormende vakken (lezen, taal, rekenen en burgerschap) ook beroepsrichtingen zoals: zorg en welzijn, dienstverlening, winkelpraktijk, groen, techniek (hout en metaal) en horeca.

Instructie aan leerlingen met een intellectuele beperking

Het proefschrift begint met de veronderstelling, opgedaan tijdens eerdere lesobservaties in verschillende praktijkrichtingen, dat het praktijkonderwijs vaak individueel gericht is. De instructie bestaat meestal uit voordoen door de docenten en na laten doen door de leerlingen. Dit is een beperkte vorm van instructie waarin leerlingen zelf weinig kans krijgen om mee te denken over hoe praktische taken kunnen worden uitgevoerd. Als deze indruk juist is zal het bestaande onderwijs de zelfstandigheid van de leerlingen bij het uitvoeren van taken niet erg bevorderen. Er zijn dan andere manieren van instructie nodig.

Het eerste uitgevoerde onderzoek had dan ook als doel vast te stellen hoe het onderwijs aan Nederlandse leerlingen met intellectuele beperkingen wordt gegeven.

Stand van zaken van de manieren van lesgeven in het Praktijkonderwijs

Het *eerste onderzoek* laat zien hoe docenten lesgeven: het merendeel van de 38 onderzochte techniekdocenten in het PrO (58%) maakte gebruik van individuele begeleiding. De leerlingen gingen direct aan het werk met een constructietekening en materialen. Ze kregen één voor één een korte demonstratie (de docent deed voor) hoe de opdracht uit te voeren. De docent probeerde zo alle leerlingen individueel te begeleiden. De klas als geheel werkte echter niet goed door en de leerlingen wachtten vaak op hun beurt om door de docent geholpen te worden. Als de leerlingen bij elkaar keken namen ze vaak een verkeerde werkwijze over. De leerlingen bleven, door de korte demonstraties van de taak, vaak afhankelijk van de hulp van de docent. Ze werden te weinig actief bij de uitleg betrokken.

Daarentegen gaf 42% van de docenten groepsinstructie. Dit was meer dan aanvankelijk verwacht. De leerlingen van deze docenten kregen van te voren uitgelegd hoe een taak kon worden uitgevoerd en ze kregen vragen van de docent om na te gaan of ze de uitleg hadden begrepen. Deze aanpak wordt vaak 'directe instructie' genoemd: de docent demonstreert, legt uit en stelt vragen. De leerlingen waren daarna beter in staat zelfstandig de taak uit te voeren. Ze hadden minder vragen voor de docent en waren actiever tijdens de uitvoering van de taak dan leerlingen die individueel werden begeleid. Het leek er dus op dat groepsinstructie tot meer zelfstandigheid in het verwerken van taken leidde dan individuele begeleiding.

Tegen de verwachting van veel docenten in is het mogelijk leerlingen met intellectuele beperkingen vragen te laten beantwoorden en na te laten denken over werkopdrachten voordat ze die gaan uitvoeren. Kennelijk is het niet nodig om instructie per afzonderlijke leerling te geven, maar kunnen leerlingen met intellectuele beperkingen ook tijdens groepsinstructie veel opsteken.

In de hierop volgende onderzoeken is gekeken of beide vormen van instructie (groepsinstructie en individuele begeleiding) verbeterd konden worden.

Verbetering van groepsgewijs georganiseerde instructie

In het *tweede onderzoek* is nagegaan in hoeverre de directe instructie aan een groep leerlingen nog kon worden verbeterd. Als tegenhanger van directe instructie is gekozen voor strategie instructie.

Tijdens directe instructie geeft de docent uitleg over een nieuwe taak en stelt daarover zo nu en dan vragen aan de leerlingen (zie voorgaand onderzoek). Tijdens strategie instructie wordt er vooral vragenderwijs uitleg gegeven. De docent laat de leerlingen eerst zelf bedenken hoe ze een nieuwe taak kunnen aanpakken en geeft daarna feedback op de antwoorden.

Uit het onderzoek bleek dat de leerlingen van twee klassen in het praktijkonderwijs die strategie instructie kregen inderdaad actiever bij de uitleg werden betrokken. Deze leerlingen werkten ook zelfstandiger bij het uitvoeren van hun werkopdrachten. De twee klassen met leerlingen die directe instructie kregen waren minder betrokken bij de instructie. Ze keken meer toe en hadden minder eigen inbreng. Bovendien waren ze ook minder zelfstandig tijdens de verwerking van de opdrachten. De leerlingen maakten toetsen waarin ze zelfstandig een taak moesten uitvoeren. Het bleek dat leerlingen die strategie instructie hadden gehad beter in staat waren om helemaal zelfstandig een toets te maken dan leerlingen die directe instructie hadden gekregen. Bovendien waren de leerlingen die strategie instructie kregen beter in staat onder woorden te brengen (te verbaliseren) in welke stappen ze de toets hadden gemaakt.

Deze resultaten van dit kleinschalige onderzoek geven de indicatie dat strategie instructie waarbij leerlingen actief uitleg moeten geven effectiever is dan directe instructie waarbij leerlingen toekijken naar wat de docent voordoet en af en toe een vraag beantwoorden.

Dit onderzoek laat verder zien dat docenten getraind kunnen worden om, middels strategie instructie, ook op een meer interactieve manier les te geven. Het is dan wel nodig om het lesmateriaal aan te vullen met opdrachtkaarten. Met behulp van een opdrachtkaart kunnen leerlingen zelf vooraf nadenken hoe een taak kan worden uitgevoerd en tijdens de zelfstandige taakuitvoering kunnen ze er op teruggrijpen.

Verbetering van de individuele begeleiding met behulp van video instructie

In het *derde onderzoek* is geprobeerd de individuele begeleiding van leerlingen met een intellectuele beperking te verbeteren. Tijdens de individuele begeleiding doen de docenten een taak aan een leerling voor. Daarna wordt er door de docent directe hulp geven bij de uitvoering als de leerling niet verder kan. Een praktisch probleem van deze individuele begeleiding is dat docenten vaak te weinig tijd hebben om alle leerlingen één voor één instructie te geven. Vooral als taken complexer worden is er meer instructietijd nodig. Er wordt daarom in de praktijk soms gebruik gemaakt van video instructie. Deze vorm van instructie wordt ingezet omdat de leerlingen er zelfstandig gebruik van kunnen maken.

In het onderzoek is nagegaan of leerlingen met intellectuele beperkingen misschien door middel van het actief uitleggen van video instructie aan een andere persoon meer kunnen leren dan van het alleen passief kijken naar de video instructie.

In een experiment met 41 leerlingen is eerst uitgezocht bij welke complexiteit van taken het uitleggen aan een ander tot betere uitvoering van de taken leidt. Het bleek dat bij taken die 5 of meer stappen bevatten, waarbij een aantal stappen die uit meerdere onderdelen bestaan, beter worden uitgevoerd als de leerling ze eerst moest uitleggen.

Daarna is met complexe taken onderzoek gedaan bij twee groepen van 29 leerlingen uit het praktijkonderwijs. Uit dit onderzoek bleek inderdaad dat leerlingen die video instructies over praktische taken uitlegden aan een ander hun taken beter uitvoerden dan hun klasgenoten die herhaald (twee keer) de video bekeken. Het bleek verder dat de leerlingen die een taak aan een ander uitlegden achteraf de stappen van de video instructie vollediger weer konden geven. Deze leerlingen konden ook iets beter inschatten hoe goed zij een taak hadden gemaakt. De resultaten wijzen er op dat de leerlingen die een video instructie aan een ander uitlegden de taken beter begrepen en onthielden.

Het onderzoek laat, net als het vorige onderzoek, zien dat leerlingen met intellectuele beperkingen wel degelijk in staat zijn om hun gedachten onder woorden te brengen. Ze zijn er zich ook beter van bewust hoe een werkopdracht kan worden uitgevoerd voordat ze aan de slag gaan.

Dit onderzoek maakt aannemelijk dat het uitleggen aan een ander, leerlingen helpt om de uitvoering van een opdracht beter te plannen. Hoe deze resultaten kunnen worden

omgezet in een computerprogramma dat leerlingen video instructies laat verwoorden is nog niet duidelijk. Daarvoor is verder onderzoek nodig. Voor de onderwijspraktijk lijkt het aan te bevelen om leerlingen, bijvoorbeeld in tweetallen, elkaar te laten uitleggen wat ze zojuist in een video instructie hebben gezien. Door de ene leerling een stappenkaart te geven kan deze de uitleg van de andere controleren en achteraf feedback geven. Individuele begeleiding kan waarschijnlijk worden verbeterd door gebruik te maken van video instructie die door leerlingen in tweetalen wordt uitgevoerd.

Training en coaching van docenten om meer interactief les te geven

In het *vierde en laatste onderzoek* is bestudeerd in hoeverre docenten, van leerlingen met intellectuele beperkingen, na training en coaching in staat zouden zijn meer interactief instructie te geven.

Uitgangspunt van dit trainingsonderzoek was dat veranderingen het beste georganiseerd kunnen worden binnen een groep van professionals die werkzaam is in hetzelfde type onderwijs of die lesgeven in dezelfde schoolvakken. Docenten zullen dan sneller in discussie gaan over hun lesgeven en meer geneigd zijn hun onderwijs aan te passen.

Aan het onderzoek namen docenten techniek deel. Ze werden naar eigen voorkeur ingedeeld in twee condities: groepsinstructie of individuele begeleiding. Uit de eerste effectmeting, na negen weken, bleek dat de training en coaching vooral bij docenten die groepsinstructie gaven behoorlijke positieve veranderingen in het lesgeefgedrag teweeg brachten. In een nieuwe lessenserie, na de zomervakantie, konden uiteindelijk zowel de docenten die groepsinstructie gaven als ook de docenten die individuele begeleiding gaven het interactieve lesgeven beter toepassen. Uiteindelijk bleek dat als de docenten bij beide vormen van lesorganisatie interactieve uitleg gaven en leerlingen tijdens de instructie om uitleg vroegen ze veel zelfstandiger werkten dan voorafgaand aan het interactieve lesgeven.

Wanneer een trainer/coach samen met docenten komt tot een plan het lesgeven meer interactief te maken en samen met hen lesmateriaal aanpast leerlingen zelfstandig te laten werken raken ze meer gemotiveerd. Docenten slagen er dan beter in hun lesgedrag te veranderen. Dit onderzoek geeft daarvoor de eerste aanwijzingen. Ze hoeven niet per se

hun favoriete vorm van lesgeven (individuele begeleiding) los te laten. Ze moeten er wel in slagen om leerlingen bij de instructie te betrekken. Meestal betekent het dat docenten de leerlingen in tweetallen interactieve uitleg geven en daarna leerlingen aanmoedigen de opdracht aan elkaar uit te leggen (zie ook het derde onderzoek naar video instructie).

Afsluitende conclusies en aanbevelingen

De dissertatie wordt afgesloten met suggesties voor verder onderzoek naar het effect van interactieve groepsinstructie op de zelfstandigheid van leerlingen. Er worden aanbevelingen gedaan voor nader onderzoek naar de praktische inzet van interactieve video bij individuele begeleiding van leerlingen met intellectuele beperkingen. Er wordt ook een suggestie gedaan om het trainingsonderzoek voor docenten grootschaliger en meer systematisch op te zetten. De resultaten kunnen daarna worden gerepliceerd in vervolgonderzoek. Het proefschrift eindigt met praktische aanwijzingen voor de toepassing van interactieve instructie. Meer interactieve instructie kan een positieve bijdrage leveren aan de zelfstandige taakplanning en taakuitvoering van leerlingen met een intellectuele beperking. Tijdens hun latere beroepsuitoefening zou meer zelfstandigheid ze goed van pas kunnen komen.

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About the author

Henk Blik was born on April 5, 1954 in Vriescheloo (Bellingwolde) in the province of Groningen, the Netherlands. In 1975 he obtained his teaching diploma from the Teacher Training College for Primary Education (PA) in Appingedam. In 1982, after teaching at primary school for seven years, he transitioned to special education for students with learning difficulties and behavioral problems. While working, he followed a course at the "Seminarium voor Orthopedagogiek" in 1983 and 1984, which he completed with a diploma in Special Educational Needs (SEN). From 2001 to 2003 he followed a pre-master's program at the Higher Institute for Pedagogical Education (HSPO), which is affiliated with the University of Groningen. He then enrolled in the master's (doctoral) program of educational science at the University of Groningen, specializing in the instructional design of learning environments in education. He obtained his master's degree in educational science from the University of Groningen in 2005.

In the same year, after 30 years (1975 – 2005) of teaching in primary and secondary (special) education, he became team manager at the school for Practical Education (PrO) of the dr. Aletta Jacobs College in Hoogezand-Sappemeer.

As the manager of a school for PrO, he realized that a professional environment is required in order for teachers and students to grow optimally. The starting point is that the need for care of indexed students is more complex. These students, who have an intellectual disability and are emotionally unstable, need support that caters to their individual needs. Schools for Practical Education promote autonomy, responsibility, and student participation.

Henk returned to the University in 2012 where he began his PhD project at the Groningen Institute for Educational Research (GION). Here, he did his PhD research between 2012 and 2017 into interactive instruction for students with intellectual disabilities.

Epiloog en dankwoord

Brief aan mijn kleinzoon Jurrian

Lieve Jurrian, bij ons thuis op de boekenplank staat een boekje met de titel “Mijn kleinkind”. In dat boekje staan al jouw mijlpalen van 0 tot 4 jaar. Op bladzijde 3 staat bovenaan geschreven “Dit is mijn opa”. Hier zou ik dus iets voor jou schrijven. Maar het is er niet van gekomen en om dit goed te maken, schrijf ik dit verhaaltje hieronder voor jou…..

Mijn officiële naam is Hendrik Blik, genoemd naar mijn opa met precies dezelfde naam. Volgens de genealogie van Groningen stam ik uit een geslacht van boerenknechten, landarbeiders en dagloners. Geboren ben ik aan de Ossedijk in Vriescheloo, een dorp in Westerwolde, de allermooiste streek van Groningen. Een groot deel van mijn jeugd bracht ik daar door. Met mijn ouders, broer, zus, oma’s, opa’s, ooms, tantes, neefjes en nichtjes. Ook nog nadat mijn ouders (jouw overgrootouders), Oktje Brinkman en Arie Blik naar Delfzijl verhuisden kwam ik er veel. In Delfzijl ging ik op mijn vierde voor het eerst naar school; kleuterschool ‘De Schans’. Toen wist ik nog niet dat ik vanaf dat moment bijna mijn hele leven naar school zou gaan! Als leerling van lagere school ‘De Morgenster’, mavo ‘De Kampanje’, de havo van de Rijks Pedagogische Academie en als student van de Pedagogische Academie. In 1975 werd ik onderwijzer, maar mocht niet direct lesgeven. In dat jaar bestond de dienstplicht nog en moest ik in militaire dienst. Ruim anderhalf jaar later, in 1977, werd ik leraar aan de ‘Scholengemeenschap voor Beroepsonderwijs’ (SBHS) in Hoogezand. In de jaren daarna was ik nog onderwijzer aan basisschool ‘Het Ruimteschip’ en de ‘Prof. Casimirschool’ en leraar en waarnemend directeur aan het dr. Aletta Jacobs College. Tot op dit moment in 2017, nu ik 63 jaar ben, ga ik nog bijna iedere dag naar school! Nog steeds in Hoogezand-Sappemeer. Naar de praktijkschool van “het Aletta” waar ik sinds 2005 teamleider ben.

We gaan nog even weer terug naar 1972. Het jaar waarin ik jouw oma Alie Dinkla ontmoette. Dat was aan de Pedagogische Academie in Appingedam. Je oma wilde graag juf worden. En daarom studeerde ze aan de PA. Zelf had ik voor het beroep van piloot gekozen. Maar omdat ik oma Alie ontmoette, haar lief vond en heel graag dicht bij haar wilde zijn heb ik ook gestudeerd voor onderwijzer. Je oma werd juf in Haren en ik werd meester in Hoogezand.

Veertig jaar geleden, op 27 mei 1977 trouwden oma Alie en ik. In 1982 werd je moeder Arianne geboren en vier jaar later je oom Christian. Oma Alie stopte met werken na de geboorte van je moeder en pas jaren later, toen je moeder al naar de basisschool ging, is ze weer juf geworden.

Zelf heb ik dus altijd in en voor het onderwijs gewerkt, er veel over gelezen en er ondertussen ook al het een en ander over geschreven. Aan de Rijksuniversiteit Groningen deed ik onderzoek naar het lesgeven aan moeilijk lerende leerlingen. Zo werd ik, na het behalen van mijn bul, onderwijskundige in 2005.

Op 29 september 2011 werd jij, Jurrian Tiemen Henrick Klein Nijenhuis geboren. Zoon van Arianne Blik en Maarten Klein Nijenhuis. In ditzelfde jaar 2011 besloot ik, nadat professor Egbert Harskamp me had aangemoedigd, nog meer onderzoek te doen in het praktijkonderwijs en er artikelen over te schrijven. Oma Alie vond dit minder leuk. Ze wilde eigenlijk veel liever samen met mij leuke dingen doen. Naar de bioscoop gaan, winkelen, reizen of gezellig samen televisiekijken. Maar weet je, jouw opa is niet alleen een beetje eigenwijs maar soms ook wel een klein beetje een “Einzelgänger”. Dus ging hij toch onderzoeken, studeren en schrijven. Heel veel schrijven. En nu, in 2017, is het proefschrift klaar. Opa heeft er ruim vijf jaren aan gewerkt om van drs. nu dr. te worden. Stel je voor, meer dan vijf jaar werken om er één letter ‘s’ minder voor je naam aan over te houden. Dat is toch eigenlijk heel raar.

Opa Henk is blij dat hij nu gaat promoveren. Toch is hij nog veel blijer met je moeder Arianne, met je oom Christian, met Allert, met de herinneringen aan je vader Maarten en met jou. En natuurlijk met jouw oma Alie, want zonder haar niet aflatende uithoudingsvermogen was het mij echt niet gelukt om deze dissertatie af te maken.

Het schrijven van dit proefschrift heeft me opnieuw overtuigd dat er meer komt kijken bij leren dan alleen maar kennis, inzet en vaardigheden. Zonder persoonlijke ambitie en vooral draagvlak in de eigen omgeving heeft het schrijven weinig kans. Vandaar dat mijn grootste dank voor de steun bij het schrijven van dit boekwerk uitgaat naar mijn lief, jouw oma Alie. Ook nu blijkt maar weer dat dat wat van waarde is, dichtbij is. Ik dank haar voor het begrip en de steun voor dit avontuur. Het proefschrift met de naam:

“Interactive Instruction for Students with Intellectual Disabilities”.

Er zijn nog veel meer mensen die ik ook graag wil bedanken. Te veel om allemaal te noemen. Toch noem ik er een aantal. De eerste is mijn wijlen collega Roelof Bakker. Hij was mijn inspirator. Als leraar aan de praktijkschool liet hij me inzien dat moeilijk lerende leerlingen veel meer kunnen dan we denken. Volgens Roelof Bakker kun je alle leerlingen best iets laten leren als je ze iets voordoet maar veel beter is het om ze bij de les te betrekken en ze zelf een strategie te laten bedenken. “Als je leerlingen iets vertelt dan vergeten ze dit, als je ze iets uitlegt dan zullen ze dit mogelijk onthouden, maar alleen als je ze er bij betrekt en zelf laat nadenken dan leren ze er van”. Daarover gaat dit proefschrift.

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Henk Blik , Wildervank, 2017.