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CODING FOR INCLUSION

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Coding for Inclusion – CODINC
WP4- Experimentation Report
2019
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Belgium (Brussels) - Codinc report

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EXECUTIVE SUMMARY

Coding for inclusion – CODINC- supports the development of coding skills for disadvantaged youth in an innovative way. On one hand it helps young children in primary school to learn and develop in ICT-skills and on the other hand the Codinc-project is giving disadvantaged students a role to play in the school environment while they also learn how to code. Putting the teenagers in a role of a teacher where they have to take responsibility, is giving them a voice and a sense of belonging to the school community. The peer-to-peer methodology is an appropriate choice to increase their well-being and empower younger people. Disadvantaged youth may not be offered the same scientific capital or social capital as their peers, leaving them at risk of higher drop-out rates and lower self-esteem. The Codinc project offers students of disadvantaged backgrounds which includes refugee or third country backgrounds, scientific and social capital by training them for the role of being a coding/STEAM animator to their peers. As a result of the Codinc project in Brussels one can clearly see young students take responsibility for themselves and for their peers. Maks could call the Codinc project a success in the participating schools, because all the primary and secondary schools are eager to participate in future coding-projects like Codinc. The pilots were successfully done and 98% of the kids would like to do more coding in the future. The biggest challenge was to motivate teachers and principals to actively participate at the project. There were a few older teachers in the secondary school who didn't see the value of these workshops in the beginning. It has to be mentioned that especially the younger teachers of the primary schools were extremely enthusiastic from the very beginning and were eager about continuing such projects in the future.

Maks vzw addressed:

- 81 primary school pupils (8 to 12 years of age) and 31 secondary school students (15 to 18 years of age) from disadvantaged areas: Molenbeek and Jette
- Primary and secondary school teachers
- Trainers and internships working with young people in formal settings

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INTRODUCTION

The digital transformation is affected all of our lives faster than before, as a result there is a need across Europe to develop the digital competences of all citizens to ensure no one is left behind. Unfortunately, many educational systems, including those in Brussels are not fully adapted to the use of ever-new technologies. In neighbourhoods where there are higher rates of exclusion, there is even more of a need to use digital tools to promote inclusive practices. However, teachers and curriculums are full, and adding on a new theme is not easy. While pupils and students are active internet and mobile device users, teachers are burdened with needing to develop their skills to adequately support students in new technologies and competences. STEAM technology and coding offers new pathways for teaching, based on the interest of kids and students, enabling them to be producers, and not just consumers of digital content.The aim of the Codinc programme is to provide all children with access to ICT skills and to bring them closer to the possibilities of the ICT and STEAM professions and to increase the chances of disadvantaged young people, access to ICT. Codinc will adapt, disseminate and scale up the inclusive learning "Capital Digital" practice, which was developed and implemented by Maks vzw in neighbourhoods in Brussels, Belgium that are classified as highly disadvantaged.

<u>The project</u>

Codinc activities were implemented in a series of phases. In July there was a 2-day internal training in Barcelona where the staff were trained in the Codinc methodology. In the following period the staff was selected who would participate in the project. At the same time schools in Brussels with a high rate of disadvantaged youth were identified, selected and contacted. The Codinc project in Brussels reached 82 pupils from primary schools with a very high rate of disadvantaged youth and 6 primary teachers over a period of 2 months (march-April 2019). In contrast to other countries Maks did the piloting in two secondary classes. It reached in total 31 students at a technical secondary school with a very high rate of disadvantaged youngsters and 5 secondary teachers over a period of 4 months (January-April 2019). In each school there was an extra class selected that served as a control group for the assessment and evaluation.

The experimentation period was categorised in several phases. First there was a training organised for the schoolteachers. The date and the length of the training varied from school to school to the availabilities of the teachers. In the secondary school there were 2 trainings of 2 hours for in total 6 teachers. In one primary school there was a training of 5 hours for 6 very enthusiastic teachers and in the other primary school 4 teachers and the principal got a training of 4 hours. The training was organised before the start of the project in the schools, so teachers would be engaged in participating during the piloting. Between January and March, the secondary students received their 15-hour training in coding. Between March and May the pupils receive their 10-hour peer-to-peer workshops in their primary schools.

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For the assessment and evaluation there were administered 4 distinct evaluations both before and after the experimentation. Students at the secondary school were administered 4 assessment scales:

1. Moreno sociogram regarding the relational aspect
2. Moreno sociogram regarding the group work appearance
3. Self-efficacy rating scale
4. Teachers' Attitudes Toward Students (TATS)

Teachers were administered two assessment scales to investigate the level of self-efficacy and the ability to integrate technology into teaching:

1. Teacher Self-Efficacy Scale (SAED)
2. Intrapersonal Technology Integration Scale (ITIS)

Teachers and pupils at the primary school were also administered all the scales above, with the exception of TATS, which was not offered to students.

After the experimentation period, Maks assessed and evaluated the data and translated into concrete policy recommendations in the conclusion. Maks organised a multiplier event on the 12th of November where it presented a showcase of the Codinc-project. In the morning 50 students from 2 secondary schools got a 3-hour Codinc-training. In the afternoon these students had to give a 2-hour training to 250 pupils from 6 different primary schools. In the afternoon teachers and experts had to evaluate this showcase. Also, these evaluations and recommendations from experts and teachers are included in the final policy recommendations.

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REGIONAL CONTEXT

Introduction

Among all the European Member States, Belgium is only 23rd in terms of the number of graduates in scientific, technological and mathematical fields (1). For every 1,000 people aged between 20 and 29, only 13.3 graduate with a STEM certificate. The average at European level is 19.1. The European Commission, author of the report, does not spare his criticism of our country. It calls the 'permanently low percentage' of STEM graduates 'worrying'. The European Commission warns that a shortage of STEM graduates could affect our country's growth and innovation. People with a STEM degree often move on to jobs that require digital skills. For this reason, Belgium is already struggling with a shortage of ICT specialists. According to the European Commission's real-time monitor, there were 13,997 vacancies for ICT experts in our country at the beginning of April. This is a clear call from the commission to take action. Belgium has to close the digital gap they created with other countries. Also Belgium has to close the digital gap between students of higher social classes and disadvantaged youth.

Regional context

Belgium is subdivided not only in three language-based communities (French, Flemish, and German-speaking), but also in three economy-based regions (Walloon, Flanders, and Brussels-capital). The regions and communities overlap largely, but not completely, which results in distinct cultural, social, and economic differences. For example, where the average yearly income in Belgium is €17 824 euro, this is higher in Flanders (€19 102), but lower in Wallonia (€16 787) and a lower in Brussels-Capital (€13 980)(1).

The demographic situation of Brussels is one of the most urbanised cities between London and Paris. The Brussels-Capital Region has a population of around 1.2 million and has witnessed, in recent years, an increase in its population. In general, the population of Brussels is younger than the national average, but the gap between rich and poor is wider. [2]

In Brussels ICT-professions and teaching-professions are highly ranked on the list of bottleneck professions in Brussels[3]. There is clearly a need for more graduates with ICT-skills and teaching skills. In 2019, the Brussels-Capital region accounted for 726 350 jobs across its territory, making the capital the main area of employment in the country. Brussels is very

1. https://ec.europa.eu/information_society/newsroom/image/document/2018-20/be-desi_2018-country-profile_eng_199603A9-AB53-4E21-03C0BEF3730537BA_52213.pdf

1https://statbel.fgov.be/sites/default/files/files/documents/Huishoudens/10.9%20Fiscale%20inkomens/fisc2016_C_NL.xls
[2]https://statbel.fgov.be/fr/themes/population/structure-de-la-population
[3]http://www.actiris.be/Portals/36/Documents/NL/Lijst%20knelpuntberoepen%20in%202018.pdf
4 https://ec.europa.eu/eures/main.jsp?lang=en&acro=lmi&catId=7552&countryId=BE&regionId=BE1
5https://www.npr.org/2016/04/04/473004999/when-it-comes-to-radicalization-in-belgium-turks-and-moroccans-are-different?t=1574776628386
6file:///C:/Users/MAKSvzw%20NL/Downloads/the_history_and_influence_of_the_belgian_isis_contingent.pdf

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attractive to jobseekers, but unfortunately a large proportion of these jobs are not held by people from Brussels: in 2019, the Brussels region had a total of 726 350 jobs, of which 355 416 (48.9%) were held by commuters (231 244 from Flanders and 124 172 from Wallonia). Moreover, in Brussels, the level of qualifications required is high. In 2017, almost 60% (59.9%) of jobs in Brussels were held by highly qualified personnel (higher (non)university level), as against approximately 6.2% for Belgium as a whole.Paradoxically, like many large urban centres, the Brussels region is one of the wealthiest in Europe (in terms of GDP) but it continues to suffer from high poverty and unemployment levels. The unemployment rate in the Brussels-Capital Region is higher than in the other two regions and higher than the European average. In 2018, the registered unemployment rate in the region was 16.1%, whereas it was 9.3% for Belgium as a whole. In late February 2019, Brussels recorded 890 332 jobseekers, equating to an unemployment rate of 15.9%. Unemployment among young people has been falling continuously for 69 months, standing at 23.5% (4).

Another reason why a project like Codinc is very useful in the Brussels context is the radicalized youth. The recent attacks in Brussels are sad evidence that terrorist activities can affect the daily life in Brussels. Before we were confronted with the multiple attacks on European soil, the jihadi threat in Belgium and Western Europe in general was largely underestimated (5). As soon as the opportunity arose, with the increasing "jihadification" of the war in Syria and ISIS's expansion across the Iraqi border, roughly a year before they proclaimed their caliphate, more then 500 of men and women left Europe and joined the emerging "jihad". The Belgian radicalised youth that left Belgium to fight were in absolute numbers much more then in France or Britain (4). Most of the Syrian fighters were from Maroccon origin and lived in Brussels. They were disadvantaged youth that were radicalised by networks or the social media. Social inclusion-projects like Codinc could help prevent disadvantaged youth being radicalised.

Educational context

In Brussels, nearly all schools are public, except the European schools and some private institutions. An average class consists of around 20-25 pupils and one teacher. The ICT-equipment in most of the Brussels schools is rather poor. Although a lot of schools have interactive whiteboards in the school and wireless internet, the hardware of the material is or outdated or not working. It also doesn't mean these materials are used. In some primary schools you will find teachers (especially young teachers) that see the value of coding and make effort to introduce them to their pupils. This is not the case for all primary schools, because neither computational thinking nor programming are compulsory subjects in primary schools in Brussels. Also in secondary schools the new education plan dictates that all the old ICT-courses should be eliminated and these ICT-skills should be incorporated in each school subject. The reality is that the practice of programming and coding is therefore highly dependent on the motivation of the teachers and the schools, which is not always the case, because subject teachers are mostly preoccupied with teaching solely their subject without introducing any programming or coding, because they don't see the value according to their subject.

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EXPERIMENTATION

Selection of participants

Maks worked together with 2 primary public schools in Brussels (Molenbeek and Jette) and one public technical secondary school (Jette). In the primary schools' computational competences are not existing in the public school curriculum. Although the teachers were quite interested in STEAM-education, the training and resources to educate STEAM-education, was quite pour or even non existing. There is a lot of willingness from the primary teachers for STEM-education. They all know the importance of digital skills, but there is a shortage of resources. In the primary schools there wasn't a lot of digital material present. In both schools there were none to two outdated computers in the classroom. In Molenbeek they had 7 iPad for the whole school, while in Jette none. Each school had only one digital schoolboard. Also in the secondary school the computational competences in the curriculum was quite pour. They had 1 computer classroom, where each class used to have 1hour of traditional computer lessons a week. During this lesson they learned to work with excel and word, but since the new education plan in catholic schools of 2019 (1), even these lessons are replaced Although this was a technical school, it was miles away from what you can call STEAM-education. That's also the reason why Maks found it very interesting to do the project with this technical school. Because the digital infrastructure was missing in all the schools, Maks brought all the material to the schools.

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(1)http://blog.associatie.kuleuven.be/natashafriedenstein/apart-vak-informatica-is-niet-meer-nodig/

In Brussels the government has an interesting indicator for measuring the rate of disadvantaged youth in schools, called the Gok-indicator. The decree on Equal Opportunities for Education (GOK) was issued in September 2002. The aim of this policy is to offer all children the same optimal opportunities to learn and develop themselves. At the same time, the decree aims to combat exclusion, social separation and discrimination and therefore pays special attention to children from disadvantaged backgrounds.

In the Equal Opportunities in Education policy different indicators are determined. These indicators are described as follows in the GOK decree:

- the family lives on a welfare income;
- the pupil is temporarily or permanently taken up outside his or her own family context by a family or person, a facility or a social service, as referred to in the coordinated decrees of 4 April 1990 on special youth assistance, with the exception of boarding schools financed or subsidised by the Department of Education of the Ministry of the Flemish Community;
- the parents belong to the travelling population;
- the mother does not hold a secondary school diploma, a second-year certificate of the third degree of vocational secondary education or an equivalent certificate of study;

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- The language used for the usual communication in the family is not Dutch.

On the basis of these data, schools are able to receive additional resources if they develop an equal opportunities policy. The higher the Gok-indicator is for a school, the higher the percentage is of disadvantaged youth in the school. In the primary and secondary schools of the Codinc project the GOK-indicator was between 80 and 100, which means a very high rate of disadvantaged youth.

Timeline experimentation

In September and October 2018 Maks defined the trainers who were going to participate on the Codinc project. Maks didn't had many problems with finding trainers. It was more a matter of choosing. In the organisation of Maks there is a lot of experienced staff that works daily with teaching coding and programming to children. 3 people were going to work on the Codinc project. The choice was made to use 3 trainers since in the piloting of the project in primary schools there were 3 classes for each school that participated at the project at the same time. In this way there was a trainer present in each class who could oversee and evaluate the students, while empowering the teacher to participate in coding. Maks also involved a student of the university who was doing his internship with Maks. He followed up the whole project which was an enormous learning experience for him.

During the months of October and November, Maks looked for schools in disadvantaged areas to participate at the Codinc project. For the primary schools there was no problem. 2 primary schools were quickly very interested in participating in this project. The profile of these schools was matching with the Codinc requirements and by the end of November we already had an agreement with the primary schools.

The deadline for the agreement with schools was by the end of December. Finding a secondary school was a much more difficult task. Maks firstly selected a school who matched perfectly to the requirements. The first school Maks contacted was a school in Anderlecht with a high range of disadvantaged students. Maks is based in Anderlecht and we are an organisation that works primarily with this disadvantaged neighbourhood. The principal was quite interested but a week before the Christmas holidays she withdrawal from the Codinc project. The director couldn't convince the teachers to give up their teaching hours. In Belgium teachers from specific subject in the secondary school have to reach certain objectives from the government. If they don't reach certain objectives during their lessons, it is possible the government closes the school.

Luckily Maks works together with a wide range of secondary schools with a high rate of disadvantaged youth on different digital projects. After contacting a few schools, a lot of schools weren't ready to give up 30 hours of their curriculum. Because in the secondary school the different subjects are given by different teachers, in contrary to a primary school where one teacher gives all the subjects, it takes quite an effort for secondary school to organise 30 hours, equally divided over the different subjects. This also means that all those teachers have to be on board with the Codinc project. Begin of January, we had an agreement with Tajette. Once we had the agreement, we discussed the school planning and specifically when to integrate CODINC-sessions. We discussed the methodology and the toolkit and what the role was of the teacher in the class and the specific resources we needed. This was not much because Maks brought all the digital material themselves and with the scratch 2.0 offline

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version no internet connection was needed, only a classroom. The planning of the training and the workshops between the primary and secondary schools took a few days. Once you had a final planning with the secondary school, the primary school had to confirm these dates. This was not always the case, for example once there was a pedagogical study day for the teachers, then there was a school picture-day or there was a fire alarm drill, etc... But in the end, it was done with the help of the enthusiast teachers and principals. Also was it a good choice of working with two secondary classes. Thus it was more easy to adapt the planning of one secondary class to one primary school.

For the experimentation period Maks firstly organised the training afternoons for teachers of the primary and secondary schools. In Brussels this training varied from school to school to the availabilities of the teachers. In the secondary school there were 2 trainings of 2 hours for in total 6 teachers. This was normally not provided in the methodology, but Maks found that this should be implemented in a future Codinc-project, because during the piloting you could really see the difference in engagement of the teachers who participated at the training and who not. The ones that participated were much more involved with the lessons while some secondary teachers were only occupied with their own work. In one primary school there was a training of 5 hours for 6 enthusiastic teachers and in the other primary school 4 teachers and the principal got a training of 4 hours. The training was organised before the start of the project in the schools, so teachers would be engaged in participating during the piloting. All of these training afternoons were a big success because teachers indicated they would like to have more training in coding and programming in the future, especially on how they could use and teach it in classrooms.

During the piloting of the secondary schools there was a 15-hour training course of coding and pedagogical skills for the students. After the 10-hour training the students had to give 10 hours of coding lessons to pupils in primary schools. In the toolkit you can find many similarities between the workshops for the students and the piloting for the pupils. This is done so the students should be trained on the same modules they will use in turn to teach the pupils. The training program for students focuses also on pedagogical methodology of coding, evaluation techniques and energizers. Maks choose to do the piloting of the secondary students weekly and not all in one day so the students repeated their ICT-skills weekly, so they wouldn't forget the study material so easily in the long run. For the piloting in the secondary schools Maks completed the toolkit in 15 hours, but we did need an extra hour in each class so the students could prepare for their peer-to-peer training. More hours are nonetheless welcome to have more practice on the pedagogic skills. After the third session we divided them into several groups on the basis of different cards they got. They had the feeling these cards were given randomly, but the e-facilitators didn't give them randomly. They ensured that there was a good proportion between sexes, people with already good ict-skills, people with good pedagogical skills, etc... These divided students became the eventual groups that were going to give the training to their peers. Therefore, the additional hour to the piloting was quite important. Giving a workshop to a primary class with several students is quite more difficult than giving it alone. At the end of this extra hour they had to present to

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their secondary teacher and the class who and how they were going to explain which part of the training.

In March we started the piloting by the peers in the primary schools. For one primary schools (and for secondary class 1) this was held on 3 following Monday mornings. For the other primary school this was held on four Monday afternoons, because the afternoons in the primary schools are shorter. All the students completed their piloting and all the kids had a duo-project on scratch. For the pupils this project was not only a fun experience, but also a learning experience. They learned computational thinking, collaborative and social skills, creative skills and problem solving and design skills. An extra qualitative evaluation showed clearly that 98% of the pupils wants to follow more coding a programming workshops in the future and they all loved makeymakey the most. 8 pupils (10%) already participated at a summercamp of Maks' Capital Digital.

Also, could the trainees see a growth in self-confidence of the secondary students. In the beginning of the workshops in the secondary school they were negative about it like teenagers normally act on something new, but after they experienced that Codinc was not a traditional way of teaching, they found it quite fun. You saw them become a bit anxious before the first piloting in the primary school, but at the end they took their responsibility without any involvement of the present teachers or e-facilitators. At the last session almost, all students stayed longer because they wanted to say goodbye to 'their' kids. The fact that the students had to teach pupils after their coding-training, helped increase their confidence and self-believe as being actors in the digital world and leaders in their community. The Codinc experience also improved the teacher-student relationship in the classroom as teachers have the chance to see students engaging in education in a different way and experiencing a different role. You could see the students growing closer to their teachers, during the training because they started on the same level. Most of the teachers of the secondary school weren't familiar with coding and programming so like the students they started from zero. It was interesting to see students explaining Scratch to their teachers. They even grew more together during the piloting in the primary schools, because it had a kind of excursion-feeling. Together in group they took public transport with all the material, the trainees and the teachers to the primary schools. I even clearly heard some students saying against their teachers that teaching wasn't so easy as they thought and that they had more respect for the job of a teacher. After the project several students signed up to participate in the capital digital-training with the aim of working with kids during the capital digital summer camps.

The teachers were even more enthusiastic about the project then their students. 85% from the primary and secondary teachers wants to work together with Maks for a digital project in the future and the 2 primary schools already filled in a project call to do so. The methodology of Codinc has already been used for 1 project (mini-Codinc) last academic year (may 2019) and 1 project (code-coach) for next academic year (October-December 2019) by Maks in schools with disadvantaged youth. The only conclusion we could see is that this project was more than a success and the methodology behind clearly has a lot of advantages.

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ASSESSMENT AND EVALUATION RESULTS

Sociometric test

The sociometric test, created by Jacob L. Moreno, is an effective tool for obtaining information about interpersonal relationships within a group and to highlight the social status of each member. This test can be used in family therapy, the education system (group and teacher training), urban planning, business, educational summer camps, military organization etc. In particular, in the educational context, the sociometric test can be used in the following circumstances:
Conflicts between students;
In the presence of isolated individuals;
Lack of collaboration in group work.

The sociometric test is based on two criteria:

A. **Affective-relational** aspect refers to the affective relationships that have been established between the members of a group and the psychological affinities of the group members;

B. **Functional aspect:** it is related to the organization of the group and is aimed at understanding the established relationships with the aim of achieving a common goal.

Each criterion includes questions that deal with preference and rejection of members of your group.

Sociomatrix

To examine sociometric test data, a procedure is used to use a double-entry table called a sociomatrix (Figure 1). In this table, the names of the group members, choices, and rejections received by each group member are located, alphabetically, on the axes of the axes and orders.

Sociogram

The graphical representation of the sociometric test is called a sociogram (Figure 2). The latter is a lattice composed of nodes and lines. Nodes represent the members of a group, and lines indicate relationships (positive or negative) between members.

How is a sociogram represented?

1. The nodes are represented with circles, the initials of the group member must be entered in each node. Circles can be represented with two different colours (such as pink and blue) to distinguish gender.
2. Choices and rejections can be indicated with different lines of colours and different hatches, for blue continuous lines with double tip for mutual choices, continuous red lines with double tip for waste blue dotted lines to a puta for one-way choices, and red-toe dashed lines for one-way waste.

The sociogram being a graphical representation allows you to see immediately and visually whether the cohesion, relationships and therefore dynamics of the class group have changed between a pre and post-test. In addition, it is immediately visible if there are famous, rejected or isolated subjects.
A more in-depth analysis requires an expert.

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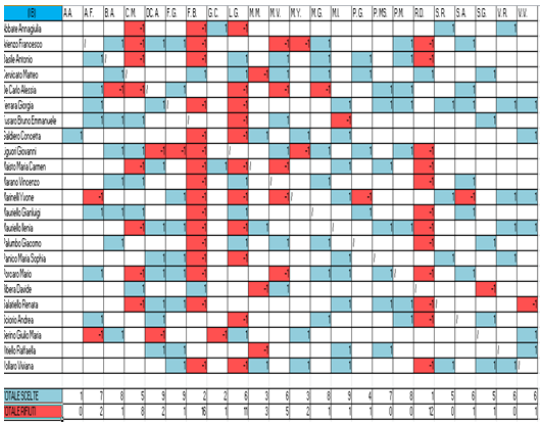
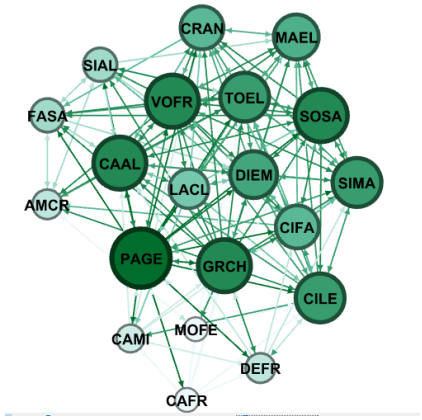


Figure 1: Sociomatrix

Figure 2: Sociogram



Scales for self-efficacy assessment

The construct of self-efficacy was formulated by Albert Bandura who defined it as the belief about an individual's own abilities in organizing and performing the sequences of actions necessary to produce certain results, (Bandura, 2000). This is not a general self-confidence, but a conviction that we can effectively deal with certain contexts. "Self-effectiveness, therefore, is not a measure of the abilities possessed, but the belief that the person has about what he is able to do in different situations with the abilities he possesses"(Borgogni,2001). In international literature, self-efficacy is an important topic among psychologists and educators. As Bandura and other researchers have shown, self-efficacy can have an impact on behaviour and motivation.

Scale for the integration of technology into teaching practice - ITIS

The process of integrating technological innovation into teaching has long been the subject of several investigations and appears to be attributable to external or, so-called interpersonal factors, and to internal or intrapersonal factors (Buabeng-Andoh, 2012; Ertmer, 2005; Revolve, 2006). Intrapersonal Technology Integration Scale (ITIS)aims to study the role played by teachers' beliefs in the integration process technology in the classroom. The conceptual structure is that of the Social Cognitive Career Theory (SCCT) (Lent, Brown and Hackett, 1994), whose key mechanisms are based on the concepts of Self-Efficacy (SE), Outcome Expectation (OE) and Interest (INT).
The scale consists of 21 Items and takes 10-15 minutes to complete, it was administered to all teachers involved in the activities (first and second degree) at the beginning and end (before and after) of the trial.

Relationship between teachers and students

Teachers have different attitudes towards students. Some teachers are conservative and autocratic, while others are liberal and democratic. In literature we can see that teachers' attitudes towards students are an important construct with many theoretical foundations, and it also has a significant psychological impact on student outcomes in terms of learning.

We can detect information about the relationship between teachers and students using the Teachers Attitude Toward Students (TATS) scale, which investigates teachers' attitudes towards students from two different approaches: conservative and autocratic versus liberal and democratic. The scale consists of 14 items divided into two groups, each of 7 elements. One set of elements measures the conservative-autocratic attitude, while the other measures

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the attitude liberal-democratic. This scale was administered to students (second grade only) to investigate what a teacher should be like from their point of view.
TATS is a self-reporting measure, subjects must express and evaluate their degree of agreement or disagreement, with each item of the test, using a 5-point Likert scale with "1" - "Strong disagreement" and "5" - "Strongly agree ", while the other scores intermediate degrees of agreement.

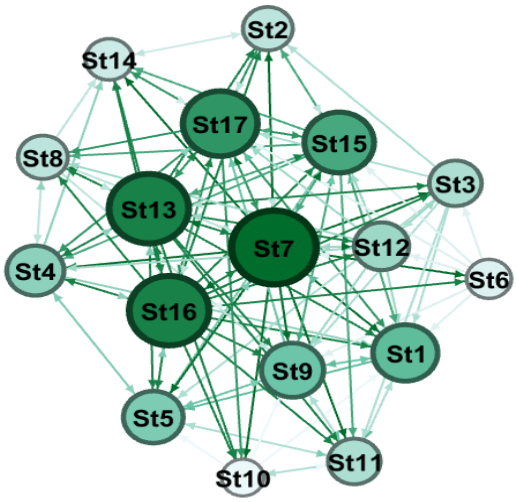
RESULT SOCIOMETRIC TEST PRE AND POST

Secondary School Results

Secondary School Technisch Atheneum Jette 4STW

Test	Nodes	Edges	Average	Density	Coherence
Affective Total Pre	16	109	6,81	0,45	0,59
Affective Selection Pre	16	106	6,62	0,44	0,32
Affective Total Post	17	138	8,12	0,5	0,61
Affective Selection Post	17	89	5,23	0,33	0,62
Group Total Pre	16	137	8,56	0,57	0,55
Group Selection Pre	16	106	6,62	0,44	0,43
Group Total Post	17	159	9,35	0,59	0,55
Group Selection Post	17	112	6,59	0,41	0,41

BAVO – SS TAJ 4STW: Affective Total – Pre-test
Nodes 16 – Edges 109 – Average 6,81 – Density 0,45 – Coherence 0,59



BAVO – SS TAJ 4STW: Affective Total – Post-test
Nodes 17 – Edges 138 – Average 8,12 – Density 0,5 – Coherence 0,61

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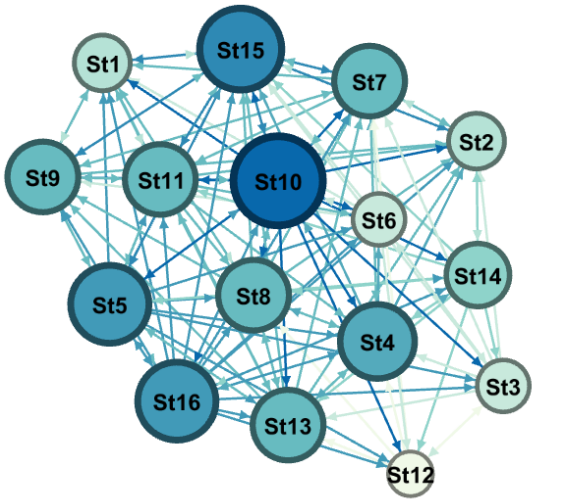
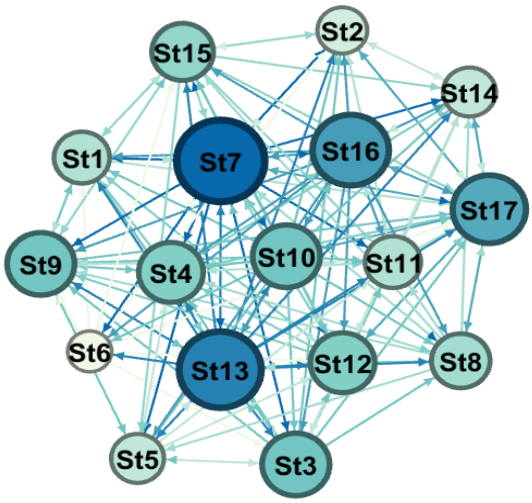


BAVO – SS TAJ 4STW: Group Total – Pre-test
Nodes 16 – Edges 137 – Average 8,56 – Density 0,57 – Coherence 0,55

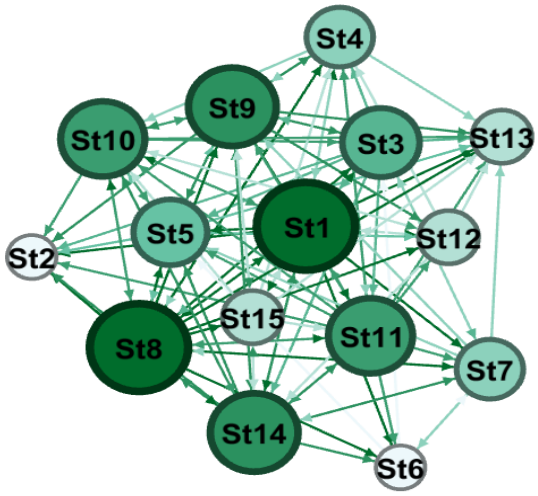


BAVO – SS TAJ 4STW: Group Total – Post-test
Nodes 17 – Edges 159 – Average 9,35 – Density 0,59 – Coherence 0,55

Secondary School Technisch Atheneum Jette 5STW

Test	Nodes	Edges	Average	Density	Coherence
Affective Total Pre	15	125	8,33	0,6	0,66
Affective Selection Pre	15	55	3,66	0,25	0,51
Affective Total Post	15	112	7,47	0,53	0,54
Affective Selection Post	15	65	4,33	0,3	0,31
Group Total Pre	15	131	8,73	0,62	0,67
Group Selection Pre	15	85	5,67	0,38	0,73
Group Total Post	15	125	8,33	0,6	0,58
Group Selection Post	15	87	5,8	0,4	0,46

BAVO – SS TAJ 5STW: Affective Total – Pre-test
Nodes 15 – Edges 125 – Average 8,33 – Density 0,6 – Coherence 0,66



BAVO – SS TAJ 5STW: Affective Total – Post-test
Nodes 15 – Edges 112 – Average 7,47 – Density 0,53 – Coherence 0,54

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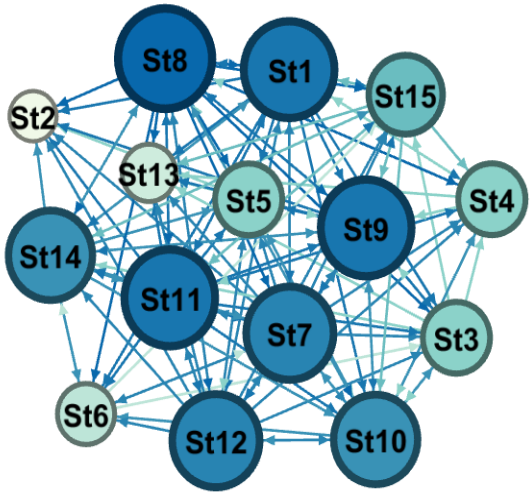
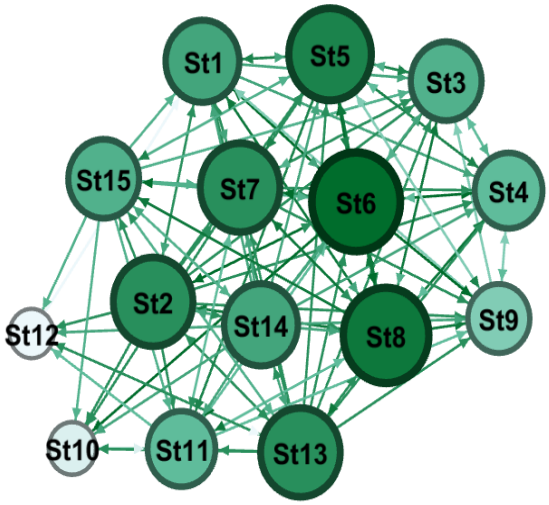
BAVO – SS TAJ 5STW: Group Total – Pre-test
Nodes 15 – Edges 131 – Average 8,73 – Density 0,62 – Coherence 0,67



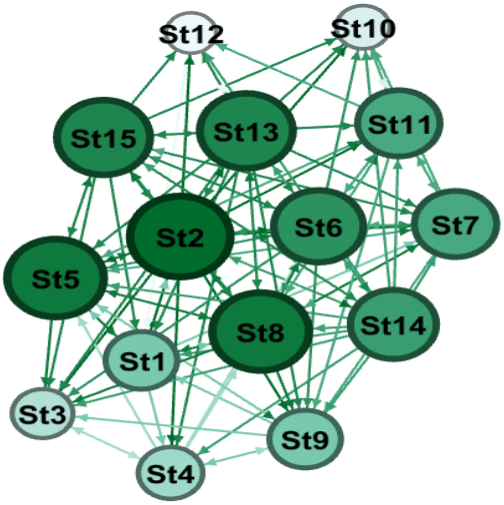
BAVO – SS TAJ 5STW: Group Total – Post-test
Nodes 15 – Edges 125 – Average 8,33 – Density 0,6 – Coherence 0,58

Secondary School Technisch Atheneum Jette 6STW: Control class

Test	Nodes	Edges	Average	Density	Coherence
Affective Total Pre	15	122	8,13	0,58	0,59
Affective Selection Pre	15	89	5,93	0,43	0,47
Affective Total Post	15	114	7,6	0,54	0,56
Affective Selection Post	15	93	6,2	0,45	0,56
Group Total Pre	15	120	8	0,57	0,55
Group Selection Pre	15	80	5,33	0,4	0,48
Group Total Post	15	107	7,13	0,51	0,52
Group Selection Post	15	72	4,8	0,35	0,47



BAVO – SS TAJ 6STW-Controle: Affective Total – Pre-test
Nodes 15 – Edges 122 – Average 8,13 – Density 0,58 – Coherence 0,59



BAVO – SS TAJ 6STW-Controle: Affective Total – Post-test
Nodes 15 – Edges 114 – Average 7,6 – Density 0,54 – Coherence 0,56

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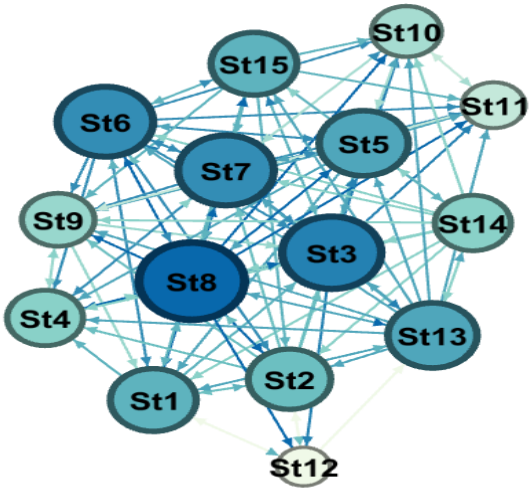


BAVO – SS TAJ 6STW-Controle: Group Total – Pre-test Nodes 15 –Edges 120 –Average 8 –Density 0,57 –Coherence 0,55

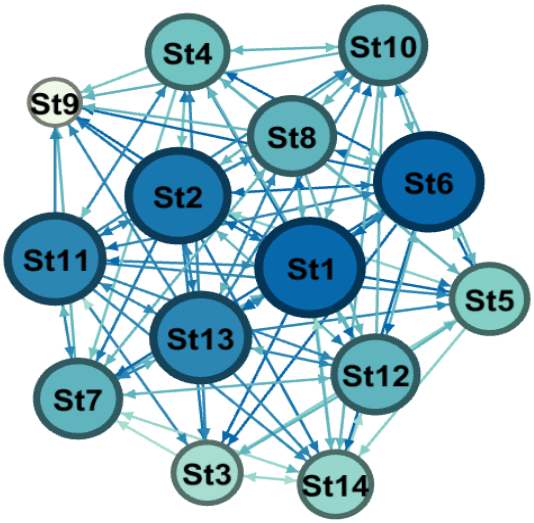
BAVO – SS TAJ 6STW-Controle: Group Total – Post-test Nodes 15 – Edges 107 – Average 7,13 – Density 0,51 – Coherence 0,56

Primary School Results

3L Primary School De Kleine Geuze

Test	Nodes	Edges	Average	Density	Coherence
Affective Total Pre	14	147	10,5	0,8	0,79
Affective Selection Pre	14	64	4,57	0,35	0,5
Affective Total Post	14	100	7,14	0,55	0,6
Affective Selection Post	14	35	2,5	0,22	0,4
Group Total Pre	14	148	10,57	0,81	0,78
Group Selection Pre	14	79	5,64	0,42	0,51
Group Total Post	14	120	8,57	0,66	0,63
Group Selection Post	14	49	3,5	0,29	0,53

BAVO – 3L PS DKG: Group Total – Pre-test Nodes 14 – Edges 148 – Average 10,57 – Density 0,81 – Coherence 0,78



BAVO – 3L PS DKG: Group Total – Post-test Nodes 14 – Edges 120 – Average 8,57 – Density 0,66 – Coherence 0,63

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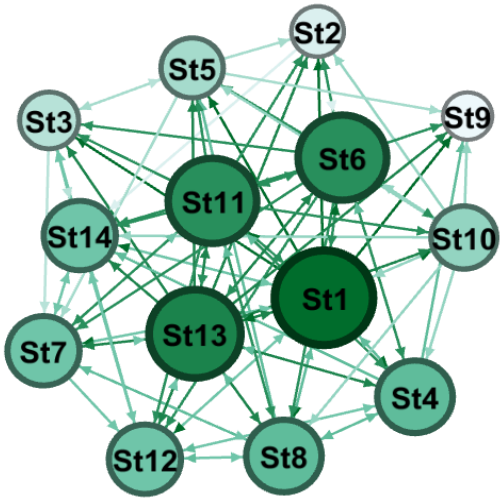
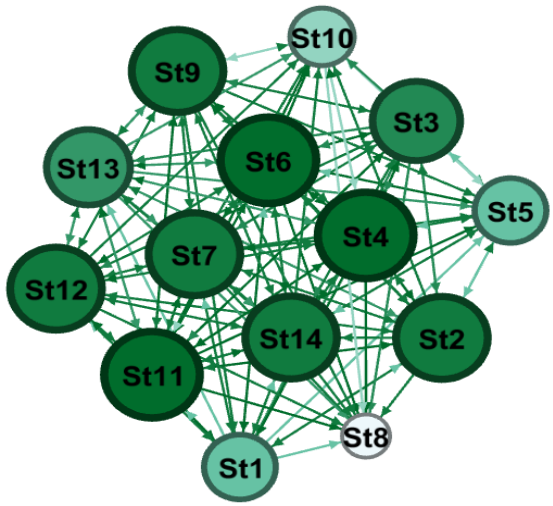


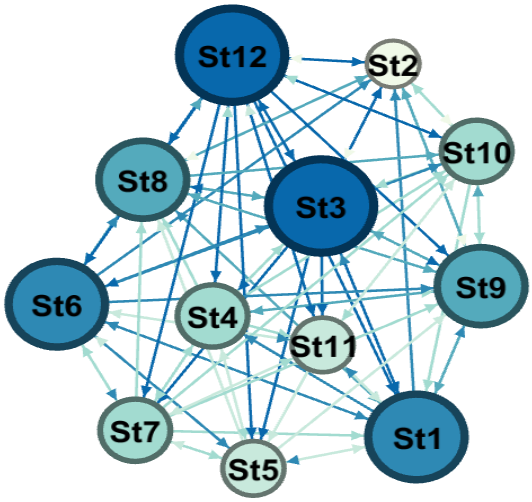
BAVO – 3L PS DKG: Affective Total – Post-test
Nodes 14 – Edges 100 – Average 7,14 – Density 0,55 – Coherence 0,6



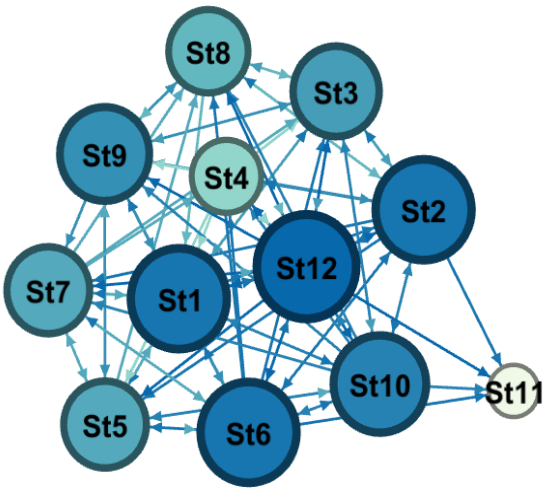
BAVO – 3L PS DKG: Affective Total – Pre-test
Nodes 14 – Edges 147 – Average 10,5 – Density 0,8 – Coherence 0,79

5L Primary School De Kleine Geuze

Test	Nodes	Edges	Average	Density	Coherence
Affective Total Pre	12	62	5,17	0,47	0,42
Affective Selection Pre	12	30	2,5	0,24	0,47
Affective Total Post	12	73	6,1	0,55	0,68
Affective Selection Post	12	40	3,3	0,31	0,7
Group Total Pre	12	91	7,58	0,69	0,73
Group Selection Pre	12	49	4,1	0,37	0,61
Group Total Post	12	88	7,33	0,67	0,7
Group Selection Post	12	61	5,1	0,45	0,62



BAVO – 5L PS DKG: Group Total – Pre-test
Nodes 12 – Edges 91 – Average 7,58 – Density 0,69 – Coherence 0,73



BAVO – 5L PS DKG: Group Total – Post-test
Nodes 12 – Edges 88 – Average 7,33 – Density 0,67 – Coherence 0,7

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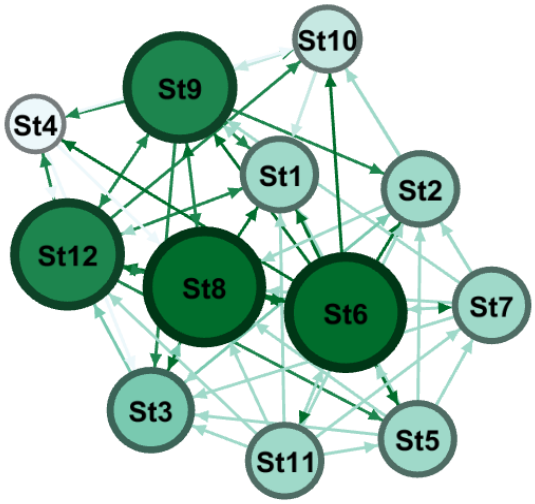
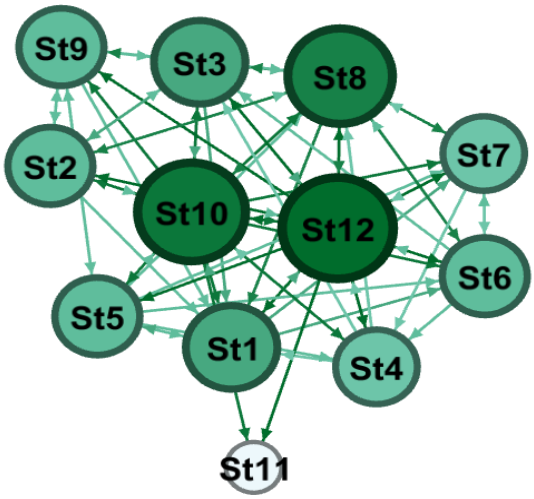


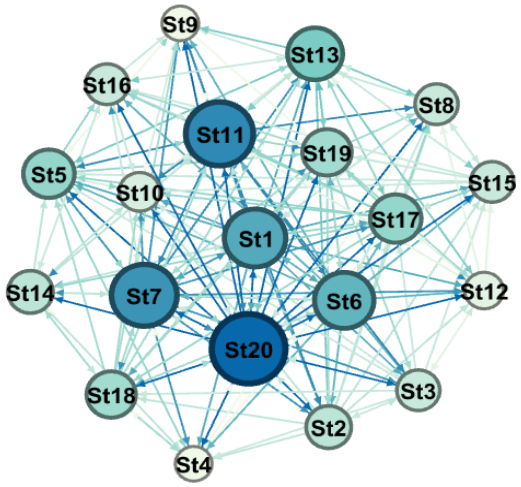
BAVO – 5L PS DKG: Affective Total – Pre-test
Nodes 12 – Edges 62 – Average 5,17 – Density 0,47 – Coherence 0,42



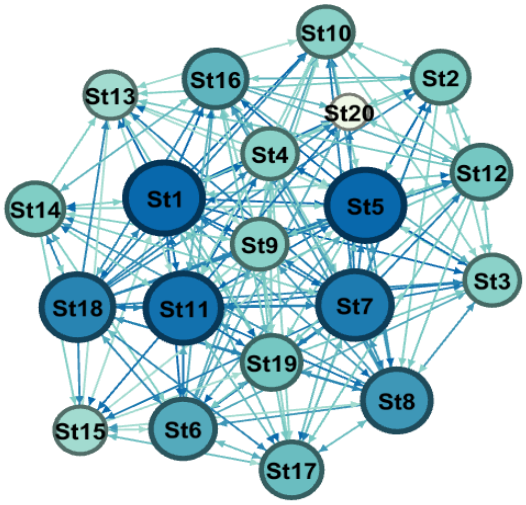
BAVO – 5L PS DKG: Affective Total – Post-test
Nodes 12 – Edges 73 – Average 6,1 – Density 0,55 – Coherence 0,68

5L Primary School Windroos

Test	Nodes	Edges	Average	Density	Coherence
Affective Total Pre	20	231	11,55	0,61	0,66
Affective Selection Pre	20	126	6,3	0,35	0,59
Affective Total Post	20	206	10,3	0,54	0,59
Affective Selection Post	20	100	5	0,25	0,59
Group Total Pre	20	214	10,7	0,56	0,6
Group Selection Pre	20	113	5,65	0,32	0,65
Group Total Post	20	213	10,65	0,56	0,62
Group Selection Post	20	91	4,55	0,26	0,57



BAVO – 5L PS WR: Group Total – Pre-test
Nodes 20 – Edges 214 – Average 10,7 – Density 0,56 – Coherence 0,6



BAVO – 5L PS WR: Group Total – Post-test
Nodes 20 – Edges 213 – Average 10,65 – Density 0,56 – Coherence 0,62

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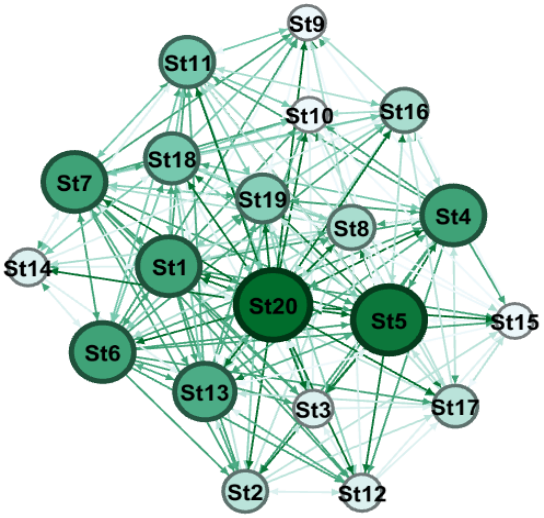
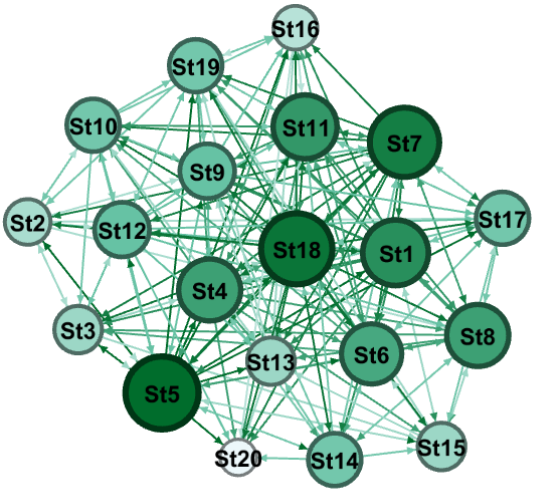


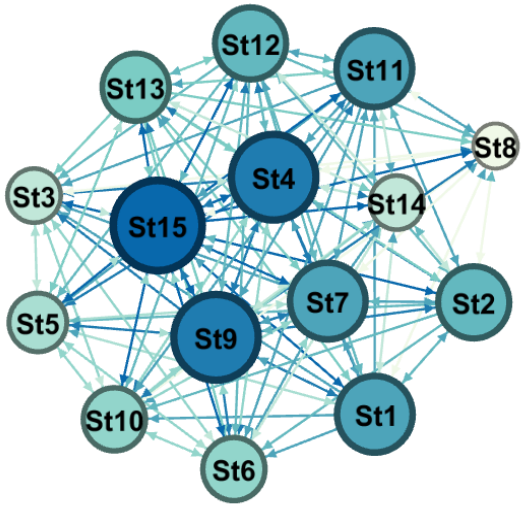
BAVO – 5L PS WR: Affective Total – Pre-test
Nodes 20 – Edges 231 – Average 11,55 – Density 0,61 – Coherence 0,66



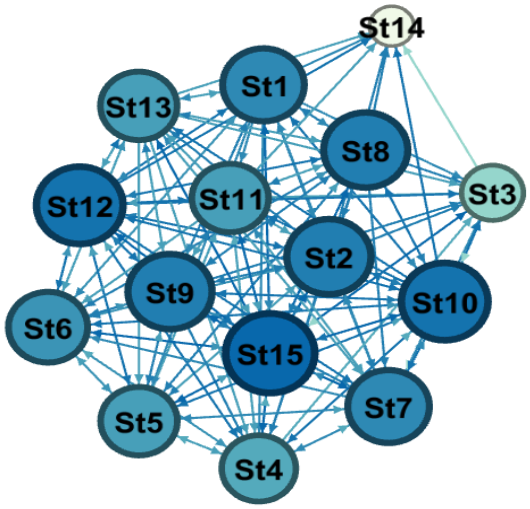
BAVO – 5L PS WR: Affective Total – Post-test
Nodes 20 – Edges 206 – Average 10,3 – Density 0,54 – Coherence 0,59

6L Primary School De Kleine Geuze

Test	Nodes	Edges	Average	Density	Coherence
Affective Total Pre	15	143	9,53	0,68	0,73
Affective Selection Pre	15	79	5,27	0,39	0,66
Affective Total Post	15	153	10,2	0,73	0,73
Affective Selection Post	15	65	4,33	0,33	0,58
Group Total Pre	15	168	11,2	0,8	0,82
Group Selection Pre	15	86	5,73	0,42	0,63
Group Total Post	15	161	10,73	0,77	0,8
Group Selection Post	15	67	4,47	0,34	0,54



BAVO – 6L PS DKG: Group Total – Pre-test
Nodes 15 – Edges 168 – Average 11,2 – Density 0,8 – Coherence 0,82



BAVO – 6L PS DKG: Group Total – Post-test
Nodes 15 – Edges 161 – Average 10,7 – Density 0,77 – Coherence 0,8

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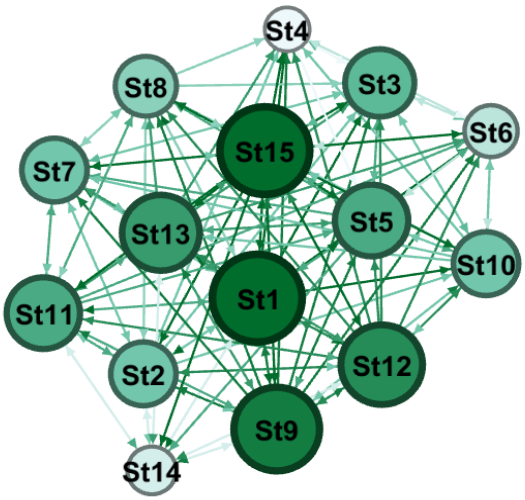
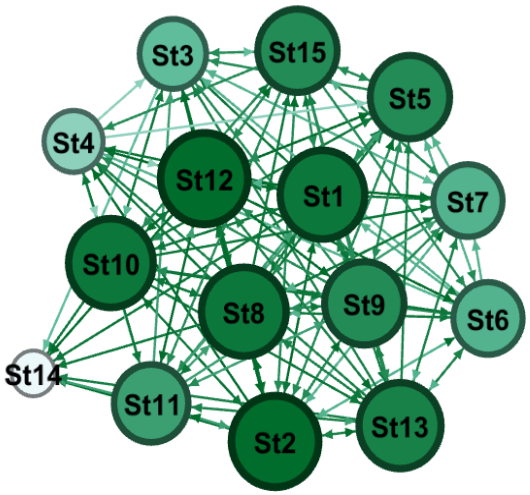


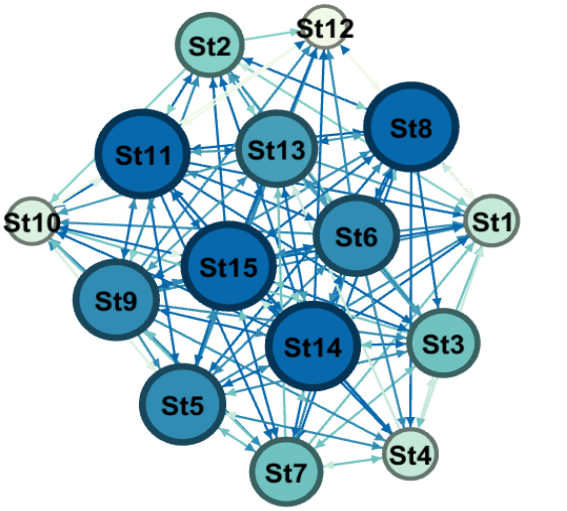
BAVO – 6L PS DKG: Affective Total – Pre-test
Nodes 15 – Edges 143 – Average 9,53 – Density 0,68 – Coherence 0,73



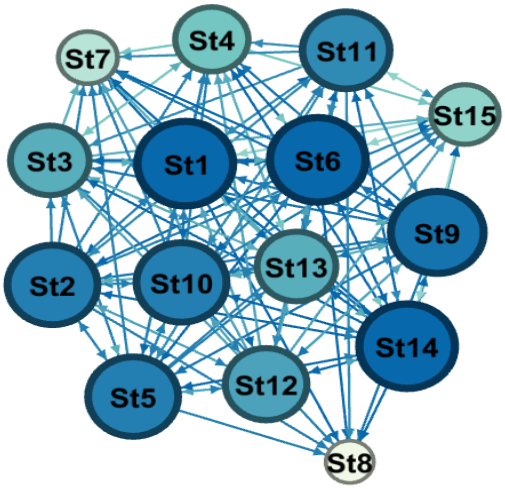
BAVO – 6L PS DKG: Affective Total – Post-test
Nodes 15 – Edges 153 – Average 10,2 – Density 0,73 – Coherence 0,73

6L Primary School Windroos

Test	Nodes	Edges	Average	Density	Coherence
Affective Total Pre	15	181	12	0,86	0,84
Affective Selection Pre	15	97	6,47	0,46	0,74
Affective Total Post	15	155	10,33	0,74	0,74
Affective Selection Post	15	115	7,67	0,54	0,57
Group Total Pre	15	148	9,87	0,71	0,7
Group Selection Pre	15	85	5,67	0,4	0,61
Group Total Post	15	150	10	0,71	0,71
Group Selection Post	15	125	8,33	0,59	0,42



BAVO – 6L PS WR: Group Total – Pre-test
Nodes 15 – Edges 148 – Average 9,87 – Density 0,71 – Coherence 0,7



BAVO – 6L PS WR: Group Total – Pre-test
Nodes 15 – Edges 150 – Average 10 – Density 0,71 – Coherence 0,71

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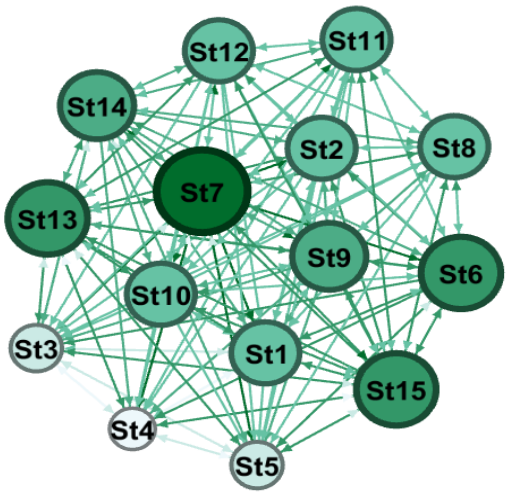
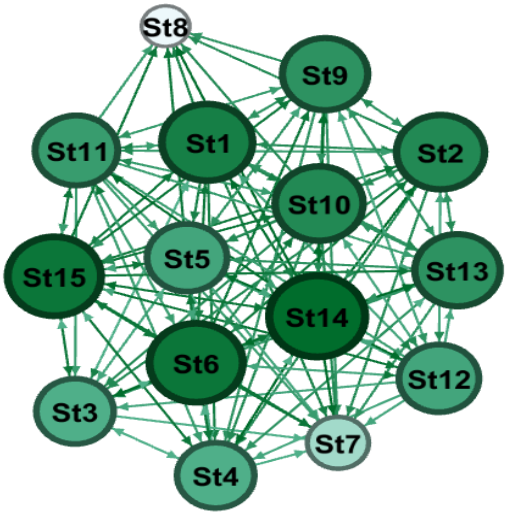


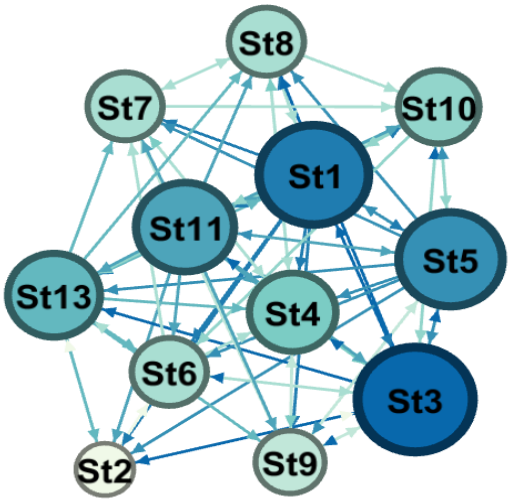
BAVO – 6L PS WR: Affective Total – Pre-test
Nodes 15 – Edges 181 – Average 12 – Density 0,86 – Coherence 0,84



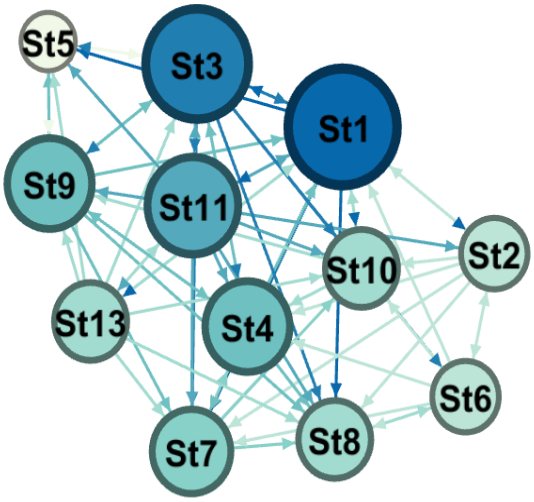
BAVO – 6L PS WR: Affective Total – Post-test
Nodes 15 – Edges 155 – Average 10,33 – Density 0,74 – Coherence 0,74

4L Primary School De Kleine Geuze: Control class

Test	Nodes	Edges	Average	Density	Coherence
Affective Total Pre	12	71	5,9	0,54	0,48
Affective Selection Pre	12	26	2,17	0,22	0,54
Affective Total Post	12	70	5,83	0,52	0,6
Affective Selection Post	12	31	2,59	0,24	0,65
Group Total Pre	12	78	6,5	0,58	0,59
Group Selection Pre	12	35	2,9	0,28	0,4
Group Total Post	12	67	5,58	0,51	0,45
Group Selection Post	12	31	2,58	0,25	0,39



BAVO – 4L PS DKG Controle: Group Total – Pre-test
Nodes 12 – Edges 78 – Average 6,5 – Density 0,58 – Coherence 0,59



BAVO – 4L PS DKG Controle: Group Total – Post-test
Nodes 12 – Edges 67 – Average 5,58 – Density 0,51 – Coherence 0,45

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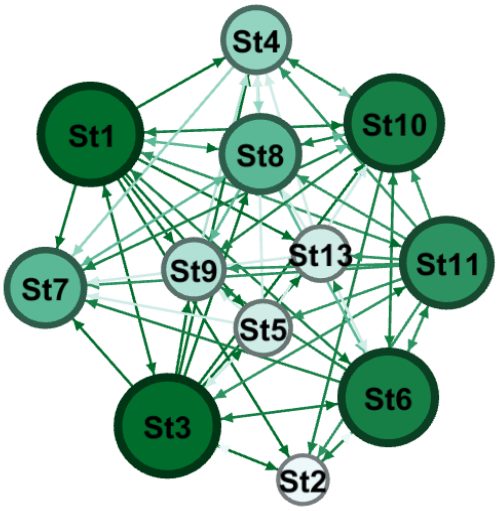
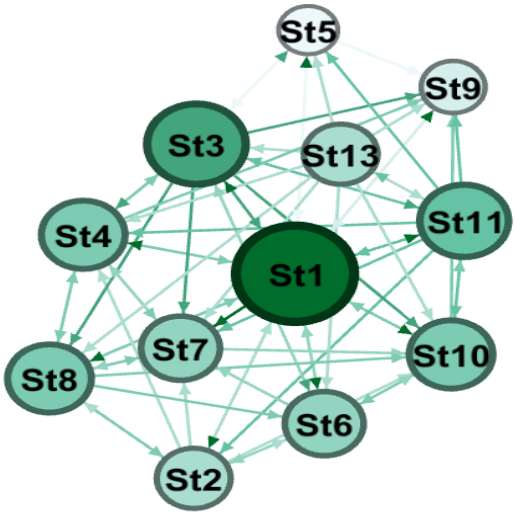


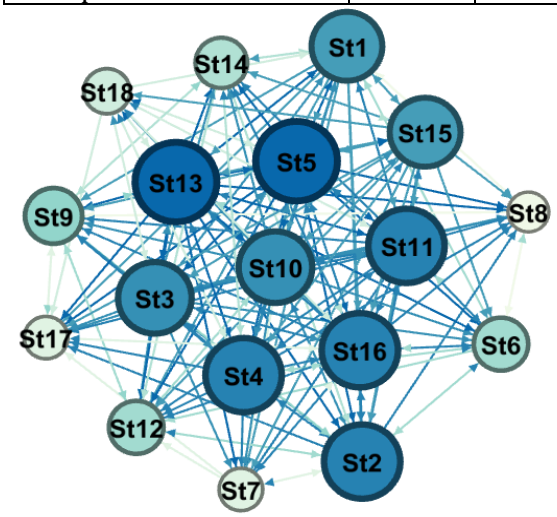
BAVO – 4L PS DKG Controle: Affective Total – Pre-test
Nodes 12 – Edges 71 – Average 5,9 – Density 0,54 – Coherence 0,48



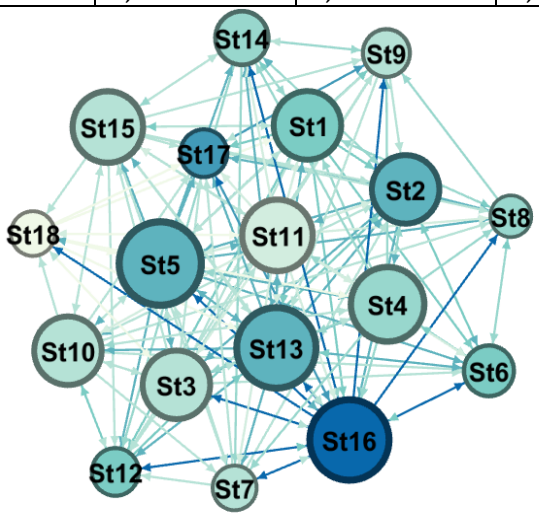
BAVO – 4L PS DKG Controle: Affective Total – Post-test
Nodes 12 – Edges 78 – Average 5,8 – Density 0,53 – Coherence 0,6

4L Primary School Windroos: Control class

Test	Nodes	Edges	Average	Density	Coherence
Affective Total Pre	18	218	12,1	0,71	0,75
Affective Selection Pre	18	69	3,83	0,24	0,64
Affective Total Post	18	193	10,72	0,63	0,65
Affective Selection Post	18	61	3,4	0,21	0,59
Group Total Pre	18	202	11,2	0,66	0,67
Group Selection Pre	18	70	3,9	0,24	0,54
Group Total Post	18	169	9,4	0,55	0,56
Group Selection Post	18	61	3,4	0,21	0,43



BAVO – 4L PS WR- Controle - Group Total – Pre-test
Nodes 18 – Edges 202 – Average 11,2 – Density 0,66 – Coherence 0,67



BAVO – 4L PS WR- Controle - Group Total – Post-test
Nodes 18 – Edges 169 – Average 9,4 – Density 0,55 – Coherence 0,56

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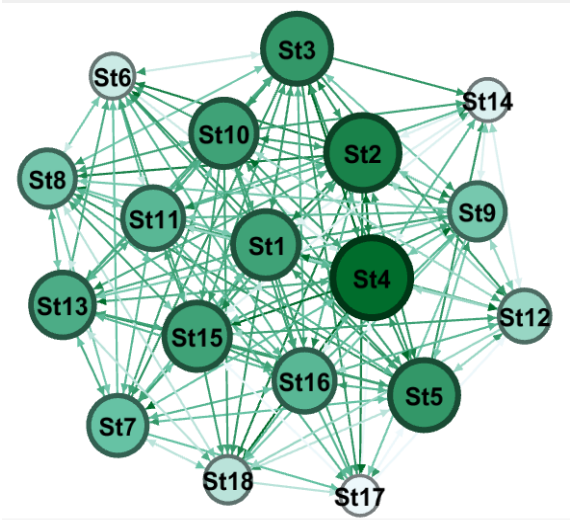
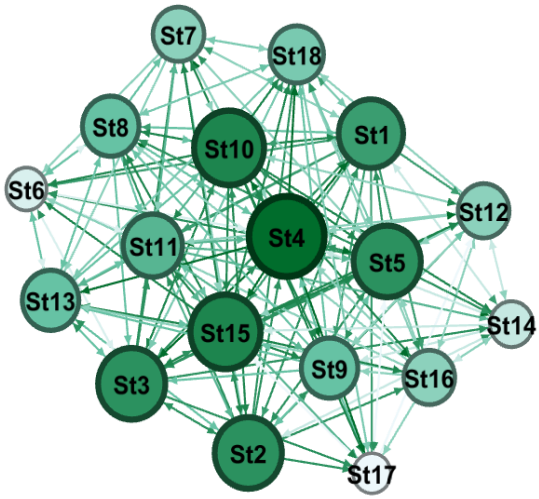


BAVO – 4L PS WR- Controle - Affective Total – Pre-test
Nodes 18 – Edges 218 – Average 12,1 – Density 0,71 – Coherence 0,75



BAVO – 4L PS WR- Controle - Affective Total – Post-test
Nodes 18 – Edges 193 – Average 10,72 – Density 0,63 – Coherence 0,65

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RESULT SELF EFFICACY AND TATS SCALE - PRE AND POST

Seondary School Results

Secondary School Technisch Atheneum Jette 4STW

The self efficacy scale was administered, before and after activities, to 16 students, 11 females and 5 males with an average age of 16 years of the 4STW class of Tajette. The data analysis shows that the average in the pre-test is 5.26, in the post-test it is 5.39; the standard deviation in the pre-test is 1.29, in the post-test it is 1.26. To determine whether the difference between pre- and post-test averages was significant, we ran the Student t-test, the analysis showed that there is no statistically significant difference (p-value 0.181399).

The TATS scale was administered, before and after activities, to 16 students, 11 females and 5 males with an average age of 16 years of the 4STW of Tajette.
The data analysis shows that the average in the pre-test is 3.48, in the post-test it is 3.50; the standard deviation in the pre-test is 1.08, in the post-test it is 0.76. To determine whether the difference between pre- and post-test averages was significant, we ran the Student t-test, the analysis showed that there is no statistically significant difference (p-value 0.764736).

Secondary school technisch atheneum jette 5stw

The self efficacy scale was administered, before and after activities, to 13 students, 8 females and 5 males with an average age of 17 years of the 5STW class of Tajette.
The data analysis shows that the average in the pre-test is 4.95, in the post-test it is 5.02; the standard deviation in the pre-test is 1.11, in the post-test it is 1.06. To determine whether the difference between pre- and post-test averages was significant, we ran the Student t-test, the analysis showed that there is no statistically significant difference (p-value0.654438).
The TATS scale was administered, before and after activities, to 13 students, 8 females and 5 males with an average age of 17 years of the 5STW of Tajette. The data analysis shows that the average in the pre-test is 3.46, in the post-test it is 3.57; the standard deviation in the pre-test is 1.14, in the post-test it is 1.02. To determine whether the difference between pre- and post-test averages was significant, we ran the Student t-test, the analysis showed that there is no statistically significant difference (p-value 0.36335).

Secondary School Technisch Atheneum Jette 6STW: Control class

The self efficacy scale was administered, before and after activities, to a control group of 15 students, 12 females and 3 males with an average age of 18.13 years of the 6STW class of Tajette. The data analysis shows that the average in the pre-test is 5.10, in the post-test it is 5.16; the standard deviation in the pre-test is 1.46, in the post-test it is 1.27. To determine whether the difference between pre- and post-test averages was significant, we ran the Student t-test, the analysis showed that there is no statistically significant difference (p-value 0.369631).

The TATS scale was administered, before and after activities, to a control group of 15 students, 12 females and 3 males with an average age of 18.13 years of the 6STW of Tajette. The data analysis shows that the average in the pre-test is 3.37, in the post-test it is 3.37; the standard deviation in the pre-test is 1.07, in the post-test it is 1.18. To determine whether

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the difference between pre- and post-test averages was significant, we ran the Student t-test, the analysis showed that there is no statistically significant difference (p-value0.715907).

Primary School Results

3L Primary School De Kleine Geuze

The self efficacy scale was administered, before and after activities, to 13 students, 5 females and 8 males with an average age of 8.38 years of the 3L class of de kleine geuzen. The data analysis shows that the average in the pre-test is 4.55, in the post-test is 4.20; the standard deviation in the pre-test is 2.21, in the post-test is 2.11. To determine whether the difference between pre- and post-test averages was significant, we ran the Student t-test, the analysis showed that there is no statistically significant difference (p-value 0.14370).

5L Primary School De Kleine Geuze

The self efficacy scale was administered, before and after activities, to 11 students, 5 females and 6 males with an average age of 10.54 years of class 5L de kleine geuzen. The data analysis shows that the average in the pre-test is 4.85, in the post-test it is 5.05; the standard deviation in the pre-test is 2, in the post-test it is 1.81. To determine whether the difference between pre- and post-test averages was significant, we ran the Student t-test, the analysis showed that there is no statistically significant difference (p-value 0.384386).

5L Primary School Windroos

The self efficacy scale was administered, before and after activities, to 19 students, 12 females and 7 males with an average age of 10.57 in the 5L class of Windroos.
The data analysis shows that the average in the pre-test is 5.34, in the post-test it is 5.01; the standard deviation in the pre-test is 1.70, in the post-test it is 1.69.
To determine whether the difference between pre- and post-test averages was significant, we ran the Student t-test, the analysis showed that there is a statistically significant difference (p-value 0.079555).

6L Primary School De Kleine Geuze

The self efficacy scale was administered, before and after activities, to 14 students, 9 females and 5 males with an average age of 11.14 years of the 6L class of de kleine geuzen. The data analysis shows that the average in the pre-test is 4.88, in the post-test it is 4.89; the standard deviation in the pre-test is 1.51, in the post-test it is 1.57. To determine whether the difference between pre- and post-test averages was significant, we ran the Student t-test, the analysis showed that there is no statistically significant difference (p-value 0.87823).

6L Primary School Windroos

The self efficacy scale was administered, before and after activities, to 13 students, 7 females and 6 males with an average age of 6L of windroos. The data analysis shows that the average in the pre-test is 5.01, in the post-test it is 5.33; the standard deviation in the pre-test is 1.63, in the post-test it is 1.46. To determine whether the difference between pre- and post-test averages was significant, we ran the Student t-test, the analysis showed that there is no statistically significant difference (p-value 0.225648).

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4L Primary School De Kleine Geuze: Control class

The self efficacy scale was administered, before and after activities, to a control group of 12 students, 8 females and 4 males with an average age of 9.33 years of the 4L class of de kleine geuzen. The data analysis shows that the average in the pre-test is 4.40, in the post-test it is 4.61; the standard deviation in the pre-test is 1.76, in the post-test it is 2.10. To determine whether the difference between pre- and post-test averages was significant, we ran the Student t-test, the analysis showed that there is no statistically significant difference (p-value 0.456892).

4L Primary School Windroos: Control class

The self efficacy scale was administered, before and after activities, to a control group of 18 students, 14 females and 4 males with an average age of 9.38 years of the 4L class of windroos. The data analysis shows that the average in the pre-test is 5.43, in the post-test it is 5.25; the standard deviation in the pre-test is 1.91, in the post-test it is 1.60.
To determine whether the difference between pre- and post-test averages was significant, we ran student's t-test, the analysis showed that there is no statistically significant difference (p-value 0.033659)

Although a lot of the evaluation results show there was not a significant result, this could be explained by the demotivation of the students to fill in twice the same test at the end of the piloting. Although the results are not significant, you could feel and see the students growing in self-confidence during the piloting in the primary schools. In the beginning they saw these workshops as a school task, but at the end they saw these peer-to-peer workshops as their responsibility to teach 'their' kids coding on a fun way.

CONCLUSIONS

The main goal for Maks with the implementation of the Codinc methodology was to

1. Enthuse teachers for steam-education. Let them see the advantages for their students.
2. Increase and improve teachers' capacity to teach STEAM education and give them tools and methods to do so

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3. Empower disadvantaged young people in the acquisition and development of IT and collaborative competences as well as problem solving, self-confidence and creativity through a peer-learning training programme
4. Learn students and pupils how to do basic-coding and programming

The Codinc project in Brussels worked out very well on all of these main goals. The enthusiasm of teachers and students exceeded the expectations of Maks. Once the project started, Codinc was perceived by participating schools as an opportunity for students, both to acquire and/or strengthen skills in coding and computational thinking but even more as a possibility of personal growth. Although a lot of the evaluation results show there was not a significant result, this could be explained by the demotivation of the students to fill in twice the same test at the end of the piloting. A second reason why the results weren't significant is because they were much too difficult for students and pupils. In the Brussels most of the students and pupils don't have Dutch as a native language, so they didn't always understand the questions. Although the results are not significant, you could feel and see the students growing in self-confidence during the piloting in the primary schools. In the beginning they saw these workshops as a school task, but at the end they saw these peer-to-peer workshops as their responsibility to teach 'their' kids coding on a fun way. In the first session students never took in account the possibility of becoming "teachers", while at the end of the piloting some students wanted to become animators at the coding summer camps of Capital Digital. Other secondary students wanted to learn more about programming games with scratch and makeymakey. You could see the students growing closer to their teachers, because on one hand something it was different than traditional school learning and they started on the same level and on the other hand they had more respect for the job as a teacher since they were in the shoes of a teacher themselves.

The results of the qualitative analysis of the pupil's spook for self. 98% of the pupils wanted more coding-workshops and they all found that 'coding is fun'. The teachers were even more enthusiast about the project then their students. 85% from the primary and secondary teachers wants to work together with Maks for a digital project in the future and the 2 primary schools already filled in a project call to do so.

Although the project was successfully completed, there were some obstacles to overcome that Maks would do differently in another implementation. First of all there should be more focus in the training for secondary students on pedagogical skills. Although the students did a tremendous good job, you felt that they missed some explanation skills to their younger peers. Maks thinks this is normal, since you can't make a coding-teacher after a 15-hour training, but more focus on this aspect would help. Maks proposes to do a longer training for secondary students where they could learn more about bringing their workshops for a class. The results of the experts during the second multiplier event, where students only got a 3-hour training to give a 2-hour workshop, also emphasized the length of the training to make it successful. On the one hand schools think that a project of 30 hours of coding takes in a lot of their curriculum, but on the other hand teachers indicated that the students learn much more then only coding and that this should be taken in account.

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Secondly, it was very difficult to organise the planning between the primary and secondary school. If schools want to continue this project on their own, they have to work very closely with the primary schools which is sometimes difficult for teachers. For some secondary schools in Brussels, it is rather easy because they have a primary school in the same building with the same principal, but this is not for all secondary schools. For these other secondary schools, Maks proposes to organise the Codinc project within the secondary school. Students of the sixth grade could give their peer-to-peer training to their fellow students of the first grade. In this way the big brother/sister effect will increase even more and organising the whole project will be much easier, because teachers know each other and there is no need for relocation. With the right materials in the school the organisation of a Codinc project would become much more accessible for schools.

Also there should be definitely provided a training or even multiple training sessions throughout the schoolyear for teachers. In Brussels you could see that secondary teachers who participated at a training session engaged and participated much more than their colleagues who didn't participate at the training session. I have to mention that you could also see a distinct difference between older and younger teachers. Maks had the feeling that older teachers didn't feel the need to set aside their traditional way of teaching or didn't feel the need to teach coding because they were afraid, they didn't master the study material. Maks thinks we have to enthuse these teachers and let them see the advantages for themselves and their students. Maks proposes to give extra trainings on how to use coding activities in classrooms.

POLICY RECOMMENDATIONS ON A NATIONAL LEVEL

A lot of schools in Brussels don't have sufficient digital materials to give steam-education. Although there is a willingness amongst teachers to teach this subjects, instead of feeding this willingness with resources, they have to overcome problems to teach this. Coding and programming skills should be incorporated in the education of a teacher and schools should provide trainings throughout the years in teaching coding skills to students. Furthermore we could see that in the context of Brussels teaching professions and ICT-professions are bottleneck professions. A project like Codinc could provide a solution here.

Next to the problem of insufficient funds for digital material, there is the problem with the given curriculum by the government. Firstly, coding and programming is not at all proportional present in this curriculum, given the needs of the work market in this digital world. Flemish and Brussels schools still follow the same traditional structure of teaching as 20 years ago. Secondly, the Flemish government put an enormous stress on teachers in secondary schools about what study material they have to give. Each specific subject has to achieve a lot of specific lesson material that they have to follow. That's why it was difficult to find a secondary school who wants to give up 30 hours, simply because they otherwise won't require to the governments' curriculum and maybe have to close down. There should be some requirements for schools, given by the government, but these should leave some space to secondary school and their teachers how to fill in their lessons.

The Codinc project is a perfect example of a project where students have their first work-experience and so boost their confidence. At the same time pupils get their first

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experience with coding on a fun way, given by their peers, who serve as rolemodels for them. At the same time, they are learning to code and program and upgrade their ICT-skills, which will be a necessary requirement for a future job on the market.

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